Factors Underlying Characteristics of Effective English Language Teachers: Validity and Sample Effect

Ebrahim Khodadady *
Assistant Professor of TEFL, Ferdowsi University, Mashhad, Iran

Abstract
This study replicated another research project to find out what factors underlie the Characteristics of Effective English Language Teachers (CEELT) when a large and more representative and homogeneous sample is selected. The CEELT questionnaire compiled by Moafian and Pishghadam (2008) was administered to 1469 Iranian learners of English as a foreign language at various private and public schools in Mashhad, Iran to test three hypotheses addressing the strength of relationship among the characteristics, the number of extracted factors and their cross loadings. The 47 characteristics revealed high correlations among themselves and loaded as well as cross loaded on only five rotated factors when the Principal Axis Factoring was applied to the participants' responses, i.e., rapport, fairness, qualification, facilitation and examination. The results have several research implications. First, reporting correlation coefficients and the KMO statistic of sampling adequacy is necessary. Secondly, samples consisting of at least 1000 participants should be selected, preferably with a ratio of 30 cases for each item. And finally, cross loading variable must be reported because these cross loadings necessitate adopting a holistic view towards teaching languages and establishing significant relationships between teacher characteristics and learner abilities such as language achievement and proficiency.

Keywords: Factors; Sample Size and Adequacy; Inter-correlations; Teacher Characteristics; Cross Loading

Introduction

Factorial studies are often conducted in order to determine the underlying traits forming given human populations. In factor analysis, a complex statistical analysis

* *E-mail address:* ekhodadady@um.ac.ir
Corresponding address: Department of English Language and Literature, Ferdowsi University, Mashhad, Iran

[Downloaded from ijal2.khu.ac.ir on 2026-11-24]

requiring the application of computers and various types of statistical software such as SPSS, each item forming a test or questionnaire is correlated with the total score from the set of items and then the items with the highest item-total correlations are chosen. This process is important for determining the validity of the tests and questionnaires because

> instead of basing the factors on investigator judgment, it bases each factor on a set of highly correlated items. Hence, misjudgements about what items measure are less likely to distort the operationalization of the construct. Additionally, new constructs may emerge that the investigator did not realize were being measured (Gorsuch, 1997, p. 535)

Horwitz (1981, 1985, 1988), for example, developed the 34-item Beliefs about Language Learning Inventory (BALLI) to explore the opinions of foreign language learners and instructors. She stated that the BALLI addressed five areas of foreign language learning, i.e., difficulty of language learning, foreign language aptitude, the nature of language learning, learning and communication strategies and motivations and expectations as its logically established factors.

However, Khodadady and Hashemi (2010) extracted 14 factors when they submitted the responses of 418 undergraduate and graduate students to Principal Axis Factoring and rotated the results by employing Varimax with Kaiser Normalization as did Khodadady (2009). They named them nature of language learning, motivation and intelligence, self-confidence and self-consciousness, age, culture, context and practice, learning and communication strategies, national importance of speaking English, compatibility of science and math with language, comparative easiness of some languages, time and interaction, hereditary and intelligence, national aptitude, learnability of speaking, gender-independency, and structural dissimilarity of Persian and English.

The extraction of factors underlying psychological instruments such as the BALLI is important in terms of curriculum design and educational planning. After specifying the factors underlying the BALLI, for example, Khodadady (2009) found that three out of 14 factors revealed significant relationships with academic achievement. The learners who ***disagreed*** that *learning English is mostly a matter of learning many of grammar rules and learning English is mostly a matter of*

[Downloaded from ijal2.khu.ac.ir on 2026-11-24]

translating from English into Persian obtained significantly higher GPAs than those who were undecided or agreed, indicating that the beliefs of freshmen foreign language learners need to be changed regarding the nature of language learning.

Though validating psychological instruments through factor analysis helps identify the underlying factors explaining the *latent characteristics of populations*, few studies meet its assumptions in terms of adequate sampling. In a recent study, for example, Moafian and Pishghadam (2008) compiled a questionnaire consisting of 47 items to find out what factors underlie the Characteristics of Effective English Language Teachers (CEELT). The items derive their strength from the results of at least 30 years of studies on effective teaching reviewed by Theall and Franklin (1990). In addition to including the criticism and suggestions made by university students regarding their professors and collected by Gadzella (1971) and Feldman (1996), Moafian and Pishghadam employed Suwandee's (1995) questionnaire and inserted new items which were exclusively expressed by 46 English learners and 11 English teachers in Mashhad, Iran.

The development, validation and application of the CEELT is of paramount importance in teaching foreign languages because there is virtually none available in the field to reveal the factors learners consider effective in teaching English. As a leading authority, Brown (2004), for example, maintained that "teaching cannot be defined apart from learning" (p. 8), implying that teachers play a secondary role while the learning of learners alone determines teaching. Based on this assumption, he contended that "teaching is [1] guiding and facilitating learning, [2] enabling the learner to learn, [and 3] setting the conditions for learning [brackets are mine]" (p. 8). In other words, teaching English as a second language for Brown consists of the three *assumed* factors, which have stayed at a definitional level and evaded any factorial validation so far.

Moafian and Pishghadam's (2008) findings, however, showed that from the language learners' perspective teaching is an effective construct in its own right. Upon compiling the CEELT, they administered it to 250 Persian learners of English as a foreign language in Iran and applied Principal Axis Factoring (PAF) along with Varimax Rotation with Kaiser Normalization to their responses and extracted 12 factors, i.e., teaching accountability, interpersonal relationship, attention to all, examination, commitment, learning boosters, creating a sense of

[Downloaded from ijal2.khu.ac.ir on 2026-11-24]

competence, teaching boosters, physical and emotional acceptance, empathy, class attendance and dynamism.

Although the results obtained by Moafian and Pishghadam (2008) contribute to the field of applied linguistics, they seem to be quite *unusual* in that a relatively large number of factors, 12, have been extracted from 47 variables, implying that the questionnaire consists of ***heterogeneous*** characteristics. However, factors two and 10 show loadings of .70 and .71, respectively (p. 135). Since the ratio of participants to the number of characteristics is just 5.3, i.e., 250/47, obtaining loadings at the magnitude of .70 and higher without cross loading is questionable if not abnormal.

Spielberg, Gorsuch, Lushene, and Jacobs (1983), for example, extracted only five factors when they administered their 40-item State-Trait Anxiety Inventory to 424 high school students. With a ratio of 10.6, i.e., 424/40, factors 1 and 2 had the highest loadings, i.e., 71, among the others and some items such as 22, loaded not only on factor 5, i.e., .46, but also cross loaded on factors 1 and 4 (p. 31). The high loadings along with the fact that none of the 47 characteristics studied by Moafian and Pishghadam (2008) cross loaded on any factor, therefore, necessitated replicating the study with a larger and more homogeneous sample to find out whether the characteristics will show high correlations with each other and whether they will load on 12 factors without any cross loadings.

