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Original Article

Psychometric Properties of Reading Comprehension Test for Fourth Grade Elementary School Students

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ABSTRACT

This study was an attempt to examine psychometric properties, reliability, and validity of a test of reading comprehension for fourth grade elementary school students in Firouzabad, Iran. The target population of the study included (458 male and 464 female) fourth grade elementary school students in the 2010-2011 school year selected by census method. The measurement instrument included a reading comprehension test developed based on the abilities of fourth grade elementary school students and from extracurricular materials so that the test can measure the student's actual ability in reading comprehension. Reliability of the test was estimated to be 0.86 after removing one of the items. Experts and experienced teachers' views were sought for validity analysis and content validity of the test was confirmed. Furthermore, after examining criterion validity of the test, a correlation analysis was made between the students' scores in reading comprehension and their scores in two courses: 'let's read' and 'composition'. The correlation coefficient for the relationship between the reading comprehension test both 'composition' and 'let's read' was the same, i.e., 0.56 and meaningful at 0.001 level of significance. Based on the results obtained in the main implementation of the test, students' mean score was 20/50 with the standard deviation of 0.36. The results of the t test showed that there was no meaningful difference between male and female students in test performance in reading comprehension. Factor analysis was also used for examining test dimensions. For this purpose, principal component (PC) analysis was used. Analysis of the scree plot showed that from the 6 factors, the first factor explained a higher percentage of the variance compared to other factors.
Keywords: Psychometric Properties, Reading, Comprehension

INTRODUCTION

Language has been the best means of understanding and making oneself understood. It is the key to treasures of human knowledge. Using language, a relationship can be established with the living people, those lived in the far past, and even those who are going to live in the future preparing the ground for transmission of culture and civilization from one generation to the other. Considering the large importance of in mental development of individuals and growth and development of the society, it can be claimed that the primary and the most important duty of teachers in the educational system is to teach language using the correct and appropriate approaches and creating appropriate learning opportunities in the direction of improving their students' linguistic skills. In this way, they help them to be most successful in their ability to adapt to different situations and conditions [1].

Reading is one of the most complicated skills in language learning which helps foster and launch all learning abilities such as the power of reasoning, distinguishing, generalizing, abstraction, giving a verdict, and judgment. Reading is also considered as a decoding skill meaning that the code of language is deciphered to understand the meaning of a message. Reading is a kind of practice in visual perception. Students should be able to distinguish between the letters. This ability is developed in majority of the children by the age of six, but

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reading is a complicated and multi-dimensional skill for understanding written texts [2]. According to Guilford, reading and comprehension are among the most complicated cognitive abilities which, on the one hand, are closely related to mental abilities and, on the other, are the means of thinking, solving problems, and learning in all educational aspects [3].

Profit showed that decoding is faster in those who have better comprehension ability. According to them, the reason is that there is a competition between decoding and comprehensions for accessing the limited resources existing in the working memory and those who have weaker comprehension ability, due to their slow recognition have access to more limited resources in their working memory. While this can be true, providing the opportunity for more resources does not necessarily improve comprehension [5].

Cramer found that it is likely that those who are weak in reading comprehension and decoding skills are normal in them, read the texts word by word without using larger grammatical units such as phrases. Esakson and Miller also concluded that those with weaker comprehension abilities process the texts word by word. On the contrary, those who have good comprehension skills, since they pick up the meaning of what they read based on the grammatical and semantic information, are expected to be influenced by the semantically or grammatically strange words [5]. In fact, Esakson and Miller predicted that individuals with good comprehension abilities are more likely to misread unknown words whereas those who have weak comprehension abilities are not more likely to misread unknown words they encounter in a text [6].

Yule et al. conducted an experimental study on perception of pronouns. They compared them with good and bad reading comprehension ability in recognition of the words the pronouns referred to. In this study, the performance of those with lower comprehension abilities was much worse than those who were good at comprehension. Furthermore, when a question was asked about the text which required using the information about the pronoun which had a higher distance from the noun (its referent), their performance would become much worse [7]. Yule et al. hypothesized that this problem is due to inadequate use of the working memory system. This hypothesis can be true, but the main reason might, in fact, be that weak grammatical processing ability leads to the imposition of an overload on the working memory which it cannot deal with. This situation is especially likely when the child reads word by word [8].

