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Assessment of basic competencies in adults: Item pool validity and reliability study

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Abstract

Achievement tests are among the most widely used data collection tools to measure the knowledge and skill levels of individuals. For this reason, the existence of valid and reliable achievement tests that can perfectly reveal the competencies that a person should have in any discipline is of great importance. The purpose of this research is to provide evidence for the validity and reliability of an achievement test that will be used to reveal the verbal competencies of adults and the degree of these competencies. In the first part of the study, 1200 multiple-choice questions were prepared from the verbal domain. The prepared items were reduced to 1030 items by passing the expert opinion. Based on the criteria determined by Webb (1997) for the evaluation of learning outcomes, the opinions of field experts and experienced teachers were evaluated. In the second part of the study, a pilot application was made to 3.250 participants across Turkey on the e-platform created. Item analysis with the ITEMAN program showed that the test was valid to some degree. The KR-20 reliability coefficient was found to be .77, providing evidence of the reliability of the test. It is expected that the developed test will contribute to revealing basic skills in adults and be used in related research.

Keywords: Basic Skills in Adults, Verbal Skills, Validity, Reliability, Computer Based Assessment

1. Introduction

For individuals to adapt to the constantly changing and transforming living conditions, it is necessary to develop their knowledge, skills and competencies in the basic areas of life. Along with that, this requires the individual to improve himself with lifelong learning, which will support his knowledge, skills and competencies after formal education in order to adapt to the changes in his life as well as his in-school learning (Bağcı, 2011). These and similar skill sets have a positive effect on the quality of life of individuals during their survival. Changes in the world of science and technology, which are constantly advancing and developing, require the need for renewal and development of the manpower needed via education in today's world. In this context, there is a need

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for the human potential to renew and develop themselves through continuous education and to renew their skills.

Today, adult skills consist of three basic areas: reading and writing, basic math and digital skills, which we discuss mostly based on literacy of these skills. Since in the literature, these skills are generally considered within the framework of literacy skills. Sanders (1999) defines literacy as "a bundle of relationships and structures, a dynamic system that people internalize and transfer to their experiences". According to this definition, while defining these skill sets in adults, it is necessary to reconstruct the structure in mathematics and digital skills and the related measurement method.

1.1. Adult Basic Skills

In order for the individual to cope with the problems he encounters throughout his life, the continuity of his skills should be ensured. Goals of lifelong learning (LLL); Developing the skill of "learning to learn" is providing access to the necessary resources for the information needed (Turan, 2005). The concept of LLL; It was first mentioned in 1929 by Basil Yeaxlee. In the 1990s, the European Union (EU) updated the traditional understanding of education with the concept of lifelong learning. With the publication of the lifelong learning strategy document in 2009, Turkey reorganized its education-training activities according to the EU education system. Turkey included lifelong learning (LLL) in its renewed understanding of education when the EU commission declared 1995 as the "European Year of Lifelong Learning". The renewed understanding of education; It does not limit the education of individuals to school only, but aims to continue their education after school and thus gain the knowledge, skills and abilities they need in their real lives and professions.

The EU has declared the competencies of communication in mother tongue and foreign language, mathematics, science and technology literacy, digital competencies, learning to learn, citizenship, entrepreneurship as LLL competencies (as cited in Günüç, Odabaşı, & Kuzu, 2012). Scales as LLL skills (2008); It deals with skills such as learning to learn and scientific production, overcoming the problems encountered, mathematics, science, information literacy, foreign language and problem solving, and analytical thinking (Günüç et al., 2012). In the 10th Development Plan prepared within the framework of LLL philosophy, individuals; It has been stated that it is possible to continue their professional lives more efficiently not only with professional skills, but also with having basic skills (Ministry of National Education [MEB], 2018).

1.1.1. Verbal Skills

According to Akyol (2001), reading is defined as the meaning-making process that occurs as a result of the interaction of all these, including written (author) and non-written sources, reader and environmental elements. According to Coşkun (2002a),

different mental processes such as reading, perception, seeing, paying attention, remembering, making sense, interpretation, synthesis and analysis occur together; It is a very important educational tool and language skill that plays a role in the individual's gaining knowledge and culture in order to know himself, his environment and the world, and reaching critical consciousness. From this perspective, the literature defines reading not only as making the shapes meaningful in the mind, but also as the only skill that an individual uses to get to know and understand the world. Reading is the individual understanding and interpretation of the message presented as a written text by the author. The main purpose of reading a text is to understand that text. If there is reading, there must be comprehension. If the individual has not analyzed and understood, it means that the reading has not achieved its purpose.