Methodology

Participants

The questionnaire addressing the Characteristics of Effective English Language Teachers (CEELT) was administered to 1469 (588 male and 881 female) high school students. They were majoring in general courses, 622 (42.3%), accounting, 19 (1.3%), computer, 14 (1%), experimental sciences, 309 (21%), humanities, 158 (10.8%), and mathematics, 158 (10.8%) at grade 1, 622 (42.3%), grade 2, 282 (19.2%), grade 3, 208 (14.2) and preuniversity, 357 (24.3%). Seven hundred sixty nine participants (52.3%) were studying English at 21 public high schools in the sixth educational district of Mashhad, the capital of Khorasan-e-Razavi province, Iran. The rest of participants studied English at beginning, intermediate and advanced English language proficiency levels at four private language institutes, i.e., 700 (47.7%), in the same city. Their age were 14 (17.8%), 15 (33.6%), 16

[Downloaded from ijal2.khu.ac.ir on 2026-11-24]

(15.7%), 17 (17.8%), 18 (11.8%) and 19 (3.2%) with a mean of 15.82 and standard deviation of 1.40. All the participants spoke Persian as their mother language.

Moafian and Pishghadam (2008), however, administered the CEELT to 162 female and 88 male language learners whose majors and/or occupations are not specified except their studying English at elementary, intermediate and advanced levels in various language institutes. Since their participants' age ranged from 14 to 36 (mean = 17.07), it can be inferred that they were not only high school but also university students and some might have worked as employees and employers in private and public sectors. In contrast, in the present study the CEELT was administered only to high school students learning English in public and private schools and institutes in one specific educational district in Mashhad and thus the homogeneity of the sample was secured in terms of their educational district, major and age.

Instrument

The questionnaire employed in this study, i.e., Characteristics of Effective English Language Teachers (CEELT), consists of two parts. The first part raises five questions requiring short answers dealing with the participants' gender, age, English language proficiency level, field of study and year of study.

The second part of the CEELT consists of 47 characteristics compiled by Moafian and Pishghadam (2008) who identified eight distinctive features by asking 46 learners and 11 teachers to write down the characteristics of successful language teachers and then added them to the 39 characteristics selected from 14 studies by Suwandee (1995). According to Hildebrand, Wilson and Dienst (1971), Irby (1978) and Sherman, Armistead, Fowler, Barksdale and Reif (1987), the 39 characteristics form the six teaching components of knowledge, preparation/ organization/ clarity, enthusiasm/ stimulation, instructor-group interaction, instructor-individual student interaction, and examination/ grading.

Both parts of the CEELT were presented in Persian in this study to avoid possible misunderstandings on the part of participants. (The English version of the CEELT is given as Appendix A). While the first part of the questionnaire required writing short answers, the second called for reading the 47 characteristics and indicating whether the participants' English teachers possessed the specified features on the basis of a five-point Likert scale, i.e., completely agree, agree, to

[Downloaded from ijal2.khu.ac.ir on 2026-11-24]

some extent agree, disagree and completely disagree. The scores of 5, 4, 3, 2 and 1, were assigned to these points, respectively.

Procedure

After printing the Characteristics of Effective English Language Teachers (CEELT) questionnaire, the researcher contacted the Education Organization of Khorassan-e-Razavi Province in Mashhad in order to obtain official permission to conduct the research in its seven educational districts. The authorities, however, allowed him to conduct the project in only one district. Out of practicality and convenience, i.e., having manageable number of schools and being accessible via public transportation, district six was chosen and all its 41 public high schools and 10 private language institutes were contacted. The senior administration of 21 public high schools and four private language institutes agreed with the administration of the questionnaire provided they were provided with a copy of results.

Upon receiving the consent of the senior administration of schools and institutes, their English teachers were contacted in person during break times. Ninety two teachers agreed when they were told that no respondent was required to write their names and no data related to any particular class would be reported to anyone. They agreed to be contacted again after they had talked to their students and ensured their voluntary participation. Having arranged the most suitable time with the teachers, the researcher attended the classes and distributed the questionnaires after the teachers left the class for a break. It took around 30 minutes for the participants to answer the 47 questions of the CEELT in one single session. The researcher answered whatever questions students raised while they completed the questionnaire.

Data Analysis

The descriptive as well as inferential statistical analyses were carried out by utilizing the SPSS version 16.0. The reliability of the questionnaire was estimated via Cronback Alpha. Between the two most frequently employed methods, i.e., Principal Component Analysis (PCA) and Principal Axis Factoring (PAF), the PAF was employed to extract rotated factors because most scholars believe that PCA does not provide a true factor analysis (e.g., Bentler & Kano, 1990; Floyd & Widaman, 1995; Ford, MacCallum & Tait, 1986; Gorsuch, 1990; Loehlin, 1990; MacCallum & Tucker, 1991; Mulaik, 1990; Snook & Gorsuch, 1989; Widaman,

[Downloaded from ijal2.khu.ac.ir on 2026-11-24]

1990, 1993). Similar to Moafian and Pishghadam (2008), Kaiser criterion, i.e., eigenvalues higher than 1, was used to determine the number of factors extracted in this study. Following Khodadady and Hashemi (2010), the unrotated factor matrix was skipped and all correlation coefficients with their frequency and magnitudes were estimated to test the following three hypotheses:

1. The 47 characteristics of effective English language teachers will correlate highly among themselves.
2. The 47 characteristics of effective English language teachers will load *acceptably*, i.e., .30 and higher, on 12 factors.
3. The 47 characteristics of effective English language teachers will not cross load *acceptably* on 12 factors.

Results and Discussion

Table 1 presents the reliability coefficients obtained in the present study along with those obtained by Moafian and Pishghadam (2008) and Suwandee (1995). As can be seen, the very inclusion of a large and homogeneous sample in this study has increased the reliability coefficient of the Characteristics of Effective English Language Teachers (CEELT) questionnaire from .94 to .97, indicating that the larger and more homogeneous the sample size is, the more reliable the results become. (The descriptive statistics of items comprising the CEELT are given in Appendix B).

