

Education Quarterly Reviews

Sağlam, Abdulkadir, Yüksel, İbrahim, and Erbasan, Ömer. (2021), Development of Verbal Games Achievement Test of Primary School 3rd Grade Science Lesson “Let’s Know About Substance” Unit. In: *Education Quarterly Reviews*, Vol.4 Special Issue 1: Primary and Secondary Education, 481-496

ISSN 2621-5799

DOI: 10.31014/aior.1993.04.02.261

The online version of this article can be found at:

<https://www.asianinstituteofresearch.org/>

Published by:

The Asian Institute of Research

The *Education Quarterly Reviews* is an Open Access publication. It may be read, copied, and distributed free of charge according to the conditions of the Creative Commons Attribution 4.0 International license.

The Asian Institute of Research *Education Quarterly Reviews* is a peer-reviewed International Journal. The journal covers scholarly articles in the fields of education, linguistics, literature, educational theory, research, and methodologies, curriculum, elementary and secondary education, higher education, foreign language education, teaching and learning, teacher education, education of special groups, and other fields of study related to education. As the journal is Open Access, it ensures high visibility and the increase of citations for all research articles published. The *Education Quarterly Reviews* aims to facilitate scholarly work on recent theoretical and practical aspects of education.



ASIAN INSTITUTE OF RESEARCH
Connecting Scholars Worldwide



Development of Verbal Games Achievement Test of Primary School 3rd Grade Science Lesson “Let’s Know About Substance” Unit

Abdulkadir Sağlam¹, İbrahim Yüksel² & Ömer Erbasan³

¹ Ministry of National Education, Van, Turkey. ORCID: 0000-0003-3023-5751

² Gazi University, Ankara, Turkey. ORCID: 0000-0001-5686-9344

³ Ministry of National Education, Afyonkarahisar, Turkey. ORCID: 0000-0001-7852-2747

Correspondence: Abdulkadir Sağlam, Ministry of National Education, Yusuf Gökçenay Science And Art Center, Van, İpekyolu, 65100, Turkey. E-mail: saglam6888@gmail.com

Abstract

The aim of the study is to develop an achievement test consisting of the questions in verbal intelligence games whose validity and reliability have been ensured and which are in accordance with the learning outcomes of the states of substance and knowing the properties of substance via the five senses taking place in the unit “Let’s Know About Substance” in primary school 3rd grade science lesson. In this framework; the games of find with code, anagram, the deleted word, deficient word and word tour being from the verbal intelligence games have been used in the test. Scanning method from quantitative research methods has been used during the development process of the test. Question inventory has been formed by the researchers. Content validity of the test has been carried out by preparing table of specifications and reliability calculations of the test have been carried out upon the data attained from 187 primary school third grade students in different cities of Turkey with random sampling method for the purpose of having a pilot study. The reliability coefficient for Primary School Third Grade Science Lesson “Let’s Know About Substance” Unit Verbal Games Achievement Test has been found as (α) 0.92. Cronbach Alpha The mean item difficulty and distinctiveness indexes of the test have been calculated with the conducted item analysis. Findings show that the developed achievement test is a valid and reliable test. An achievement test consisting of 15 items and three factors as coding games, circle games and word games, in which the distinctiveness of all questions is at sufficient level, which is at a difficulty level close to the average, whose mean difficulty index is at medium level, which is valid and whose points are highly reliable and which has been formed with verbal intelligence games has been developed within the direction of the aim of the study.

Keywords: Let’s Know About Substance, Science, Verbal Intelligence Games, Third Grade

1. Introduction

1.1 Problem Status

Today, states make many reformist innovations and modifications in the field of education to adapt to the rapidly changing world and to the life becoming more competitive with new arrangements. The developments

experienced also in the field of science give rise to the emergence of new information and they come into our daily lives in the form of new technologies. As the data obtained especially in the field of science affect human life directly, the need for education on this subject increases in the society and therefore, science education gains importance day by day.

In our current world, the impact of change shown in almost all areas of our lives by the rapidly developing technology and tools becomes inevitable also in the education-teaching environment. As an impact of this change, it is aimed to transform the education-teaching activities into satisfactory events for students in the teaching environments and ensure the students to conduct their own learning willingly and in an active way (Yükseltürk & Altıok, 2016). Within this context; game-based teaching environments are prepared by using the games popular for students in which they could freely express themselves and focus without any boredom also in the teaching process (Öztemiz & Önal, 2013; Ülküdür, 2016). Games could be handled as natural learning tools and the players could be ensured to be able to learn the phenomena such as habits, experiences, knowledge acquisition and cooperation through doing and living by using the information and skills necessary during the game.

Game is an activity also used in the education and teaching activities though it is mostly used for entertainment purposes. Game is one of the most important tools urging the students to be able to express themselves and realize their skills and supporting their mental, social, emotional, physical and linguistic developments. Also; game based teaching could be defined as supporting teaching with educative and informative games. The greatest benefit of game based teaching is that it makes teaching more entertaining and it increases motivation (Demirel, 2008). Game based teaching activities could be conducted in every area of education. Also, it increases the efficiency of teaching by urging the students to learn by doing and living (Yağız, 2007).