1.1.2. Verbal Skills Sub-Fields

Based on the Turkish Language Curriculum included in the Adult Literacy Teaching and Basic Education Program (2007) of the Ministry of National Education and the verbal skills mentioned in terms of literacy for adults listed as;

- To gain listening/watching, speaking, reading and writing skills,
- To ensure that they use Turkish consciously, correctly and carefully in accordance with the rules of speaking and writing,
- To gain the ability to read simple texts,
- To gain the ability to read with understanding,
- To enable them to critically evaluate and question what they have read.

Developing research, exploration, interpretation and mental construction skills

Care was taken to ensure that the outcomes to be used as a framework for the scale to be prepared in this context should reflect the mentioned sub-headings.

Question writing process was based on following text types:

- Explorative Texts
- Narrative Texts
- Descriptive Texts
- Persuasive Texts

1.1.3. Learning Outcomes

The achievements for measuring basic verbal skills in adults were formed under two headings as reading achievements and visual reading achievements. As emphasized by Coşkun (2002), the common point of the learning outcomes, which are defined as reading outcomes, focuses on perception, seeing, paying attention, remembering, making sense,

interpreting, synthesis and analysis. Visual reading learning outcomes are summarized as questioning, interpretation, information gathering and evaluation.

1.1.4. Quantitative Skills

Mathematics is a science that started to emerge with the history of humanity. Mathematics is one of the main areas of knowledge that occurs with the skills of grouping, matching, quantifying the objects that human beings encounter throughout their lives and expressing them with audio and visual symbols. The developments in trade life, the comparison of distance amounts, the efforts to know the time cycles in advance, the sharing problems and the efforts to preserve the amounts have led to the formation of number systems and calculations with these numbers. It can be said that this situation plays an important role in the formation of mathematics and arithmetic.

1.1.5. Quantitative Skills Sub-Fields

When we look at the studies examining the basic mathematical skills of adults, we see that a mathematical perception that is socially constructed and has a cultural basis (Zaslavsky, 1994) and that is not just about numbers (Withnall, 1995) is an "abstract, neutral and universal" perception of mathematics. It is suggested that it be replaced. From this perspective, according to this new approach, the uses of mathematical operations such as literacy are cultural practices that reflect specific social and historical contexts (Joram, Resnick, & Gabriele, 1994). Many of our daily life activities (shopping, learning a new hobby, various games, using technology, etc.) require the use of mathematical skills in various fields and forms (Gal, 1993; Withnall, 1995).

Based on the Mathematics Curriculum included in the Adult Literacy Teaching and Basic Education Program (2007) of the Ministry of National Education and the numerical skills mentioned in terms of literacy for adults;

- To enable them to use their mathematical literacy skills effectively by developing them.
- To enable them to understand mathematical concepts and use these concepts in their daily shopping.
- To provide their own thinking and reasoning in the problem solving process
- To enable them to use their estimation and mental processing skills effectively.
- It is aimed to enable them to comprehend the units of length, weight, liquid, circumference and area measurements used in daily life.

Care was taken to ensure that the outcomes to be used as a framework for the scale to be prepared in this context should reflect the aforementioned sub-headings.

In the prepared questions, within the framework of the learning outcomes written by highlighting the content of the above-mentioned titles;

- Natural numbers
- Four Operations with Natural Numbers
- Fractions
- Geometrical shapes
- Measuring
- Tables and Graphs

sub-learning domains were used.

1.1.6. Learning Outcomes

Learning outcomes for measuring basic numerical skills in adults were formed under six headings as natural numbers, four operations with natural numbers, fractions, geometric shapes, measurement, tables and graphics. The common points of the achievements created are able to understand mathematical concepts and systems, establish relationships between them, use them in daily life and other learning areas, make logical induction and deductions, know mathematical thinking and reasoning, predict and use mental processing skills effectively, developing solving strategies and using them in solving problems in daily life.