Table 1
Reliability statistics of the characteristics of Effective English Language Teachers questionnaire

	Present study	**Moafian & Pishghadam (2008)**	**Suwandee (1995)**
Cronbach's Alpha	.97	.94	.94
N of Items	47	47	39
N of participants	1469	250	505

Upon estimating the reliability coefficient and insuring that the responses were reliable enough, the Kaiser-Meyer-Olkin (KMO) measure of Sampling Adequacy was employed to find out whether employing factor analysis to extract latent variables was appropriate. The KMO statistic obtained in this study was .98. According to Kaiser and Rice (1974), KMO statistic in the .90s is “marvelous,” in

[Downloaded from ijal2.khu.ac.ir on 2026-11-24]

other words, the sample selected in the study and the factor analysis employed would probably provide the best common factors. The significant Bartlett's Test of Sphericity, i.e., $X^2 = 3.722$, df = 1081, $p < .001$, indicated that the correlation matrix was not an identity matrix.

Table 2 presents the ordered initial and extracted communalities obtained from the 47 characteristics of English language teachers. MacCallum, Widaman, Zhang and Hong (1999) believed that selecting *small samples* would be all right if item communalities were consistently high, i.e., .80 or above. In other words, although Moafian and Pishghadam's (2008) sample size was far smaller than the sample of the present study, i.e., 250 and 1469, respectively, if their item communalities were consistently high, their sample size would be statistically acceptable. However, as can be seen, none of the initial or extracted communalities of the present study reach .80 and thus challenge high communalities as a sign of strong data not only in small but also in large samples.

Table 2
47 characteristics (C) and the Initial Communalities (IC) and extracted communalities (EC) obtained via Principal Axis Factoring

C	IC	EC	C	IC	EC	C	IC	EC	C	IC	EC
3	.68	.71	**4**	.53	.53	**26**	.54	.49	**29**	.45	.44
7	.66	.69	**34**	.55	.52	**35**	.50	.49	**43**	.41	.41
9	.65	.63	**40**	.52	.52	**20**	.40	.48	**44**	.41	.38
46	.62	.61	**10**	.51	.52	**1**	.50	.48	**36**	.38	.37
5	.60	.60	**22**	.54	.52	**30**	.50	.48	**18**	.40	.37
24	.63	.59	**8**	.52	.52	**13**	.51	.46	**32**	.38	.37
15	.59	.59	**19**	.41	.51	**42**	.46	.45	**17**	.33	.33
45	.58	.59	**38**	.53	.51	**41**	.45	.45	**31**	.35	.30
33	.59	.56	**2**	.52	.51	**6**	.45	.45	**11**	.35	.30
25	.60	.56	**21**	.52	.51	**16**	.48	.45	**14**	.33	.29
27	.54	.55	**37**	.52	.50	**23**	.46	.45	**47**	.33	.29
12	.57	.54	**39**	.52	.50	**28**	.48	.44			

In addition to challenging the criterion of high communalities, the results presented in Table 2 provide support for Costello and Osborne's (2005) observation that *uniformly* high item communalities are unlikely to occur in real data and that more common magnitudes in social science research are in the order

[Downloaded from ijal2.khu.ac.ir on 2026-11-24]

of .40 to .70. In other words, as communalities become lower, the size of the sample exerts a greater impact on factorial analyses. The unlikelihood of obtaining consistently high communalities in social sciences is further supported when inter correlations among real items are taken into account.

Table 3 presents the frequency, percent and cumulative percent of correlation coefficients obtained among the 47 characteristics of teachers. As can be seen, out of 1080 coefficients, 53.2% correlate significantly at 0.40 and higher with each other, indicating that characteristics of effective English language teachers are strongly interrelated. These results support the first hypothesis that *the 47 characteristics of Effective English Language Teachers will correlate highly among themselves.*

Table 3
The frequency (F), percent (P) and cumulative percent (CP) of 1080 correlation coefficients (CC) obtained among the 47 characteristics

CC	**F**	**P**	**CP**	**CC**	**F**	**P**	**CP**	**CC**	**F**	**P**	**CP**
0.69	2	0.2	0.2	0.49	30	2.8	15.3	0.32	35	3.2	79.0
0.66	3	0.3	0.5	0.48	37	3.4	18.7	0.31	35	3.2	82.2
0.65	2	0.2	0.6	0.47	47	4.4	23.1	0.30	28	2.6	84.8
0.63	1	0.1	0.7	0.46	49	4.5	27.6	0.29	33	3.1	87.9
0.62	1	0.1	0.8	0.45	47	4.4	31.9	0.28	27	2.5	90.4
0.61	3	0.3	1.1	0.44	40	3.7	35.6	0.27	19	1.8	92.1
0.60	1	0.1	1.2	0.43	58	5.4	41.0	0.26	20	1.9	94.0
0.59	3	0.3	1.5	0.42	49	4.5	45.6	0.25	15	1.4	95.4
0.58	5	0.5	1.9	0.41	35	3.2	48.8	0.24	16	1.5	96.9
0.57	4	0.4	2.3	0.40	48	4.4	53.2	0.23	14	1.3	98.1
0.56	4	0.4	2.7	0.39	31	2.9	56.1	0.22	9	0.8	99.0
0.55	8	0.7	3.4	0.38	37	3.4	59.5	0.21	3	0.3	99.3
0.54	13	1.2	4.6	0.37	35	3.2	62.8	0.20	2	0.2	99.4
0.53	19	1.8	6.4	0.36	52	4.8	67.6	0.19	2	0.2	99.6
0.52	21	1.9	8.3	0.35	28	2.6	70.2	0.18	2	0.2	99.8
0.51	24	2.2	10.6	0.34	32	3.0	73.1	0.17	1	0.1	99.9
0.50	21	1.9	12.5	0.33	28	2.6	75.7	0.12	1	0.1	100.0
								Total	**1080**	**100**	

[Downloaded from ijal2.khu.ac.ir on 2026-11-24]

The correlation coefficients (CCs) presented in Table 3 are in sharp contrast to what Khodadady and Hashemi (2010) found when they administered the 34-item Beliefs about Language Learning Inventory (BALLI) to 418 undergraduate and graduate university students. The 561 CCs obtained among the 34 beliefs held by Iranian learners of English ranged from -0.23 to 0.40 (Mean = 0.04). These results seem to show that the factorial validation of a given questionnaire and the number of rotated factors extracted from their items depends on their homogeneity, i.e., the more conceptually related the items, the higher the correlation coefficient obtained among its constituting items and thus the fewer the number of factors extracted.

Hortwitz (1985), for example, included belief 21, i.e., *Women are better than men at learning English*, in her logical area of *Foreign Language Aptitude* which includes belief 2, *Some people are born with a special ability which helps them learn English* among seven other beliefs. Khodadady and Hashemi's (2010) findings, however, showed that belief 21 loads .53 on a single factor upon which none of the other eight beliefs categorized logically under the *Foreign Language Aptitude* load. In other words, beliefs constituting this logical area/factor are not homogenous or conceptually related otherwise all its constituting beliefs would have loaded acceptably on a single factor.