Kirriemur and McFarlane (2004) have stated that game is vitally important in developing the skills decision making as a group and data processing, discussion, practices on numbers, communication, planning, such as strategic thinking; and Bottino and Ott (2007) have specified that intelligence games are highly significant in developing the properties such as logical reasoning, thinking skills and strategic thinking. In addition; Devocioğlu and Karadağ (2014) have expressed that intelligence games support the critical thinking and authentic problem solving skills of the individuals such as visual and verbal intelligence, forming solution ways, developing approach peculiar to themselves, designing, problem solving, shaping and tactical development. The contributions of games towards behavior increasing attention and concentration (Garris, Ahlers, Driskell, 2002), such as increasing motivation (Rosas et al., 2003) and developing positive attitude towards learning (Lou, Abrami & D'Apollonia, 2001) could also be mentioned as well as its benefits towards teaching (Saygı & Alkaş Ulusoy, 2019). One of the intelligence games consisting of six sub-disciplines is verbal games (Head Council of Education and Morality [HCEM], 2013:3). Verbal games are the types of games in which vocabulary is used as well as logical inferences. Logical inferences of the individuals are necessary to be used together with their vocabulary knowledge. The games such as anagram, word finding, taboo, scrabble, dixit, word hunt, password games, contextualization and word ladder could be given as examples for these games (Marangoz, 2018; MEB, 2016). Recognition of students by teachers, knowledge of the methods and techniques to be used in teaching and supporting the teaching process with family contribution works are important for the concepts related to science to be taught via intelligence games (Kurupınar, 2020: 58). It is possible for most of these games to be able to be used in the teaching of the concepts/learning outcomes taking place in science teaching.

The organized games related to the subjects taught in science activities means that those learned emerge via experiences in a way. Especially the fact that the games arranged for teaching science significantly increase the learning success could be expressed as a main qualification. Game based on teaching could be said to ensure a more permanent learning of science.

The recent developments in the field of informatics and technology and the demands changing depending on these developments have made it obligatory to develop new approaches and searches in the area of education. Especially the new approaches in the area of learning such as constructivist learning theory, multiple intelligence

theory and project based learning have deeply affected the traditional learning, teaching and evaluation approaches (Fourie & Van Niekerk, 2001).

Together with this new approach, the inclusion of the learning process to the evaluation as well as the learning product has gained importance. This situation has brought to the forefront the alternative evaluation methods such as performance evaluation, project, portfolio, rubric, self and peer assessments (Anderson, 1998; Dochy, 2001; Sherpard, 2000). Assessment and evaluation being an inseparable part of the teaching process are conducted for the purpose of determining the achievements and deficiencies of students, understanding the efficiency of teaching methods and revealing the strong and weak sides of the program (MEB, 2004). Questionnaires, oral exams, true-false tests, multiple choice tests and matching tests are used in all branches of education so as to assess and evaluate the success of students (Kempa, 1986; Şimşek, 2009; Ogan Bekiroğlu, 2004; Yılmaz, 2004; İpek Akbulut & Çepni, 2013). Each one of these assessment tools has superior and inferior sides when compared to one another depending on their usage purpose. Multiple choice tests providing opportunities for assessing the success of students, examining all the lessons in an efficient way by asking so many questions within a test period and measuring both basic and complex concepts are one of the most frequently used assessment tools today. Teachers who could manage this process as required will be able to have an opportunity of being able to see their students and their capacities in a closer way and conduct extra activities that will fill the deficiencies if existent by reviewing the teaching process. Game based assessment and evaluation methods will contribute to the students to have more entertaining learning, obtain more permanent knowledge and develop high-level thinking skills.

1.2 The Aim and Significance of the Study

The aim of this study is to provide more permanent information in learning science at early ages, make science subjects more entertaining, provide students with high-level thinking skills and develop primary school third grade science lesson “Let’s Know About Substance” unit verbal games achievement test for the purpose of teaching science subjects with games. The subject “Let’s Know About Substance” is one of the main units containing concepts hard to understand for students. When the primary education teaching program is examined, it is seen that the unit “Let’s Know About Substance” contains many different subjects and concepts in its sub-heading. Many studies related to these concepts have been conducted regarding the revelation of the errors and readiness of the students of different ages and grades. Achievement tests have been developed in these conducted studies. In this study, teachers are believed to find an opportunity of being able to determine the errors, readiness and learning status of students and, in parallel to this, being able to arrange the learning activities together with the test developed with verbal intelligence games. Besides, it is thought that it will be an entertaining assessment and evaluation tool in all learning areas of science specific to “Let’s Know About Substance” unit of primary school third grade students.

2. Method

This study has been conducted using scanning pattern being from quantitative research methods. For this reason, some stages have been followed to develop the test in this study. These stages have been followed respectively as follows. Firstly, the aim of the test has been determined. The aim of the test for this study is to develop primary school third grade science lesson “Let’s Know About Substance” unit verbal games achievement test. After that; the properties/learning outcomes to be assessed in the test have been determined. Items have been written in the next stage and a trial test has been prepared after reviewing. The pilot scheme of the test has been conducted, results have been scored and statistical calculations have been made. Test has been finished as a result of the calculations (Gömlüksiz & Erkan, 2010: 144). Data have been attained via online methods and the ethical board permit for application has been taken with the date 22/02/2021 and no. 9178 from Afyon Kocatepe University.

2.1 Sample

The sample of this study consists of primary school third grade students having education in 8 cities of Turkey in 2020-2021 education-teaching term and voluntarily participating in the study. Within this scope, 187 primary school third grade students whose data have been collected via online methods have formed the sample group of the study. Convenience sampling method has been used in the study.

2.2 The Development Process of Primary School Third Grade Science Lesson “Let’s Know About Substance” Unit Verbal Games Achievement Test

In this part, the achievement test has been developed by also considering the four criteria taking place in the method developed by Webb (1997). Within this scope; firstly, the stage of the determination of the aim and area of the test has been conducted. At the second stage, the item number of the test has been determined, spell check has been conducted and expert opinions have been asked. At the third stage, the content validity of the test has been examined and at the last stage, the reliability of the test has been analyzed and the test has been finalized.

2.2.1 The Determination of the Aim and Area of the Test

As a result of the literature review; considering the problem situation, the aim of the study was determined as the development of the primary school third grade science lesson “Let’s Know About Substance” unit verbal games success test.