1.1.7. Digital Skills

Digital competence involves confident, critical and responsible use and participation in digital technologies for learning, participation in the workplace and society. This competence area focuses on information and data literacy, communication and collaboration, media literacy, digital content creation, security, intellectual property questions, problem solving and critical thinking (European Commission, 2018). Digital skills are recognized as one of the key competencies for the workforce, lifelong development and effective participation in social and economic life. The main argument is that people who can understand and effectively use digital tools and opportunities have educational opportunities and success, professional development, employment prospects, civic engagement, and many other aspects of their personal and social lives (for example, public and social services, cultural and everyday practices, online shopping), social network etc.) is significantly powerful and advantageous (Jimoyiannis, 2015).

The definition of the concept ranges from simply employing technology to the ability to apply information literacy skills in digital environments with a wide variety of skills, understandings, norms and practices in broader, more complex conceptual frameworks (Meyers, Erickson, & Small, 2013). Today, digital competence has become a prerequisite for creativity, innovation and entrepreneurship, and it has become widely accepted that citizens who do not have this skill cannot both fully participate in society and acquire the necessary knowledge and skills to live in the 21st century (European Commission, 2003).

1.1.8. Digital Skills Sub-Fields

In the rapidly increasing digitalization environment, there are certain knowledge, skills and attitudes that citizens are expected to have. There are common universal features of digital actions that occur in the form of searching for information in digital environments, communicating and participating in online environments. European Qualifications Framework, Digital Competences Framework for Citizens, Problem Solving Skills Framework in a Technology-Rich Environment introduced by PIAAC, as sub-fields within the scope of Informatics Production Curriculum piloted by the Ministry of National Education;

- Information and data literacy,
- Digital citizenship,
- Digital communication,
- Digital security
- Using digital technologies and problem solving

fields were created. To a large extent, individuals who do not have the skills under these headings will not be able to fulfill the tasks expected of them; they will not be able to participate effectively in social, economic and political life as citizens.

1.1.9. Learning Outcomes

The learning outcomes for measuring basic digital skills in adults are formed under five headings as information and data literacy, digital citizenship, digital communication, digital security and using digital technologies, and problem solving. The common points of the achievements created are that they serve the features of workforce, lifelong development and active participation in social and economic life, understanding and using digital tools and opportunities effectively.

1.2. Aim of the Study

Today, employers attach importance to the employment of talented individuals. For this reason, it was thought that the necessary intervention processes should be planned and a measurement tool should be developed to measure the aforementioned skills of adults based on the saying of the management scientist Drucker (2015) "You cannot manage what you do not measure". The aim of this study is to reveal the validity and reliability of the Adult Basic Skills Scale (ABSS).

2. Method

2.1. The Process of Developing the Learning Outcomes

The main purpose of validity and reliability studies is to prove and reveal the accuracy of the approach designed for evaluation underlying the philosophy of the measurement tool to be created. In other words, this study defines what is meant by the concepts of "verbal skills", "quantitative skills" and "digital skills" mentioned in the Adult Basic Skills Assessment Tool (YTBÖ), and aims to prove whether the items accurately measure the skills they aim to measure.

2.2. Online Assessment

One of the main features taken into consideration during the design of the YTBÖ is the administration of the measurement tool online, both on mobile devices and on computers. During the administration of the measurement tool, the participants can use the application they have installed on their mobile phones, as well as the measurement tool can be accessed on the computer via the prepared website. The interface used will be prepared in the simplest way and made available to public education centers. The paper and pencil to be used while solving the questions during the application will also be provided to the participants.

In addition, there are question pools consisting of 1000-1100 questions each in the measurement tool. Within the scope of this study, the participant is subjected to an exam consisting of 25 questions from each field and a total of 75 questions (Figure 1).