While the beliefs comprising the BALLI load on a large number of factors, most characteristics comprising the CEELT, load on a few in this study, i.e., fourteen and five, respectively. The factors extracted by Moafian and Pishghadam (2008) are similar to the ones extracted from BALLI in that they are many in number and most of them consist of few items. For example, out of twelve factors extracted by Moafian and Pishghadam, four consist of only two characteristics and the two factors upon which most characteristics load comprise only seven, implying that the characteristics of effective English teachers are as heterogeneous as the beliefs about language learning, i.e., the more factors are extracted from a given measure, the more heterogamous its constituting items will be.

As another example, on factor nine named Physical and Emotional Acceptance by Moafian and Pishghadam (2008), characteristics 28, *Speaks clearly with a correct pronunciation*, and 29, *Has clean and tidy appearance*, load .32 and .66, respectively. In the present study, however, these two characteristics load .43 and .45 on the third factor called Qualification (see Table 9). The findings of this study therefore show that characteristics 28 and 29 along with 18 other characteristics are

[Downloaded from ijal2.khu.ac.ir on 2026-11-24]

homogeneous in that they constitute teacher Qualification and thus emphasize their being a part of a single construct rather than the students' physical and emotional acceptance of teachers as a separate factor.

Table 4 presents the descriptive statistics of the five rotated factors extracted via Principal Axis Factoring, Varimax with Kaiser Normalization. As can be seen, the two factors Rapport and Fairness are the most reliable, i.e., α = .95, followed by Facilitation and Qualifications, i.e., α = .94 and .93, respectively. (The characteristics forming these factors are presented in Table 7 onwards.) As the last factor, Examination has the lowest reliability coefficient, i.e., α = .66, which is, nonetheless, reasonably acceptable due to the fewness of its constituting characteristics.

Table 4
Descriptive statistics of factors and their loading and cross loading characteristics

Name	**# of item**	**Characteristics**	**Alpha**	**Eigenvalue**	**Variance explained (48.6%)**
Rapport	19	2, 3, 4, 5, 7, 8, 9, 12, 13, 15, 22, 24, 25, 26, 33, 34, 44, 45, 46	.95	5.961	12.1%
Fairness	23	22, 23, 24, 25, 26, 28, 29, 30, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47	.95	5.499	11.5%
Qualification	20	1, 2, 6, 10, 12, 13, 14, 16, 18, 21, 22, 23, 24, 25, 28, 29, 30, 31, 32, 35	.93	4.910	11.2%
Facilitation	21	2, 3, 5, 6, 9, 10, 11, 12, 13, 15, 16, 17, 18, 24, 25, 26, 27, 37, 38, 39, 46	.94	4.020	9.6%
Examination	3	19, 17, 20	.66	1.964	4.2%

Table 5 presents the rotated factor matrix obtained via Principal Axis Factoring, Varimax with Kaiser Normalization. As can be seen, all 47 characteristics of Effective English Language Teachers load "acceptably" (Khodadady & Hashemi 2010, p. 18), i.e. .30 or higher, only on five factors in the present study. These

[Downloaded from ijal2.khu.ac.ir on 2026-11-24]

results disconfirm the second hypothesis that *the 47 characteristics of Effective English Language Teachers will load acceptably, i.e., .30 and higher, on 12 factors* and thus challenge the validity of factors extracted by Moafian and Pishghadam (2008).

Table 5

Rotated Factor Matrix of 47 characteristics (C) of English language teachers

C	Factors					C	Factors					C	Factors				
	1	2	3	4	5		1	2	3	4	5		1	2	3	4	5
1	*	*	.57	*	*	17	*	*	*	.40	.36	33	.42	.48	*	*	*
2	.31	*	.52	.32	*	18	*	*	.32	.34	*	34	.41	.43	*	*	*
3	.72	*	*	.33	*	19	*	*	*	*	.63	35	*	.41	.38	*	*
4	.62	*	*	*	*	20	*	*	*	*	.62	36	*	.43	*	*	*
5	.62	*	*	.32	*	21	*	*	.52	*	*	37	*	.36	*	.47	*
6	*	*	.44	.37	*	22	.33	.34	.46	*	*	38	*	.44	*	.43	*
7	.72	*	*	*	*	23		.33	.47	*	*	39	*	.50	*	.36	*
8	.60	*	*	*	*	24	.48	.30	.33	.39	*	40	*	.52	*	*	*
9	.62	*	*	.41	*	25	.37	.40	.31	.39	*	41	*	.54	*	*	*
10	*	*	.43	.50	*	26	.34	.34	*	.40	*	42	*	.49	*	*	*
11	*	*	*	.43	*	27	*	*	*	.54	*	43	*	.49	*	*	*
12	.39	*	.41	.36	*	28	*	.31	.43	*	*	44	.31	.45	*	*	*
13	.31	*	.41	.33	*	29	*	.40	.45	*	*	45	.46	.54	*	*	*
14	*	*	.42	*	*	30	*	.37	.45	*	*	46	.41	.51	*	.37	*
15	.38	*	*	.53	*	31	*	*	.46	*	*	47	*	.40	*	*	*
16	*	*	.32	.41	*	32	*	*	.48	*	*						

* Loadings less than .30

As can be seen in Table 5, in addition to loading on far fewer factors, out of the 47 characteristics of English teachers explored in the present study, 29 (62%) cross loaded on at least two factors and thus disconfirmed the third hypothesis that *the 47 characteristics of Effective English Language Teachers will not cross load acceptably on 12 factor*. While none of the characteristics studied by Moafian and Pishghadam (2008, p. 135), cross loaded on any of their 12 extracted factors, no factor was found in this study whose constituting characteristics did not load on the other four factors.

[Downloaded from ijal2.khu.ac.ir on 2026-11-24]

The cross loadings obtained in this study pose a serious question in applied linguistics, i.e., what should be done with cross loading items? Costello and Osborne (2005, p.4) suggested they be dropped if there were several strong loaders on the same factor. While Moafian and Pishghadam (2008) seemed to have followed their suggestion, this study suggests they be reported for several reasons.

The first and most important reason is the possible contribution of a given characteristic to more than one factor. For instance, the statement, "I believe in my ability to handle most upsetting problems," contributes not only to Optimism but also to Stress Tolerances as sub scales of Emotional Quotient (EQ). Similarly, the statement, "Even when upset, I' m aware of what's happening to me," forms a part of Emotional Self-Awareness and Reality Testing subscales of the EQ questionnaire designed by Bar-On (1997, 2003).