2.2.2 The Determination of Item Number, Spell Check and Expert Opinions

Firstly, a question inventory consisting of the questions produced by researchers regarding 5 verbal intelligence games handled for the learning outcomes determined within the theoretical framework formed at the data collection stage. 15 questions from this question inventory whose distribution has been given in Table 1 have been broached to the opinions of experts. Necessary corrections have been made by taking into consideration the feedbacks of 3 people expert in the areas of intelligence games and science education. Afterwards, the corrected 15 questions have been sent to 3 more experts and the test has been finalized by conducting spell check and controls within the direction of the feedbacks.

2.2.3 Provision of the Content Validity of the Test

Content validity forms the starting point in the development of achievement tests. Preparation of the table of specifications for tests is a way in increasing the content validity of the test (Büyüköztürk et al., 2012: 188). For this purpose; firstly, the table related to the learning outcomes covered by the questions has been prepared before the application to ensure the content validity of the test to be applied in the study.

2.2.4 Reliability of the Test

The statistical technique that may serve the reliability of the points taken by students from a test is Cronbach Alpha method. This method could be used in the test in which correct answers are given one point and wrong answers are given zero point (Atılgan, 2013). Interpretations could be made on the reliability of the points taken by the students from the test by considering the coefficient obtained with these statistical techniques. Reliability coefficient is expressed with a number changing between zero and one. The reliability of the points taken by students from the test increases as long as this value approaches to one (Gömleksiz & Erkan, 2010). Cronbach Alpha coefficient (α) being lower than 0.40 shows that the points taken by students from the test are not reliable; being between 0.60-0.90 shows that the points taken by students from the test are very reliable; and being above 0.90 shows that the points taken by students from the test are highly reliable (Can, 2014). Within this scope; the results of the analysis conducted in order to reveal the reliability of the test are given in the findings part.

3. Findings

The validity and reliability studies of the verbal games achievement test developed for 3rd grade Science lesson “Let’s Know About Substance” unit are given place in this part of the study.

3.1. Validity Study of the Test

3.1.1. Content validity

Content validity forms the starting point in the development of achievement tests. Preparation of the table of specifications for tests is a way in increasing the content validity of the test (Büyüköztürk et al., 2012: 188). For this purpose; firstly, the table related to the learning outcomes covered by the questions has been prepared before the application to ensure the content validity of the test to be applied in the study. The learning outcomes in the related unit and the distribution of the games corresponding to these learning outcomes are given in Table 1.

Table 1: Learning outcomes related to the content of the test and their distribution to the games

Learning Outcomes	Games				
	Find with Code	Anagram	Deleted Letters	Word Tour	Deficient Letters
Students will be able to explain the main characteristics qualifying the substance by using the sense organs.	x	x	x	x	x
Students will be able to classify substances in their environment according to their states.	x	x	x	x	x
Item Number	6	3	3	2	1

When Table 1 is considered, third grade science lesson “Let’s Know About Substance” unit learning outcomes corresponding to the games in the developed test are given. When the question distributions are considered, it is seen that 6 questions take place in Find with Code game, 3 questions take place in Anagram game, 3 questions take place in Deleted Letters game, 2 questions take place in Word Tour game and 1 question takes place in Deficient Letters game.

Another way used to be able to determine the content validity of the test is to rank the points of the students in an ascending sort, determine two groups as 27% lower group and 27% upper group and calculate the item distinctiveness and difficulty indexes of the questions according to these groups. The scores of 50 students being 27% of 187 students have been examined at the stage of the determination of the upper group. The point of the 50th student among these students is 14. Thereof; 19 more students having the same point have been included and in this way, the upper group has consisted of 69 students. Again; while determining the lower group, the point of the 50th student has been seen to be 11. Thereof; 21 more students having the same point have been included and in this way, the upper group has consisted of 71 students. After that; the item distinctiveness indexes (D) and item difficulty indexes (p) of the questions have been calculated according to the lower and upper groups and given in Table 2.

Table 2: Item difficulty (p) and distinctiveness (D) indexes of the items in the test

Items	p	D
1	0,778	0,414
2	0,792	0,385
3	0,792	0,385
4	0,800	0,371
5	0,792	0,357
6	0,821	0,328
7	0,592	0,671
8	0,728	0,514
9	0,7	0,571
10	0,45	0,871
11	0,657	0,628
12	0,785	0,400
13	0,778	0,414
14	0,778	0,414
15	0,464	0,614

Item distinctiveness index being 0.40 and above for each item shows that the distinctiveness power of that item is high, being between 0.30-0.39 shows that the distinctiveness power of the item is at medium level; being between 0.20-0.29 shows that the distinctiveness power of the item is at insufficient level and the item should be corrected and being 0.19 and below shows that the item has no distinctiveness power; namely, it should be extracted from the test (Tekin, 2010). As seen in Table 2, the item distinctiveness values of the questions taking place in the test are seen to be above 0.30. In this respect; it could be said that the distinctiveness of all questions is at sufficient level.

Item difficulty index approaching 1 means that that item is easy and it is hard for that item to approach 0; being 0.50 means that the question is at medium difficulty (Atılğan, 2009). Besides; if a test is desired to correctly define the variability between those knowing and not knowing the subject, it should consist of the items with medium difficulty (Gömleksiz & Erkan, 2010). When these values and explanations are taken into consideration, it is seen that the questions are close to being easy according to Table 2.

The average difficulty index of a test gives some information regarding the test. The average difficulty of the test being below 0.50 shows that the test is hard for students; being above 0.50 shows that the test is easy for students. Depending on this, it is necessary for the average difficulty index of a test to be around 0.50 (at medium difficulty) (Tekin, 2010). When the average difficulty index of the applied test ($p = 0.489$) is considered, it could be said that the test is in medium difficulty.