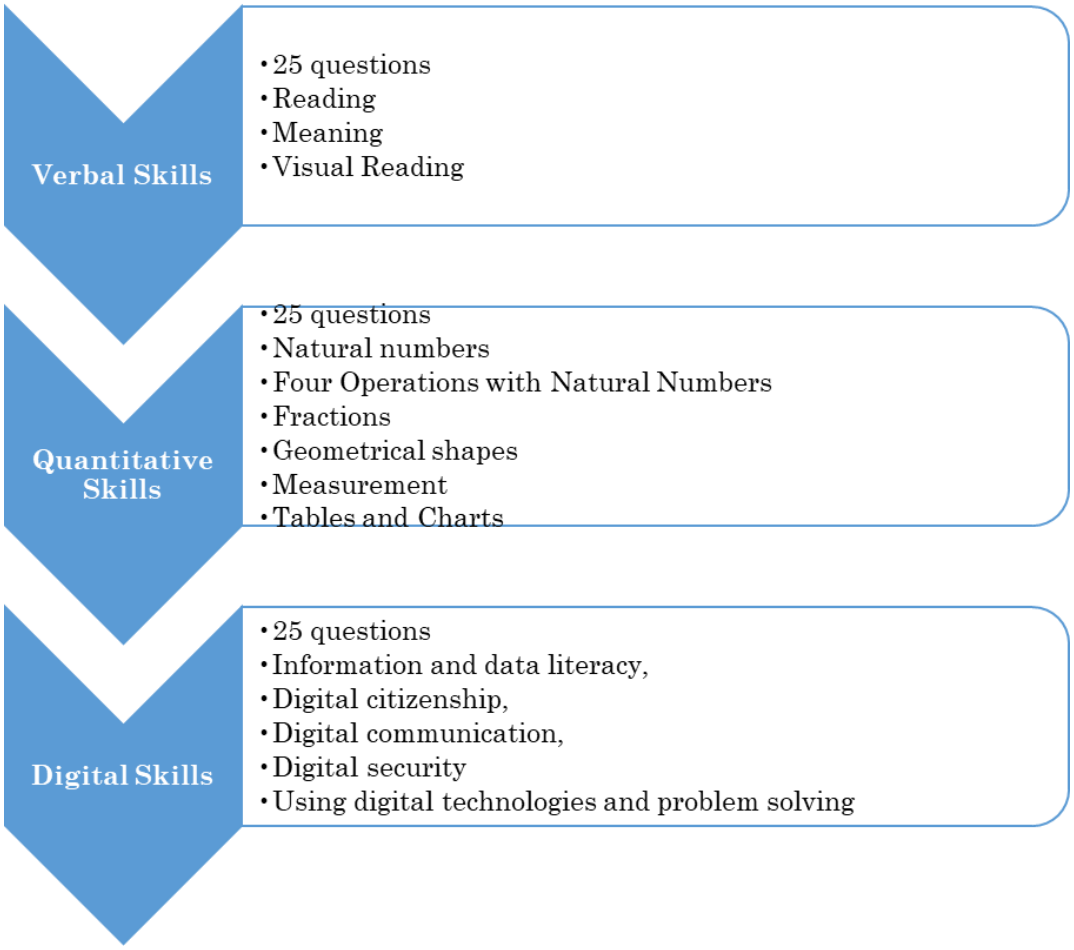

Figure 1. *YTBÖ Learning Areas*

2.3. Participants

The sample of the research consists of 3,250 participants studying at 995 public education centers affiliated to the General Directorate of Lifelong Learning. While determining the sample group, a convenient sampling method equivalent to the characteristics of the population and easily accessible to researchers was used.

2.4. Tool Development Process

First of all, at the beginning of the process, the areas on which the test will be developed were determined. Adult basic skills and sub-fields of these skills were created within the framework of expert opinions until the learning outcomes. In the field of measurement and evaluation, the appropriate test type is as important as the subject. It

is necessary to develop a valid and reliable achievement test to measure the knowledge level of the participants on the relevant subjects. In order to create a valid and reliable test within the scope, the methods of obtaining the objectives, making them suitable for the objectives, asking at least three questions from each objective, applying the expert opinion and concluding the test with the analysis to be made with the obtained data are followed (Akbulut & Çepni, 2013).

Three of the criteria defined by Webb (1997) were taken into account when creating test items to ensure that test results and questions were compatible. These;

1. Categorical concurrence: Experts check whether the questions of the measurement tool cover all achievements of the subject and the percentage of agreement is calculated.

2. Depth of knowledge consistency: Gains and question fit are investigated.

3. Balance of representation criterion: This criterion considers how questions are distributed according to achievements.