Ock Hill compared the abilities of the children who had good comprehension abilities with those who were weak in this respect in their response to some sets of questions related to the text they have been exposed to. Some of the questions required answers which had been clearly mentioned in the text while others needed inferring. In one case, the students had to answer based on their memory. Those who were weak in reading comprehension, Answered, but they were still weak in answering questions that required them to draw inferences. The second state is of special significance as in the normal process of reading, there is always a text the understanding of which requires making inferences based on the text [6]. The results of studies by Raven et al. Related to reading and comprehension in Florida show that age, gender, and economic and social background do not make any meaningful difference in terms of scores obtained in reading comprehension. Briter conducted another study comparing reading and listening in the science course for sixth grade elementary school students. The results of his study indicated that there is no meaningful difference between girls and boys in comprehension. Monfared [9] found that the mean scores of girls in the reading comprehension test were better than their scores in listening comprehension.

Garner et al. asked two groups of children with bad and good performance in reading comprehension to read parts of a text along with some questions related to the topic mentioned in the previous page. Only the oldest one in the group with good reading comprehension performance (aged 13) was able to look simultaneously at the previous page to find the answer to the questions. There is quite similar evidence to show that those weak in reading comprehension use reading strategies less effectively than others [10].

Considering the point mentioned above, despite the fact that the most important goal of reading is to comprehend, it seems that this goal has been marginalized at schools and, instead, less primary aspects of reading, i.e., grammar and spelling, have been focused upon. Furthermore, during instruction it can also be observed that students have gone through some texts several times, but in evaluation it was found that reading did not lead to comprehension. For this reason, there is a need for standard reading comprehension tests. Therefore, considering the large importance of reading comprehension at all educational levels, the present study attempts to assess fourth grade elementary school students' reading comprehension and help teachers and school advisors to identify students' learning difficulties.

Research questions

1) To what extent is the reading comprehension test which is developed based on extracurricular materials reliable?

2) Is the reading comprehension test valid enough in the population under study?

3) Is there any difference between male and female students in test performance?

MATERIALS AND METHODS

This study is an attempt to construct a test of reading comprehension and examine its reliability, validity, and Standardization for the fourth grade elementary school students in Forouzabad, Iran. For this purpose, the

performance of students based on their gender was also examined. This study is both developmental and descriptive and survey-based as it examines validity of a test of reading comprehension .

Population, sample and sampling method

The target population included all the male and female fourth grade elementary school students (458 male and 464 female) from 45 institutes in the 2010-2011 school year in Firouzabad, Iran. Therefore, in order to have a good sample representative of the target population, census sampling method was used, that is all the fourth grade elementary school students formed the sample population .

Instrument

The measurement instrument in this study included a reading comprehension test for fourth grade elementary school students. Clearly the constructed test is compatible with the ability level and mental abilities of these students. Initially, some texts were selected based on the mental abilities of the fourth grade elementary school students from books of the 'thought center for children and adolescents' (an educational institution in Iran) which were available to the students. Every text was carefully edited. Then objectives of every text were specified. A two-dimensional table was prepared and questions were developed based on the objectives and the content of the texts .

In preparing the texts, there was an attempt to make sure that they are not based on the contents covered at the school to make sure that educational progress has been least influenced by direct instruction and the test is a better representation of students' reading and comprehension ability. Besides, experienced teachers and education expert's views were sought about the content of the texts, questions, and the items and the problematic parts were removed. After developing the test, the questions that overlapped in terms of the objective and those which assessed less important topics were removed. The finalized form included a 56-item test with multiple choice items. The items of the reading comprehension test included 35 questions of the objective kind which can increase internal validity of the test and help correct interpretation of the results .

Reliability and validity

Content analysis of the test is considered by matching what is being tested against educational objectives and content of the test. This stage of validity analysis was gone through when developing the experimental forms and preparing the final form of the test. To ensure criterion validity, as there was no standard test to be set as the criterion, the students' score in 'composition' and 'let's read' courses were considered as an index of educational progress which was estimated by examining the correlation between the scores obtained in the test and the scores of educational progress of the sample group in coordinated exams. Reliability of the test was also estimated by Cronbach's Alpha which was 0.867 before eliminating weak items and 0.869 after removing them .