3.1.2. Construct Validity of the Test

There are two important conditions to be able to start exploratory factor analysis while developing an assessment tool. These are Kaiser-Meyer-Olkin (KMO) value and Bartlett's test results. KMO test gives information on whether the sample magnitude is sufficient or not. If this value is 0.7 and above, it means that it is good and if it is between 0.5-0.7, it means that it has sample that will provide sufficient relation. Moreover; number of individuals 5 or 10 times more than the item number taking place in the assessment tool is tried to be reached as a general way regarding the sample magnitude. Bartlett's test is used in the determination of whether the data come from normal distribution or not. The value related to this test should be significant (Can, 2014; Seçer, 2013). By taking these values into consideration, it could be said that the sample magnitude of 150 people regarding the 15-question test used in the study is sufficient. This number has been excessively met in this study by reaching 187 students. Furthermore; KMO value of the test has been found as 0.900 and Bartlett's test has been found as significant ($p=0.00<.05$). According to the results obtained from KMO and Bartlett's tests, it has been decided that the sample magnitude and the distributional normality of the data are convenient for continuation to the factor analysis.

When the matrix of components attained as a result of the exploratory factor (main components) analysis conducted to be able to turn the assessment tool into a tool that could assess the highest properties with the least number of items is considered, it has been seen that the first factor load value of all 15 items of the scale is 0,466 and above. The variance caused by this factor before rotation is 51.16%. In addition; there is no cyclical item in the test. Results of the analysis are given in Table 3.

Table 3: Factor distribution of the test after rotation

Item Number	Factor Common Variance	After Rotation		
		Load at 1 st Factor	Load at 2 nd Factor	Load at 3 rd Factor
6	,840	,963		
5	,808	,915		
2	,880	,893		
4	,830	,860		
3	,778	,820		
1	,731	,807		
14	,853		,903	
13	,833		,882	
7	,679			,849
9	,660			,730
10	,557			,726
11	,522			,552
8	,664			,547
15	,309			,521
12	,560			,362

As seen in Table 3, the emerging scale has three factors. The first factor explains 51.16% of the total variance regarding the scale, second factor explains 10.08% and the third factor explains 8.77%. The total factor explained by the three factors altogether is 70.02%. In this respect; the items taking place in each factor are as follows:

1st Factor: 6, 5, 2, 4, 3, 1

2nd Factor: 14, 13

3rd Factor: 7, 9, 10, 11, 8, 15, 12

After the determination of the factors, items taking place in each factor have been examined and these factors have been named by the researchers. In this respect; 1st factor questions have been named as coding games, 2nd factor questions have been named as circle games and 3rd factor questions have been named as word games. It could be said that the achievement test prepared in the study reveals a three-factor structure and this structure consists of the factors of coding games, circle games and word games.

Another element giving ideas for the factors in the assessment tool is “Scree Plot” graph. The graph has been given place in Figure 1.

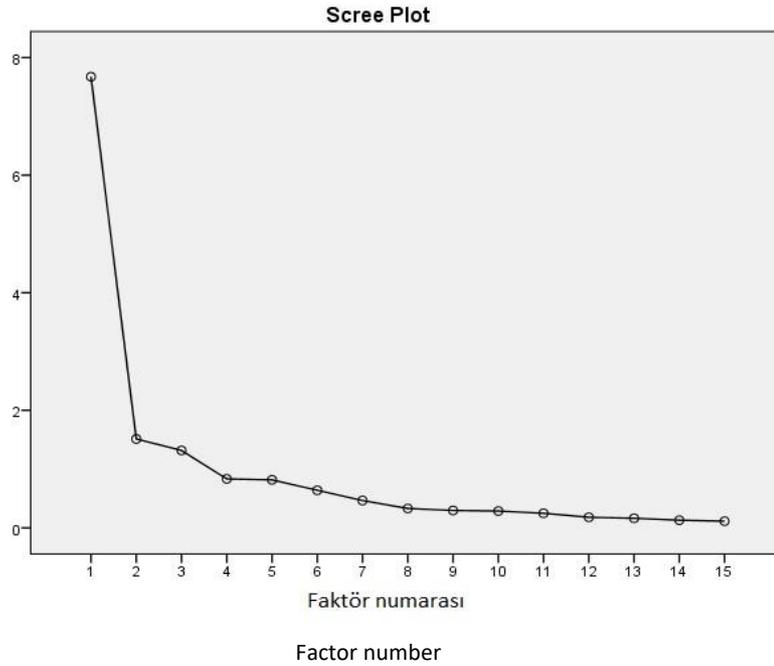


Figure 1: Scree plot graph of the test items

The distance between two points indicates a factor in “ScreePlot” graph. The curve gets smoother after a certain point in this graph. The contribution of the factors after this point to the variance is little (Çokluk, Şekercioğlu & Büyüköztürk, 2010). When the graph in Figure 1 is considered, it is seen that the curve starts to get smooth after the 3rd factor. In this respect, it could be said that the test significantly consists of three factors.

3.2. The Reliability Study of the Test

There are different statistical techniques that may serve the reliability of the points taken by students from a test. KR-20 and KR-21 statistical techniques have been developed for usage purposes in the tests in which correct answer is given one point and wrong answer is given zero point. KR-20 among them is used in the event of knowing the difficulty indexes of each item in the test and KR-21 is used in the event of not knowing it. Another statistical technique that may serve the reliability of the points taken by students from a test is Cronbach Alpha method. Because this method is established on the same logic, it could be used in the tests in which correct answer is given one point and wrong answer is given zero point (Atılğan, 2013). Interpretation could be made on the reliability of the points taken by the students from the test by considering the coefficient attained with these used statistical techniques. The reliability coefficient is expressed with a number changing between zero and one. The reliability of the points taken by students from the test increases as long as this value approaches to one (Gömleksiz & Erkan, 2010). Cronbach Alpha coefficient (α) being lower than 0.40 shows that the points taken by students from the test are not reliable; being between 0.60-0.90 shows that the points taken by students from the test are very reliable; and being above 0.90 shows that the points taken by students from the test are highly reliable (Can, 2014).