Webb's (1997) criteria were also considered in this study. Accordingly, at the first stage in the test development process,

- development of questions,
- submission to expert opinion,
- ensuring the construct validity of the test, which was prepared as a result of expert opinions, and
- Testing the appropriateness of the distribution of the questions to the achievements

works have been done.

In the first stage, in order to prepare the items of the test, a literature review was made in the relevant fields, and similar structures were examined and the gains were selected. In accordance with the revised Bloom's (2002) taxonomy, the achievements were handled according to the steps of remembering, understanding, applying, analyzing and evaluating. Considering the breadth of the study, twice as many questions were written for the pilot study. For this reason, with the understanding of preparing questions twice as much for each behavior to be measured, at least three items were prepared for each of the 11 learning outcomes gathered under 3 main areas, and a test form consisting of 1,200 items from each area was written. In order to test whether the prepared questions fully cover the outcome statements, a table of specifications was created.

Later, the table of specifications and questions were presented to the expert advisory board consisting of experts, academics and linguists (Table 2). In line with the prepared reports, the number of questions was reduced to 3,018.

Table 2. *Demographic Characteristics of Experts*

Gender	Age	Title	Field

1.	Male	42	Assistant Professor	Measurement and Evaluation
2.	Male	46	Professor	Linguistics
3.	Female	52	Teacher	Literature
4.	Male	42	Assistant Professor	Elementary Education
5.	Female	48	Dr.	Adult Learning
6.	Female	41	Research Assistant	Adult Learning

The analysis was made according to the first two criteria, which were put forward by Webb (1997) and discussed in the study. Thus, the experts evaluated whether the questions covered all the outcomes and whether the questions were compatible with the relevant outcome.

In the next stage, item analysis was performed to ensure the construct validity of the test, which was corrected in line with expert opinions (Baykul, 2015). Thus, it is aimed to ensure that the questions and the test are more valid and qualified. In this study, 3600 questions prepared were reduced to 3159 questions in line with the determined criteria and expert opinions. Then, 25 questions from each field were applied to 3,250 participants across Turkey via the e-platform. Participants were given 40 minutes for the test.

Afterwards, item analysis was carried out in line with the data obtained. The discrimination index of the items ranges between -1 and +1. Items with high discrimination increase the validity of the test. Regarding this, items with .40 and above have very high discrimination; .30 to .39 is pretty good; .20 - .29 should be controlled; for .19 and smaller values, comments that must be removed from the test or made necessary to make adjustments are made (Tekin, 2000; Turgut, 1992). As a result of the item analysis, items with a discrimination index of 0.40 and higher and items between .30 and .39 were left in the test, and those that could not be improved with corrections and items between .20 and .29 were excluded from the test. Along with that, item difficulty categories were created as follows:

- very easy
- easy
- medium
- difficult
- very difficult

3. Results

In this section, the findings obtained from the validity and reliability analyzes of the developed achievement test are presented.

3.1. Findings Concerning the Validity of the Test

In order to ensure the content validity of the test, the described test development stages were carried out. For this, expert opinions were taken by considering the criteria set forth by Webb (1997). It was concluded that the content validity of the test was provided within the scope of expert opinions. In addition, the face validity of a test is that it appears to measure what it intends to measure. The face validity of the questions in each field was examined by experts and the face validity of the tests in each field was ensured.

In order to ensure the construct validity of the test, the items in the test were analyzed. The item discrimination and difficulty levels of the test items are summarized in Table 3. Considering the analyzes of the items, the discrimination indexes of the verbal test were between -.18 and .83; difficulty levels were between .12 and .89, the discrimination index of the numerical test was between -.15 and .88; difficulty levels are between .09 and .91, and the discrimination indexes of the digital test are between -.17 and .89; difficulty levels are seen to vary between .11 and .87.