The second reason for the necessity of reporting cross loading characteristics is their effect on the reliability of factors extracted. As can be seen in Table 6, the removal of cross loading characteristics has reduced the reliability quotient (RQ) of four factors extracted in this study. The removal of 12 characteristics cross loading on the first factor has, for example, reduced its RQ from .95 to .83. It has, nonetheless, increased the RQ of the last factor from .66 to .72, indicating that the removal of cross loading characteristics reduces the reliability level of *most* factors.

Table 6
The descriptive statistics of factors having no cross loading characteristics

Name	**# of item**	**Characteristics**	**Alpha**
Rapport	7	3, 4, 5, 7, 8, 9, 24	.83
Farness	15	25, 33, 34, 35, 36, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47	.92
Qualification	14	1, 2, 6, 12, 13, 14, 21, 22, 23, 28, 29, 30, 31, 32	.90
Facilitation	9	10, 11, 15, 16, 17, 18, 26, 27, 37	.85
Examination	2	19, 20	.72

The last reason for the necessity of reporting cross loading characteristics is to provide evidence for further research. One of the anonymous reviewers of this study, for example, has argued that characteristic 17, *Uses good learners to help weaker ones*, "has a higher loading on 'facilitation' and logically seems to be more

[Downloaded from ijal2.khu.ac.ir on 2026-11-24]

relevant to this factor." If a teacher facilitates the learning process successfully, the learners must experience the effectiveness of that facilitation in their examinations. The involvement of good learners in helping weaker counterparts has, in fact, been one of the most successful strategies adopted by the present researcher in achieving educational objectives as reflected in examinations. Future research must, therefore, show which examination factor reveals higher relationships with abilities such as language proficiency, the factor with two characteristics or the one which contains the cross loading characteristic as well.

In addition to revealing cross loadings, the results presented in Table 5 provide empirical support for MacCallum, Widaman, Zhang and Hong's (1999) assertion that factor analyses are based on ***strong data*** if the extracted factors exhibit high loadings on a substantial number of items, i.e., at least three or four, and the number of factors is small. As can also be seen in Table 4, with the exception of the fifth factor, i.e., Examination, a substantial number of items, i.e., 19 to 23 items, have loaded on a small number of factors, i.e., 4, indicating that the results obtained in this study are based on strong data. In contrast, the highest number of items loading on any factor in Moafian and Pishghadam's (2008) study is seven and the number of extracted factors is large, i.e., 12, implying that their data was weak.

Furthermore, the results of the present study provide empirical evidence to challenge Gorsuch (1983) who recommended five subjects per item, with a minimum of 100 subjects, regardless of the number of items. The number of participants in Moafian and Pishghadam's (2008) study is the same as what Gorsuch recommends, i.e., 250. If the recommendation was empirically valid both studies must have yielded similar results. Similarly, the findings of the present study question the validity of having a minimum of 200 to 250 participants suggested by Guilford (1954) and Cattell (1978), respectively.

Table 7 presents the nineteen characteristics forming the first rotated factor which is named ***rapport*** in this study, i.e., 2, 3, 4, 5, 7, 8, 9, 12, 13, 15, 22, 24, 25, 26, 33, 34, 44, 45 and 46. This factor might be used to explain Irby's (1978) two teaching components of *instructor-group interaction* and *instructor-individual student interaction*. Out of 48.6%, ***rapport*** explains 12.1% of rotation sums of squared loadings. (Most of the factors extracted in this study are compared with those of Irby because his randomly selected sample consisting of 408 participants

[Downloaded from ijal2.khu.ac.ir on 2026-11-24]

chosen from a homogenous population, i.e., 308 MD degree holders, 263 fourth-year medical students and 382 residents. No comparison was made with Moafian and Pishghadam's (2008) findings because they did not specify what educational background their 250 participants had except specifying them as elementary, intermediate and advanced language learners whose age ranged between 14 and 36 and studied English at various language institutes in Mashhad. While the former sample is drawn from a homogenous population in terms of academic fields the latter accounts for homogeneity neither in their participants' academic fields nor in their age.)

Table 7

Nineteen characteristics forming the first factor of **rapport**

Characteristic	**Loading**	**Factors Cross Loading**
07 Is good-tempered.	.72	-
03 Is friendly towards learners.	.72	4 (.33)
05 Understands learners well.	.62	4 (.32)
09 Has a sense of humour.	.62	4 (.41)
04 Respects learners as individuals.	.62	-
08 Is patient.	.60	-
24 Is a dynamic and energetic person.	.48	2 (.30) 3 (.33) 4 (.39)
45 Avoids being too strict.	.46	2 (.54)
33 Respects all ideas.	.42	2 (.48)
46 Creates self-confidence in learners.	.41	2 (.51)
34 Accepts constructive criticisms.	.41	2 (.43)
12 Enjoys teaching.	.39	3 (.41) 4 (.36)
15 Has the ability to stimulate learners in learning.	.38	4 (.53)
25 Pays attention to all students.	.37	2 (.40) 3 (.31) 4 (.39)
26 Is willing to help learners in and out of the classroom.	.34	2 (.34) 4 (.40)
22 Is careful and precise in answering learners' questions.	.33	2 (.34) 3 (.46)
02 Has up to date information.	.31	3 (.52) 4 (.32)
44 Avoids making fun of the learners.	.31	2 (.45)
13 Is interested in the subject matter he/she is teaching.	.31	3 (.41) 4 (.33)

Table 8 presents the twenty-three characteristics contributing to the second extracted factor named ***fairness*** in this study, i.e., 22, 23, 24, 25, 26, 28, 29, 30, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, and 47. The second factor

[Downloaded from ijal2.khu.ac.ir on 2026-11-24]

corresponds roughly to Irby's (1978) teaching component of preparation/ organization/ clarity. Out of 48.6%, ***fairness*** explains 11.5% of rotation sums of squared loadings.