In this study, Cronbach Alpha coefficient has been used to determine the reliability of the points taken by students from the test. Reliability coefficient has been calculated as $\alpha=0.921$ for this test. As a result of the conducted analyses; it could be said that a verbal games achievement test which is valid for 3rd grade Science lesson “Let’s Know About Substance” unit and whose points are reliable has been developed in this study (Appendix - 1).

4. Result, Discussion and Suggestions

The aim of the study is to develop an achievement test consisting of the questions in verbal intelligence games whose validity and reliability have been ensured and which are in accordance with the learning outcomes of the states of substance and knowing the properties of Substance via the five senses taking place in the unit “Let’s Know About Substance” in primary school 3rd grade science lesson. While preparing the test; the stages of the determination of the aim and content of the test, determination of item number, spell check and expert opinions, content validity of the test and the calculation of the reliability of the test being the main criteria in the method developed by Webb (1997) have been followed (Güler, 2012; Özçelik, 2011).

An achievement test consisting of 15 items and three factors as coding games, circle games and word games, in which the distinctiveness of all questions is at sufficient level, which is at a difficulty level close to the average, whose mean difficulty index is at medium level, which is valid and whose points are highly reliable and which has been formed with verbal intelligence games has been developed within the direction of the aim of the study. When the literature is examined, it is possible to encounter with many test development studies prepared in the subjects of “Let’s Solve the Puzzle of Our Body, Granular Structure of Substance, Work and Energy, Simple Electric Circuits, Solutions, Heat and Temperature” and in different science subjects at various grade levels within the scope of Science education studies (Saraç, 2018; Açıkgöz and Karlı, 2015; Demir and Akarsu, 2014; Demir, Kızılay and Bektaş, 2016; Şener and Taş, 2017; Şen and Eryılmaz, 2011; Ayvacı and Durmuş, 2016; Tosun and Taşkesenligil, 2011). When these studies are examined, it can be said that the test development stages show similarities with those of this study.

Moreover; in the study conducted by Değirmenci and Doğru (2019), the realization levels of the learning outcomes of primary 4th grade science lesson “Let’s Know About Substance” unit have been examined and it has been concluded that the learning outcomes could not be gained to the students at the desired level. Üçüncü and Sakiz (2020) have developed a multiple-choice test with high validity and reliability and consisting of 35 items related to primary school 4th grade “Let’s Know About Substance” unit. Alkış Küçükaydın, Karamustafaoğlu and Uluçınar Sağır (2014) have also developed a multiple-choice achievement test consisting of 30 items for 4th grade “Let’s Know About Substance” unit. Again; when these studies in the literature are considered, it is seen that they have used the criterion stage of Webb and examined “Let’s Know About Substance” unit. The difference of these studies from this study is that they are the studies at primary school 4th grade level and they have used multiple-choice assessment and evaluation method in the tests they have developed. Primary school third grade Science lesson “Let’s Know About Substance” unit verbal games achievement test has been developed via intelligence games and it is at 3rd grade level and therefore, it shows differences from the studies in the literature.

It is also possible to encounter with the achievement tests developed using intelligence games and studies revealing the efficiency of intelligence games. Savaş (2019) has studied the impact of intelligence games on the critical thinking skills of science teacher candidates and stated according to the obtained results that intelligence games could be used in science education at the assessment and evaluation stages. Marangoz and Demirtaş (2017) have studied the impact of mechanical intelligence games on the cognitive skills of primary school 2nd grade students, Şahin and Tezci (2018) have examined the impact of intelligence games on the problem solving tendencies of primary school 4th grade students. Tarakçı and Yüksel (2020) have developed verbal games test using the deficient letters and anagram game in the subject of astronomy for science teacher candidates. Again; it is also possible to see many studies in the literature related to intelligence games. However, when the studies conducted about intelligence games are considered, no study could be seen for the development of science lesson “Let’s Know About Substance” unit achievement test with verbal games at third grade level. In this concept, it could be said that there is only one study conducted by Tarakçı and Yüksel (2020) having similarities with this study.

As known; today, multiple-choice tests, written exams and oral exams are frequently used to evaluate the student success in assessment and evaluation processes. These assessment tools both tire the students with many questions in a very short period of time, cause the students to get bored and may cause them to stay away from

the related lessons. The achievement test developed with verbal intelligence games is considered to be an efficient method in teaching the concepts in all science subjects specific to “Let’s Know About Substance” unit at especially primary school third grade level students and in measuring the obtainment degree of the learning outcomes.

Consequently; primary school third grade science lesson “Let’s Know About Substance” unit verbal games achievement test is a valid and reliable assessment tool that could be used during the in-class assessment processes in Science Education in terms of its preparation in accordance with both other scientific studies and the curriculum.

This developed test could be used as an alternative assessment tool in other grades of primary school and after adaptation to other disciplines. Again; an achievement test in which verbal games are used could be developed in accordance with the curriculum (middle school and high school) in the educational levels at different grades.