Table 3. *Summary of Items in Each Domain by Discrimination Index according to Pilot Test Results*

Verbal Skills	
Item Discrimination Index	**Number of Items**
≥ 0.40	488
0.30-0.39	386
0.20-0.29	81
≤ 0.19	75
Item Difficulty	**Number of Items**
0.80-1.00 (Very Easy)	44
0.60-0.79 (Easy)	228
0.40-0.59 (Medium)	462
0.20-0.39 (Difficult)	221

≤ 0.19 (Very Difficult)	75
Total	1030
Quantitative Skills	
Item Discrimination Index	**Number of Items**
≥ 0.40	382
0.30-0.39	545
0.20-0.29	46
≤ 0.19	72
Item Difficulty	**Number of Items**
0.80-1.00 (Very Easy)	42
0.60-0.79 (Easy)	491
0.40-0.59 (Medium)	353
0.20-0.39 (Difficult)	126
≤ 0.19 (Very Difficult)	36
Total	1045
Digital Skills	
Item Discrimination Index	**Number of Items**
≥ 0.40	298
0.30-0.39	526
0.20-0.29	74
≤ 0.19	45
Item Difficulty	**Number of Items**
0.80-1.00 (Very Easy)	89
0.60-0.79 (Easy)	347
0.40-0.59 (Medium)	349

0.20-0.39 (Difficult)	78
≤ 0.19 (Very Difficult)	80
Total	943

When Table 3 is examined, there are 488 items in the verbal test that have a discrimination index of .40 and above with very high discrimination; It is seen that about 386 items are good questions with discrimination indexes in the range of .30 and .39 values. It was observed that 81 items had to be arranged with a discrimination index of .20, and about 75 items had a discrimination index of less than .19. On the other hand, the highly distinctive questions with a discrimination index of .40 and above for 382 items in the numerical test; It is seen that about 545 items are good questions with discrimination indexes in the range of .30 and .39 values. It was decided to use these questions in the achievement test without making any adjustments. It can be said that about 46 items have a discrimination index of .20 and 72 items have a discrimination index lower than .19. In addition, questions with very high discrimination, which have a discrimination index of .40 and above, of about 298 items in the digital test; It is seen that about 526 items are good questions with discrimination indexes in the range of .30 and .39 values. It was decided to use these questions in the achievement test without making any adjustments. It was determined that 74 items had to be arranged with a discrimination index of .20, and about 45 items had a discrimination index of less than .19. In this context, since the total number of items in the targeted item pool is 600 items from each area, 156 items that should be both removed and edited from the verbal test item pool according to the item discrimination index, 118 items that should be both removed and edited from the numerical test item pool, and both removed from the digital test item pool. It was also decided to remove 119 articles that needed to be regulated.

3.2. Findings Concerning the Reliability of the Test

The application of the test was carried out with 25 questions from each field selected from the item pool in the electronic environment. At this point, the KR-20 reliability value of all the tests developed were calculated separately and their arithmetic averages were obtained. The average KR-20 value of 3.250 tests created in the verbal domain was 0.78, the average KR-20 value of the 1.806 tests created in the numerical domain was 0.73, and the average KR-20 value of the 1.480 tests created in the digital domain was 0.79 (Table 4). In order to reveal the reliability of a test, the KR-20 value must be 0.70 and above.

Table 4. *Mean KR-20 Values of Tests*

Test	**Total Number of Items per Test**	**Total Number of Tests**	**Mean KR-20 Value**
Verbal	25	3.250	0,78
Quantitative	25	1.806	0,73
Digital	25	1.480	0,79

4. Discussion

It is very important to develop tests with high validity and reliability compatible with the achievements in order to determine the level of success and skill and to evaluate the effectiveness of the program. In this study, it was aimed to create a valid and reliable multiple-choice test suitable for the learning outcomes in the framework program and the cognitive levels of these learning outcomes in order to reveal basic competencies in adults in 3 basic areas, based on the criteria put forward by Webb (1997) to ensure the harmony between achievements and exams. intended. In this study, in accordance with the purpose, an item pool of 874 valid and reliable questions from the verbal domain was developed for the relevant domains as a result of the study. As a result of the study, according to the difficulty level of the question pools from each field, the validity and reliability of which were proven;

- very easy
- easy
- middle
- difficult
- very difficult

divided into subcategories. The participant is subjected to an exam consisting of 25 questions from each field and a total of 75 questions. In the exam, it is ensured that the average question difficulty in each sub-field is at "medium" level, and the level of the participant's having basic skills is revealed. In addition to this, the exam is computer-based and administered from the website temelbeceriler.org.

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