Table 8

Twenty three characteristics forming the second factor of **fairness**

Characteristic	**Loading**	**Factors Cross Loading**
41 Avoids discriminating against learners.	.54	-
45 Avoids being too strict.	.54	-
40 Creates opportunities for discussion and asking questions.	.52	-
46 Creates self-confidence in learners.	.51	-
39 Creates equal opportunities for learners' participation in the classroom.	.50	-
42 Attends to the learners problems in learning.	.49	-
43 Divides class time appropriately for the different language skills according to the purposes of the course.	.49	-
33 Respects all ideas.	.48	-
44 Avoids making fun of the learners.	.45	-
38 Involves all students in learning.	.44	-
34 Accepts constructive criticisms.	.43	-
36 Is impartial in grading.	.43	-
35 Has the subject matter well-organized according to the number of sessions and hours	.41	3 (.38)
29 Has clean and tidy appearance.	.40	3 (.45)
25 Pays attention to all students.	.40	3 (.31) 4 (.39)
47 Emphasizes the presence of students in the classroom.	.40	-
30 Presents materials at learners' level of comprehension.	.37	3 (.45)
37 Has creativity in teaching.	.36	-
22 Is careful and precise in answering learners' questions.	.34	3 (.46)
26 Is willing to help learners in and out of the classroom.	.34	4 (.40)
23 Emphasizes important materials and points.	.32	3 (.47)
28 Speaks clearly with a correct pronunciation.	.31	3 (.43)
24 Is a dynamic and energetic person.	.30	3 (.33) 4 (.39)

[Downloaded from ijal2.khu.ac.ir on 2026-11-24]

Table 9 presents the third factor named ***qualification*** in this study. Its twenty constituting characteristics, i.e., 1, 2, 6, 10, 12, 13, 14, 16, 18, 21, 22, 23, 24, 25, 28, 29, 30, 31, 32 and 35 explain 11.2% of rotation sums of squared loadings. The ***qualification*** factor is referred to as the ***knowledge*** component of teaching by Irby (1978).

Table 9
Twenty characteristics forming the third factor of **qualification**

Characteristic	**Loading**	**Factors Cross Loading**
01 Has a good knowledge of subject matter.	.57	-
02 Has up to date information.	.52	4 (.32)
06 Has the ability to manage the classroom well.	.44	4 (.37)
10 Is aware of new teaching methods and strategies.	.43	4 (.50)
12 Enjoys teaching.	.41	4 (.36)
13 Is interested in the subject matter he/she is teaching.	.41	4 (.33)
14 Has self-confidence.	.42	-
16 Knows his/her learners well (talents, abilities, weaknesses).	.32	4 (.41)
18 Gives sufficient number of assignments.	.32	4 (.34)
21 Is well-prepared for the class.	.52	-
22 Is careful and precise in answering learners' questions.	.46	-
23 Emphasizes important materials and points.	.47	-
24 Is a dynamic and energetic person.	.33	4 (.39)
25 Pays attention to all students.	.31	4 (.39)
28 Speaks clearly with a correct pronunciation.	.43	-
29 Has clean and tidy appearance.	.45	-
30 Presents materials at learners' level of comprehension.	.45	-
31 Enters the classroom on time.	.46	-
32 Leaves the classroom on time.	.48	-
35 Has the subject matter well-organized according to the number of sessions and hours	.38	-

Table 10 presents the twenty one characteristics loading on the fourth factor named ***facilitation*** in this study, i.e., 2, 3, 5, 6, 9, 10, 11, 12, 13, 15, 16, 17, 18, 24, 25, 26, 27, 37, 38, 39, and 46. Out of 48.6 % of variance, ***facilitation*** explains 9.6% of teaching component referred to as enthusiasm/stimulation component of teaching by Irby (1978).

[Downloaded from ijal2.khu.ac.ir on 2026-11-24]

Table 10
Twenty one characteristics forming the fourth factor of **facilitation**

Characteristic	**Loading**	**Factors Cross Loading**
27 Encourages learners in different ways.	.54	-
15 Has the ability to stimulate learners in learning.	.53	-
10 Is aware of new teaching methods and strategies.	.50	-
37 Has creativity in teaching.	.47	-
11 Uses extra instructional materials such as tapes, movies, etc.	.43	-
38 Involves all students in learning.	.43	-
09 Has a sense of humour.	.41	-
16 Knows his/her learners well (talents, abilities, weaknesses).	.41	-
17 Uses good learners to help weaker ones.	.40	5 (.36)
26 Is willing to help learners in and out of the classroom.	.40	-
24 Is a dynamic and energetic person.	.39	-
25 Pays attention to all students.	.39	-
06 Has the ability to manage the classroom well.	.37	-
46 Creates self-confidence in learners.	.37	-
12 Enjoys teaching.	.36	-
39 Creates equal opportunities for learners' participation in the classroom.	.36	-
18 Gives sufficient number of assignments.	.34	-
03 Is friendly towards learners.	.33	-
13 Is interested in the subject matter he/she is teaching.	.33	-
02 Has up to date information.	.32	-
05 Understands learners well.	.32	-

Table 11 presents the three characteristics which loaded on the fifth factor named ***examination*** in this study, i.e., 19, 17 and 20. Out of 48.6 % of variance explained by the five factors extracted in this study, ***examination*** claims a distinct percent of 4.2 as a single factor and thus factorially validates the examination/ grading component of teaching component identified by Irby (1978).

[Downloaded from ijal2.khu.ac.ir on 2026-11-24]

Table 11
Three characteristics forming the fifth character of ***examination***

Characteristic	**Loading**	**Factors Cross Loading**
19 Holds adequate number of tests.	.63	-
20 Is prompt in returning test results.	.62	-
17 Uses good learners to help weaker ones.	.36	4 (.40)

The extraction of a distinct factor from the response of 1469 English language learners indicate the importance of examination in offering language programs and provide further support for Khodadady's (1998, 1999) assertion that testing is an *integral part* of teaching. Language learners expect their teachers to hold an adequate number of tests and to be prompt in returning their test results so that they can have concrete values to measure their own achievement.

Conclusion

A questionnaire exploring the 47 Characteristics of Effective English Language Teachers (CEELT) was administered to 1469 learners at 25 public and private language schools and their responses showed that five factors form their perception of effective English teaching, i.e., rapport, fairness, qualification, facilitation and examination. The results obtained in this study thus show that having a small sample results in extracting a large number of factors whose justification becomes personal and hard to maintain. On the other hand, larger samples tend to minimize the probability of errors, maximize the accuracy of population estimates, and increase the generalizability of the results.

In addition to identifying fewer underlying factors, the present study provides evidence to challenge Gorsuch's (1997, p. 541) assertion that the sample size of 10 cases for every item was recommended (e.g., Everitt 1975, Nunnally, 1978) "largely out of ignorance rather than theory or research". Had Moafian and Pishghadam (2008) accepted 10 cases at least and administered the CEELT to 470 participants, instead of 250, i.e., slightly higher than five cases for each item, as Gorsuch (1983) recommended, the results might have been similar to those obtained in the present study.