References

- Açıköz, M. & Karşlı, F. (2015). Alternatif ölçme-değerlendirme yaklaşımları kullanılarak iş ve enerji konusunda geliştirilen başarı testinin geçerlilik ve güvenilirlik analizi [Validity and reliability analysis of achievement test developed on work and energy issue using alternative measurement-evaluation approaches]. *Amasya Education Journal*, 4(1), 1-25.
- Alkış Küçükaydın, M., Karamustafaoğlu, S. & Uluçınar Sağır, Ş. (2014). İlkokul 4.sınıf maddeyi tanıyalım ünitesine yönelik bir başarı testi geliştirme çalışması [An achievement test development study for the 4th grade Let's Know the Substance unit]. *International Conference on Education in Mathematics, Science & Technology*. 16-18 May, Konya.
- Anderson, S.R. (1998). Why talk about different ways to grade? the shift from traditional assessment to alternative assessment. *New Directions for Teaching and Learning*, 74, 5-16.
- Atılğan, H. (Ed.) (2013). *Eğitimde ölçme ve değerlendirme* [Assessment and evaluation in education] (6th edition). Ankara: Anı Yayıncılık.
- Ayvacı, H. Ş. & Durmuş, A. (2016). Bir başarı testi geliştirme çalışması: ısı ve sıcaklık başarı testi geçerlik ve güvenilirlik araştırması [A success test development study: heat and temperature achievement test validity and reliability research]. *Ondokuz Mayıs University Journal of Education Faculty*, 35(1), 87-102.
- Bottino, R. M. & Ott, M. (2006). Mind games, reasoning skills, and the primary school curriculum: hints from a field experiment. *Learning Media & Technology*, 31(4), 359-375.
- Büyüköztürk, Ş., Kılıç Çakmak, E., Akgün, Ö. E., Karadeniz, Ş. & Demirel, F. (2012). *Bilimsel araştırma yöntemleri* [Scientific research methods] (13th edition). Ankara: Pegem Akademi.
- Can, A. (2014). *SPSS ile bilimsel araştırma sürecinde nicel veri analizi* [Quantitative data analysis in the scientific research process with SPSS] (2nd edition). Ankara: Pegem A Yayıncılık.
- Çokluk, Ö., Şekercioğlu, G. & Büyüköztürk, Ş. (2010). *Sosyal bilimler için çok değişkenli istatistik: SPSS ve LISREL uygulamaları* [Multivariate statistics for social sciences: SPSS and LISREL applications]. Ankara: Pegem Akademi.
- Değirmenci, A. & Doğru, M. (2019). İlkokul 4. sınıf fen bilimleri dersi öğretim programı maddeyi tanıyalım ünitesi kazanımlarının gerçekleşme düzeyinin değerlendirilmesi [The evaluation of realization level of gains of let's know about substance unit in 4th grade science curriculum in primary school]. *Gazi Journal of Education Sciences*, 5(1), 102-121.
- Demir, B. & Akarsu, N. (2014). Modern Fizik konuları ile ilgili kavram testi geliştirilmesi ve uygulanması: Modern Fizik Kavram Testi (MKFT) [Concept test development and implementation of modern physics topics: Modern Physics Concept Test]. *Journal of European Education*, 4(2), 39-51.
- Demir, N., Kızılay, E. & Bektaş, O. (2016). 7. Sınıf çözümler konusunda başarı testi geliştirme: geçerlik ve güvenilirlik çalışması [Development of an achievement test about solutions for 7th graders: A validity and reliability study]. *Necatibey Faculty of Education, Electronic Journal of Science and Mathematics Education*, 10(1), 209-237.
- Devecioğlu, Y. & Karadağ, Z. (2014). Amaç, beklenti ve öneriler bağlamında zeka oyunları dersinin değerlendirilmesi [Evaluation of mind puzzle course at the context of goals, expectations and recommendations]. *Bayburt Üniversitesi Eğitim Fakültesi Dergisi*, 9(1), 41- 61.
- Dochy, F. (2001). A new assessment era: different needs, new challenges. *Learning and Instruction*, 10(1), 11-20.