Data analysis

Factor analysis and correlation matrix of the test items were used to find the answer to the research questions of the study. For finding the constructs underling the test, principal component (PC) analysis was used. Independent samples t-test was also used to compare male and female students' performance in the test. Percentile rank of the test takers' raw scores was calculated and then the scores were converted to standard z scores and for all the students, IQ scale scores with the mean of 100 and standard deviation of 15 was determined.

RESULTS

In order to find out how many factors the reading comprehension test has, principal component analysis was used. For determining the factor or factors underlying the test items factor analysis via axis rotation method was used. Before performing factor analysis, in order to ensure about the adequacy of the sample, KMO measure reflecting adequacy of sampling was applied. And finally Bartlett's Test of Sphericity was used to make sure that matrix of correlations which are set as the basis for factor analysis is not zero in the population.

Table1. The results of KMO test and Bartlett's Test of Sphericity

KMO	0.916
Bartlett's Test of Sphericity	4436.08
DF	276
Sig.	0.001

As shown in Table 1, KMO and Bartlett's Test of Sphericity values are meaningful at 0.001 level of significance. Therefore, based on these two criteria, it can be concluded that performing factor analysis based on matrix of correlations in the sample group under study is justified.

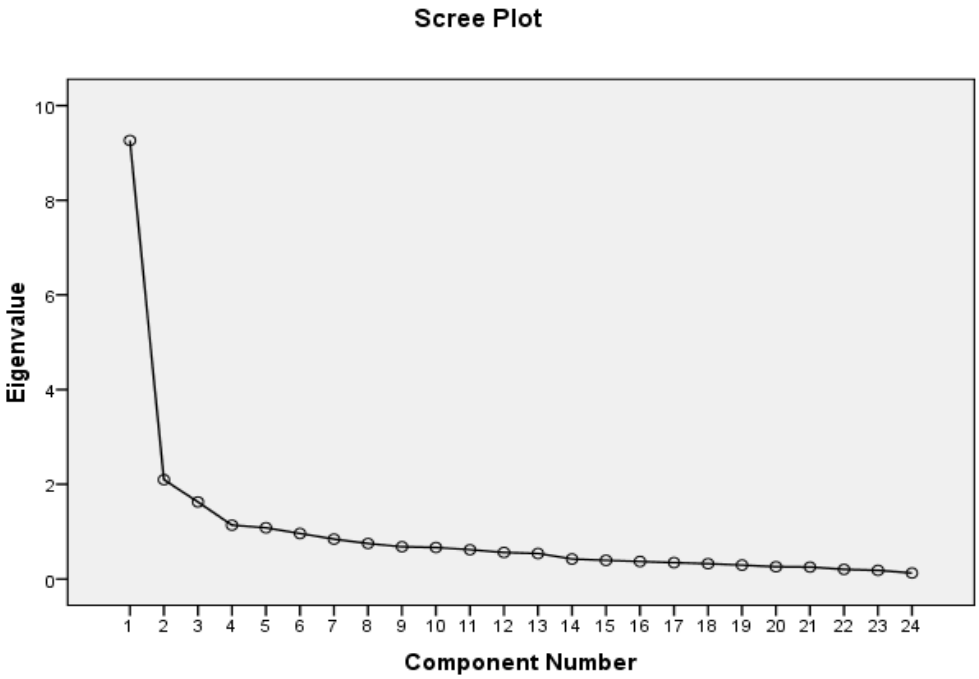

Fig. 1. Scree plot

Based on the screen plot and Equity values, it can be stated that the test is composed of one factor with the Equity values of 9.26.