If we take the sample selected in this study as a research-based example, then we should follow Comrey and Lee's (1992) guidance in determining the adequacy

[Downloaded from ijal2.khu.ac.ir on 2026-11-24]

of sample size, i.e., 100= poor, 200 = fair, 300 = good, 500 = very good, 1,000 or more = excellent. Since most studies in social sciences are conducted on human beings whose selection is based on voluntary participants and convenience, including a large sample, e.g., a ratio of 30 cases for each item seems to approximate random selection and secure its representativeness. Moafian and Pishghadam's (2008) convenient selection of 250 students from all elementary, intermediate and advanced learners without controlling their academic fields and age, for example, might have contributed to the large number of factors they have extracted.

Furthermore, employing the findings of simulation studies to design research projects in contexts such as Iran where large populations such as English language learners are available does not seem to provide reliable and valid conclusions. These studies are basically conducted on computers which are fed by the data extracted from a large number of studies conducted on representative samples. Guadagnoli and Velicer (1988), for example, employed a simulation study and evaluated the stability of results across several conditions. They concluded that a number of 150 participants was enough to validate a psychological measure consisting of 40 or 50 items, i.e., a ratio of 3 to 1, as did Reddon (1990). The finding of the present study, however, show that even a slightly higher ratio such as 5 to 1 is not enough in an Iranian context because the results obtained on this ratio are noticeably different from the one employing a much higher ratio of 30 to 1.

And finally, cross loading seems to be quite natural among the few factors extracted in the studies conducted on large samples. This observation may show that as latent variables, factors underling the CEELT share a number of features with each other and thus implicate the adoption of a holistic approach towards teaching by effective English language teachers. Future research must therefore show whether the whole score obtained on the CEELT along with the factors having cross loading characteristics as well as the factors having no cross loading characteristics will reveal any significantly different relationships with abilities such as achievement and language proficiency.

Acknowledgements
This paper is partly based on a research project conducted under the contract coded 2/15545 and dated November 2, 2010 (1389.8.11). It was sponsored and funded by

[Downloaded from ijal2.khu.ac.ir on 2026-11-24]

the Office of Research Vice-Dean of Dr. Ali Shariati Faculty of Letters and Humanities at Ferdowsi University of Mashhad.

Received 2 July 2010
Revised version accepted 8 September 2010

References

Bentler, P. M., & Kano, Y. (1990). On the Equivalence of Factors and Components, *Multivariate Behavioral Research*, 25 (1), 67-74.

Brown, H. D. (2007). *Principles of language learning and teaching* (5rd ed.). NY: Pearson Education.

Cattell, R. B. (1978). *The scientific use of factor analysis*. New York: Plenum.

Comrey, A. L., & Lee, H. B. (1992). *A first course in factor analysis*. Hillsdale, New Jersey: Erlbaum.

Costello, A. B. & Osborne, J. W. (2005). Best Practices in Exploratory Factor Analysis: Four Recommendations for Getting the Most From Your Analysis, *Practical Assessment Research & Evaluation*, 10 (7), 1-9. Retrieved from: *http://pareonline.net/pdf/v10n7.pdf.*

Everitt, B. S. (1975), Multivariate analysis: the need for data and other problems, *British Journal of Psychiatry*, 126, 237-240.

Feldman, K. A. (1996). Identifying exemplary teaching: Using data from course and teacher evaluations, *New Directions for Teaching and Learning*, 65, 41-50.

Floyd, F. J., & Widaman, K. F. (1995). Factor analysis in the development and refinement of clinical assessment instruments, *Psychological Assessment*, 7(3), 286-299.

Gadzella, B. M. (1971). College students' views and ratings of an ideal professor. In I. J. Lehmann and W. A. Mehran (Eds.), *Educational research readings in focus* (pp.131-138). New York: Holt, Rinehart and Winston.

[Downloaded from ijal2.khu.ac.ir on 2026-11-24]

Gorsuch, R. L. (1983). *Factor Analysis* (2nd Ed.). Hillsdale, NJ: Erlbaum.

Gorsuch, R. L. (1990). Common Factor-Analysis versus Component Analysis - Some Well and Little Known Facts, *Multivariate Behavioral Research*, 25 (1), 33-39.

Gorsuch, R. L. (1997). Exploratory factor analysis: Its role in item analysis, *Journal of Personality Assessment*, 68 (3), 532-560.

Guadagnoli, E., & Velicer, W. F. (1988). Relation of sample size to the stability of component patterns, *Psychological Bulletin*, 103, 265-275.

Guilford, J. P. (1954). *Psychometric methods* (2nd Ed.). New York: McGraw Hill.

Hildebrand, M., Wilson, R. C., & Dienst, E. R. (1971). *Evaluating university teaching*. Berkeley, California: Center for Research and Development in Higher Education, University of California.

Horwitz, E. K. (1981). *Beliefs about language learning inventory*. Unpublished instrument, The University of Texas at Austin, Austin, TX.

Horwitz, E. K. (1985). Using student beliefs about language learning and teaching in the foreign language methods course, *Foreign Language Annals*, 18, 333-340.

Horwitz, E. K. (1988). The beliefs about language learning of beginning university foreign language students, *The Modern Language Journal*, 72, 283–294.

Irby, D. M. (1978). Clinical teacher effectiveness in medicine, *Journal of Medical Education*, 53, 808-815.

Kaiser, H. F., & Rice, J. (1974). Little Jiffy, Mark IV, *Educational and Psychological Measurement*, 34, 111-117

Khodadady, E. (2009).The Beliefs about Language Learning Inventory: Factorial Validity, Formal Education and the Academic Achievement of Iranian Students

[Downloaded from ijal2.khu.ac.ir on 2026-11-24]

Majoring in English, *Iranian Journal of Applied Linguistics* (*IJAL*), 12 (1), 115-165.

Khodadady, E., & Hashemi, M. R. (2010). Construct Validity of Beliefs about Language Learning: Componential or Factorial, *Ferdowsi Review*, 1(1), 3-20.

Loehlin, J. C. (1990). Component Analysis Versus Common Factor-Analysis - a Case of Disputed Authorship, *Multivariate Behavioral Research*, 25(1), 29-31.

MacCallum, R. C., & Tucker, L. R. (1991). Representing Sources of Error in the Common-Factor Model - Implications for Theory and Practice, *Psychological Bulletin*, 109 (3), 502-511.

MacCallum, R. C., Widaman, K. F., Zhang, S., & Hong, S. (1999). Sample size in factor analysis, *Psychological Methods*, 4, 84-99.

Moafian, F., & Pishghadam, R. (2008). Construct validation of a questionnaire on characteristics of successful English language teachers, *Pazhuhesh-e Zabanhe-ye Khareji Journal* (University of Tehran), 54, 127-142.

Mulaik, S. A. (1990). Blurring the Distinctions between Component Analysis and Common Factor-Analysis, *Multivariate Behavioral Research*, 25 (1), 53-59.