- Fourie, I. & Van Niekerk, D. (2001). Follow-Up on the portfolio assessment a module in research information skills; an analysis of its value. *Education for Information, 19*, 107-126.
- Garris, R., Ahlers, R. & Driskell, J.E. (2002) Games, motivation, and learning: A research and practice model. *Simulation & Gaming, 33*(4), 441-467.
- Gömlüksiz, M. ve Erkan, S. (2010). *Eğitimde ölçme ve değerlendirme* [Assessment and evaluation in education] (2nd edition). Ankara: Nobel Yayın Dağıtım.
- Güler, N. (2012). *Eğitimde ölçme ve değerlendirme* [Assessment and evaluation in education] (4th edition). Ankara: Pegem A Yayıncılık.
- İpek Akbulut, H. & Çepni, S. (2013). Bir üniteye yönelik başarı testi nasıl geliştirilir?: İlköğretim 7. sınıf kuvvet ve hareket ünitesi [How to develop an achievement test for a unit?: A study for grade 7 force and motion unit]. *Amasya Education Journal, 2*(1), 18-44.
- Kempa, R. (1986). *Assessment in Science*. Cambridge University Press, Cambridge, London.
- Kirriemuir, J. & McFarlane, A. (2004). Literature review in games and learning, report 8, Futurelab series, http://admin.futurelab.org.uk/resources/documents/lit_reviews/Games_Review.pdf.
- Kurupınar, A. (2020). Kaynaştırma eğitiminde zekâ oyunları ile fen eğitimi ve aile katılımı. *Özel eğitime gereksinimi olan öğrenciler için zekâ oyunları ile fen eğitimi ve etkinlik örnekleri* [Science education and family participation with intelligence games in inclusive education. In Science education and activity examples with intelligence games for students who need special education] (ed., İ. Yüksel & Y. Çıkkılı). Ankara: PegemA.
- Lou, Y., Abrami, P. & D'Apollonia, S. (2001) Small group and individual learning with technology: a metaanalysis. *Review of Educational Research, 71*(3), 449-521.
- Marangoz, D. & Demirtaş, Z. (2017). Mekanik zekâ oyunlarının ilkökul 2. sınıf öğrencilerinin zihinsel beceri düzeylerine etkisi [The effect of mechanical mind games on mental skill levels of primary school second grade students]. *The Journal of International Social Research, 10* (53), 612-623.
- Marangoz, D. (2018). *Mekanik Zekâ Oyunlarının İlkokul 2. Sınıf Öğrencilerinin Zihinsel Beceri Düzeylerine Etkisi* [The effect of mechanical mind games on mental skill levels of primary school second grade students] (unpublished master thesis). Sakarya University, Institute of Education Sciences, Sakarya.
- Milli Eğitim Bakanlığı (MEB) (2004). *İlköğretim okulu matematik dersi öğretim programı* [Elementary school mathematics curriculum]. Ankara: MEB. Talim ve Terbiye Kurulu Başkanlığı.
- Milli Eğitim Bakanlığı [MEB] (2016). *Zekâ oyunları 5, 6, 7 ve 8. sınıflar ortaokul ve imam hatip ortaokulu öğretmenler için öğretim materyali* [Intelligence games Teaching material for 5th, 6th, 7th and 8th grades middle school and imam hatip middle school teachers] (2nd edition). Ankara: Ministry of Education.
- Ogan Bekiroğlu, F. (2004). *Ne kadar başarılı?, klasik ve alternatif ölçme- değerlendirme yöntemleri ve fizikte uygulamalar* [How successful ?, classical and alternative assessment-evaluation methods and applications in physics]. Ankara: Nobel Yayın Dağıtım.
- Özçelik, D. A. (2011). *Ölçme ve değerlendirme* [Assessment and evaluation] (4th edition). Ankara: Pegem Akademi.
- Öztemiz, S. & Önal, H. İ. (2013). İlkokul öğrencilerinin oyun tekniği ile okuma alışkanlığı kazanmasına yönelik öğretmen görüşleri: Ankara Beytepe İlkokulu örneği [Teacher opinions regarding primary school students to gain reading habits by means of play technique: Ankara Beytepe Primary School sample]. *Bitlis Eren University Social Science Journal, 2*(1), 70-85.
- Rosas, R., Nussbaum, M., Cumsille, P., Marianov, V., Correa, M., Flores, P., Grau, V., Lagos, F., López, X., López, V., Rodriguez, P. & Salinas, M. (2003). Beyond Nintendo: design and assessment of educational video games for first and second grade students. *Computer & Education, 40*(1), 71-94.
- Saraç, H. (2018). Fen bilimleri dersi 'maddenin değişimi' ünitesi ile ilgili başarı testi geliştirme: geçerlik ve güvenilirlik çalışması [Development of achievement test about science lesson 'change of Substance' unit: validity and reliability study]. *Bolu Abant İzzet Baysal University Journal of Faculty of Education, 18*(1), 416-445.
- Savaş, M. A. (2019). Zekâ oyunları eğitiminin fen bilimleri öğretmen adaylarının eleştirel düşünme becerileri üzerine etkisi [The effects of intelligence games education on prospective science teachers' critical thinking skills]. (Unpublished master thesis), Bartın University, Bartın.
- Saygı, E. & Alkaş Ulusoy Ç. (2019). İlköğretim matematik öğretmen adaylarının hafıza oyunları ile hafıza oyunlarının matematik öğretimine katkısına ilişkin görüşleri [Views of the pre-service elementary mathematics teachers about memory games and contribution of memory games to mathematics teaching]. *Bolu Abant İzzet Baysal University Journal of Faculty of Education, 19*(1), 331- 345.
- Shepard, L. A. (2000). The role of assessment in a learning culture. *Educational Researcher, 29*(7), 4-14.
- Şahin, E. & Tezci, E. (2018). Zekâ oyunlarının ilkökul 4. sınıf öğrencilerinin problem çözme eğilimlerine etkisi [The effect of intelligence games on the problem solving tendencies of primary school 4th grade students]. *International Necatibey Educational and Social Sciences Research Congress. 26-28 October, Balıkesir, Turkey.*

- Şen, H. C. & Eryılmaz, A. (2011). Bir başarı testi geliştirme çalışması: Basit elektrik devreleri başarı testi geçerlik ve güvenirlik araştırması [An achievement test development study: reliability and validity investigation of simple electric circuits achievement test]. *Van Yuzuncu Yıl University Journal of Education*, 8(1), 1-39.
- Şener, N. & Taş, E. (2017). Developing Achievement Test: A Research for Assessment of 5th Grade Biology Subject. *Journal of Education and Learning*, 6(2), 254-271
- Şimşek, A. (2009). *Öğretim Tasarımı* [Instructional Design]. Ankara: Nobel Yayın Dağıtım.
- Talim ve Terbiye Kurulu Başkanlığı [TTKB] (2013). *İlköğretim kurumları Fen Bilimleri Dersi Öğretim Programı* [Primary Education Institutions Science Curriculum]. Ministry of Education, Ankara.
- Tarakçı, B. & Yüksel, İ. (2020). Fen bilgisi öğretmen adaylarına yönelik astronomi konusunda sözel oyunlar testi geliştirme [Test development of verbal games on astronomy for science teacher candidates]. İ. Dökme (Ed.). *Fen eğitimi araştırmalarına güncel bakış* [Current overview of science education research]. In (243-252) Ankara: Akademisyen Kitap evi.
- Tosun, C. & Taşkesenligil, Y. (2011). Revize edilmiş Bloom'un taksonomisine göre çözümler ve fiziksel özellikleri konusunda başarı testinin geliştirilmesi: Geçerlik ve güvenirlik çalışması [Development of an achievement test about solutions and their physical properties based on bloom's revised taxonomy: validity and reliability]. *Kastamonu Education Journal*, 19(2), 499-522.
- Üçüncü, G. & Sakız, G. (2020). Başarı testi geliştirme süreci: ilkokul dördüncü sınıf maddeyi tanıyalım ünitesi örneği [The phases of achievement test development: the case of fourth-grade introduction to Substance unit]. *Kastamonu Education Journal*, 28(1), 82-94.
- Ülküdür, M. A. (2016). *Proje tabanlı öğrenme etkinlikleri ile oyun tabanlı öğrenme etkinliklerinin akademik başarı, tutum ve motivasyona etkisi* [The effect of project based learning and game based learning activities to the achievement, attitude and motivation]. (Unpublished Master Thesis). Amasya University, Amasya.
- Webb, N. L. (1997). *Determining Alignment of Expectations and Assessments in Mathematics and Science Education*. NISE Brief 1(2). Madison, WI: University of Wisconsin Madison, National Institute for Science Education.
- Yılmaz, H. (2004). *Eğitimde Ölçme ve Değerlendirme* [Assessment and Evaluation in Education]. (7th edition). Konya: Çizgi Kitabevi Yayınları.
- Yükseltürk, E. & Altıok, S. (2016). BT öğretmen adayları tarafından scratch görsel programlama aracı ile geliştirilen eğitsel oyunların incelenmesi [Investigation of Pre-Service Information Technology Teachers' Game Projects Prepared with Scratch]. *SDU International Journal of Educational Studies*, 3(1), 59-66.