Table 2. The results of factor loadings after varimax rotation

Item	Factor loading	Item	Factor loading
1	0.601	13	0.574
2	0.760	14	0.493
3	0.538	15	0.660
4	0.836	16	0.597
5	0.468	17	0.634
6	0.652	18	0.849
7	0.814	19	0.779
8	0.631	20	0.873
9	0.519	21	0.855
10	0.633	22	0.787
11	0.841	23	0.644
12	0.865	24	0.545

Matrix of factor loadings indicates that all the factor loadings are above 0.4. For reliability analysis, internal consistency approach using Cronbach's Alpha was applied (See Table 3 for the results).

Table 3. The results of internal consistency test using Cronbach's Alpha

Number of test takers	336
Number of items	24
Cronbach's Alpha	0.902

For validity analysis of test, however, criterion validity was used, i.e., the correlation between the test scores and the scores from two courses of 'composition' and 'let's read' as the educational progress score (see Table 4 for the results)

Table 4. Matrix of correlation between test scores and the scores from 'composition' and 'let's read' courses

	Test	Composition	Let's read
Test	1		
Composition	0.568**	1	
Let's read	0.565**	0.732**	1

P> 0.001

As shown in Table 4, there is a meaningfully positive relationship between the test scores and the scores obtained in 'composition' and 'let's read'. The correlation coefficient for the relationship between test scores and 'composition' scores is 0.568 and for the relationship between test scores and 'let's read' scores it was 0.565.

Table 5. The results of independent samples t-test for the difference between male and female students

Group	Mean	Std.	Standard error	t	df	Sig.
Girls	79.42	16.24	1.26	0.218	334	0.828
Boys	79.87	12.5	965			

Based on the t value (0.218) and level of significance (0.828), the results of t-test indicate that there is no meaningful difference between boys and girls in reading comprehension.

DISCUSSION

Based on the results in the main implementation of the study, mean score of the students in this test were 20.50 with the standard deviation of 0.36 .

For reliability analysis of the reading comprehension test, after estimating the correlation coefficient of each of the questions with the whole test using the point biserial correlation coefficient, it was found that item 27 was weakly correlated with the test and was, therefore, removed from the test. Reliability of the test was 0.867 before and 0.869 after eliminating this item. The results showed that the test was reliable and valid enough for testing students' reading comprehension ability .

Validity of the test was examined using two approaches. First, experts and experienced teachers' views were used to confirm content validity of the test. Second, the correlation of students' scores in reading comprehension test with their scores in 'composition' and 'let's read' courses, as students' scores of educational progress was examined. The correlation between test scores and the scores in both these courses was estimated to be 0.56 which is meaningful at 0.001 level of significance. Therefore, criterion validity of the reading comprehension test was confirmed .

T-test was used to answer the third research question (Is there any difference between male and female students in test performance?). The performance of the two groups was compared. The results showed that there is no meaningful difference between the two groups of students in terms of their reading comprehension ability .

A set of standardized norms (percentile rank and IQ scale scores with the mean of 100 and standard deviation of 15) was used for all the test takers to report the results of the reading comprehension test .

Factor analysis was used for reveal dimensions of the test after examining KMO sampling adequacy and also significance of the Bartlett sphericity test and making sure about the existence of the conditions required for performing factor analysis. Principal components analysis was used for this purpose. Analysis of the scree plot showed that the contribution of the first factor was more than other factors. The results of analysis of the p values and variance explained by each factor yielded 6 factors. These six factors explained 38.8 percent of all the variance of the variables. The contribution of the first factor was 19.1 percent and that of other factors (from the second to the sixth) was 4.7, 4, 3.0, 3.6, and 3.5 percent respectively. In this analysis, varimax orthogonal rotation method was used. The results from factors rotation and their interpretation are as the following :

1 .Out of the 35 items in the reading comprehension test, nine of them has is correlated with the first factor which is called comprehension ability .

2 .The second factor, i.e., vocabulary understanding has a strong correlation with 7 items .

3 .The third factor called complicated literal understanding has a relatively strong correlation with five items .

4 .The fourth factor, that is inferential comprehension, has a relatively strong correlation with six items .

5 .The fifth factor called simple literal understanding has a relatively high correlation with 4 questions .

6 .Finally, the sixth factor is correlated with 4 items. This factor is called skimming .

It should be mentioned that the labels for these factors are temporary. There is a need for further examine these factors underlying this test in the future studies.

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