Reddon, J. R. (1990). The rejection of the hypothesis of complete independence prior to conducting a factor analysis, *Multivariate Experimental Clinical Research*, 9, 123-129.

Sherman, T. M., Armistead, L P., Fowler, F., Barksdale, M. A., & Reif, G. (1987). The quest for excellence in university teaching, *Journal of Higher Education*, 58, 676-84.

Snook, S. C., & Gorsuch, R. L. (1989). Component Analysis versus Common Factor-Analysis – a Monte- Carlo Study, *Psychological Bulletin*, 106 (1), 148-154.

Suwandee, A. (1995). 'Students' perceptions of university instructors' effective teaching characteristics', *SLLT Journal*, 5, 6–22.

[Downloaded from ijal2.khu.ac.ir on 2026-11-24]

Theall, M., & Franklin, J. (Ed.). (1990). Student ratings of instruction: Issues for improving practice. *New Directions for Teaching and Learning #43*. San Francisco: Jossey- Bass.

Widaman, K. F. (1990). Bias in Pattern Loadings Represented by Common Factor-Analysis and Component Analysis, *Multivariate Behavioral Research*, 25 (1), 89-95.

Widaman, K. F. (1993). Common Factor-Analysis Versus Principal Component Analysis – Differential Bias in Representing Model Parameters, *Multivariate Behavioral Research*, 28 (3), 263-311.

Appendix A
Characteristics of Effective English Language Teachers

Characteristics	**CD**	**D**	**SEA**	**A**	**CA**
01 Has a good knowledge of subject matter.					
02 Has up to date information.					
03 Is friendly towards learners.					
04 Respects learners as individuals.					
05 Understands learners well.					
06 Has the ability to manage the classroom well.					
07 Is good-tempered.					
08 Is patient.					
09 Has a sense of humour.					
10 Is aware of new teaching methods and strategies.					
11 Uses extra instructional materials such as tapes, movies, etc.					
12 Enjoys teaching.					
13 Is interested in the subject matter he/she is teaching.					
14 Has self-confidence.					
15 Has the ability to stimulate learners in learning.					
16 Knows his/her learners well (talents, abilities, weaknesses).					
17 Uses good learners to help weaker ones.					
18 Gives sufficient number of assignments.					
19 Holds adequate number of tests.					

[Downloaded from ijal2.khu.ac.ir on 2026-11-24]

20 Is prompt in returning test results.					
21 Is well-prepared for the class.					
22 Is careful and precise in answering learners' questions.					
23 Emphasizes important materials and points.					
24 Is a dynamic and energetic person.					
25 Pays attention to all students.					
26 Is willing to help learners in and out of the classroom.					
27 Encourages learners in different ways.					
28 Speaks clearly with a correct pronunciation.					
29 Has clean and tidy appearance.					
30 Presents materials at learners' level of comprehension.					
31 Enters the classroom on time.					
32 Leaves the classroom on time.					
33 Respects all ideas.					
34 Accepts constructive criticisms.					
35 Has the subject matter well-organized according to the number of sessions and hours					
36 Is impartial in grading.					
37 Has creativity in teaching.					
38 Involves all students in learning.					
39 Creates equal opportunities for learners' participation in the classroom.					
40 Creates opportunities for discussion and asking questions.					
41 Avoids discriminating against learners.					
42 Attends to the learners problems in learning.					
43 Divides class time appropriately for the different language skills according to the purposes of the course.					
44 Avoids making fun of the learners.					
45 Avoids being too strict.					
46 Creates self-confidence in learners.					
47 Emphasizes the presence of students in the classroom.					

Completely disagree (CD), disagree (D), to some extent agree (SEA), agree (A), and completely agree (CA)

[Downloaded from ijal2.khu.ac.ir on 2026-11-24]

Appendix B

Descriptive statistics of items comprising CEELT (N = 1469)

Item	No Response	Completely disagree	Disagree	Agee to some extent	Agree	Completely agree	Mean	Std. Deviation
1	9	17	14	131	386	912	4.45	.863
2	5	19	37	217	480	711	4.23	.922
3	5	66	94	146	304	754	4.07	1.180
4	11	22	42	190	303	901	4.35	.994
5	10	70	105	279	415	590	3.90	1.186
6	7	48	48	162	377	827	4.27	1.050
7	11	50	48	177	297	886	4.29	1.095
8	10	46	73	211	334	795	4.18	1.115
9	6	137	123	242	311	650	3.81	1.347
10	20	52	94	268	486	549	3.90	1.158
11	21	419	206	259	244	320	2.85	1.558
12	5	28	60	186	380	810	4.27	.997
13	7	6	38	156	463	799	4.35	.861
14	6	12	12	107	403	929	4.50	.790
15	13	94	120	278	417	547	3.79	1.251
16	19	75	110	280	428	557	3.83	1.228
17	37	273	312	327	251	269	2.88	1.440
18	23	109	110	226	324	677	3.87	1.348
19	51	119	137	246	377	539	3.63	1.434
20	51	116	114	238	357	593	3.71	1.435
21	18	27	34	147	323	922	4.38	1.007
22	14	48	41	138	331	897	4.32	1.076
23	12	31	41	123	317	945	4.41	.997
24	8	62	83	174	337	805	4.17	1.154
25	11	90	95	247	320	706	3.97	1.256
26	28	94	135	312	406	494	3.67	1.300
27	27	161	212	319	374	376	3.35	1.381

[Downloaded from ijal2.khu.ac.ir on 2026-11-24]

28	14	65	57	153	298	882	4.25	1.162
29	12	26	29	94	254	1054	4.53	.934
30	20	45	47	158	449	750	4.19	1.097
31	10	15	33	118	302	991	4.49	.897
32	13	43	37	119	312	945	4.39	1.039
33	21	64	86	193	390	715	4.05	1.213
34	33	93	99	241	389	614	3.84	1.325
35	25	44	62	200	391	747	4.13	1.157
36	33	59	51	169	298	859	4.19	1.235
37	29	88	122	238	417	575	3.80	1.305
38	16	63	104	191	381	714	4.04	1.208
39	28	58	94	223	386	680	3.99	1.238
40	21	63	74	207	306	798	4.12	1.220
41	19	66	76	147	308	853	4.19	1.210
42	25	57	69	230	354	734	4.06	1.209
43	33	64	85	200	313	774	4.05	1.282
44	13	68	64	141	238	945	4.29	1.179
45	11	89	68	156	329	816	4.14	1.221
46	14	108	97	247	377	626	3.87	1.287
47	13	30	39	138	235	1014	4.45	1.008

[Downloaded from ijal2.khu.ac.ir on 2026-11-24]