Appendix A

Primary School Third Grade Science Lesson “Let’s Know About Substance” Unit Verbal Games Achievement Test

Dear students, please carefully review what you have learnt in “Let’s Know About Substance” unit and the following image before starting the test.

What are the main properties qualifying a Substance? Please write in items.



Answer: The main properties qualifying a Substance



- 1- Hardness – softness
- 2- Flexibility
- 3- Fragility
- 4- Roughness – Smoothness
- 5- Color
- 6- Odor
- 7- Flavor
- 8- Transparent – Opaque



FIND WITH CODE

Please find the concepts related to “Let’s Know About Substance” unit by writing the letters in the given codes to their places.

	1	2	3	4	5
A	P	A	N	İ	O
B	F	R	D	T	E
C	L	V	Ş	C	U
D	S	M	Z	K	Ü
E	G	H	I	Y	Ö

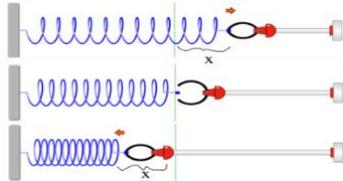
1. 4D, 2A, 4B, 3E

- 2. 4D, 5A, 4D, 5C
.....
- 3. 4B, 2A, 4B
.....
- 4. 2B, 5B, 3A, 4D
.....
- 5. 1D, 3E, 2C, 3E
.....
- 6. 1E, 2A, 3D
.....

ANAGRAM

Please produce a word related to “Let’s Know About Substance” unit using all letters of the given two words just once.

7.



SİNEK
KEL



.....

8.



AD
DEM



.....

9.

Please find the new word by replacing the places of the words below and using each letter once.

T	E	R	S	➔
---	---	---	---	---	-------	-------	-------	-------

THE DELETED LETTERS

One or two letters of the words or phrases below have been deleted and the remaining letters have been ordered in a mixed way. Please find these words or phrases whose clues have been given as related to “Let’s Know About Substance” unit.

10.

A	C	D	E	I	ı	ı	R	T	
---	---	---	---	---	---	---	---	---	--

ANSWER: AYIRT EDİCİ

A	T	E	İ
---	-------	-------	-------	---	---	-------	-------	-------	-------	---

11.

A	A	D	D	E	H	İ	İ	L	M	N	
---	---	---	---	---	---	---	---	---	---	---	--

ANSWER: MADDENİN HALİ

M	D	N	İ
---	-------	-------	---	-------	-------	-------	---	-------	-------	-------	---

12.

P	R	S	Ü	Ü	Ü	Z	
---	---	---	---	---	---	---	--

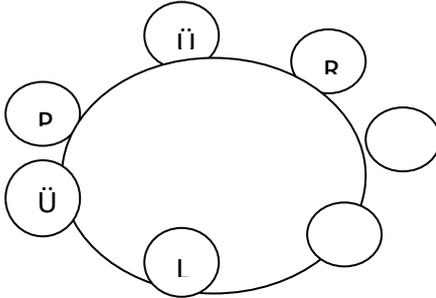
ANSWER: PÜRÜZSÜZ

.....	Ü	S	Z
-------	---	-------	-------	-------	---	-------	---

DEFICIENT LETTERS

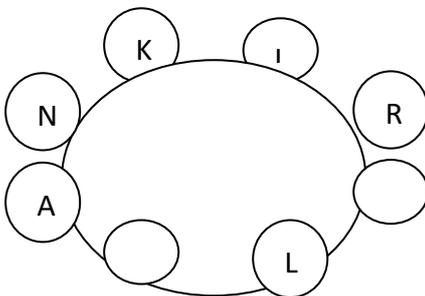
Please obtain a word by completing the deficient letter when you read by starting from a letter in clockwise or counterclockwise direction.

13.



ANSWER: PÜRÜZLÜ

14.



ANSWER: KIRILGAN

WORD TOUR

You are supposed to wander all squares on condition that you will be existent in every square exactly once and also supposed to find 2 words with respectively 7 and 9 letters.

- You can start from any square.
- You can move to a square adjacent to the square you are in (horizontal, vertical, crosswise, right and left) at every step.

Tip: The first letter of the words you will produce takes place in the colored boxes.

15.

B	E	N	K						
U	Ş	A	Z						
M	L	R	E						
U	Y	İ	K						
B

ANSWER: BENZERLİK

Y
---	-------	-------	-------	-------	-------	-------	-------

ANSWER: YUMUŞAK