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The Effect of Learning Environments Enriched with Multisensory Reading Activities on Reading Comprehension, Reading Comprehension Strategies and Reading Motivation

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Abstract. The research aims to investigate the effect of learning environments enriched with multisensory reading activities on reading comprehension, reading comprehension strategies and reading motivation of primary school fourth-grade students. When the methods related to the reading comprehension process are analysed, the students' meaning process is provided by the texts in the book. This situation makes it difficult for students to focus on texts and make correct inferences, and it is necessary to produce practical solutions to improve reading comprehension. Therefore, it is vital to identify the effect of learning environments enriched with multisensory reading activities on the development of reading comprehension. For these purposes, a quasi-experimental model with a pre-and post-test control design was used in the research. The existing Turkish curriculum was used in the control group, while the Turkish curriculum enriched with multisensory activities prepared by the researcher was conducted in the experimental group. The study sample comprised primary school fourth-graders aged 9-10. The experimental group included 21 students, and the control group consisted of 12 students. The research lasted for six weeks. The study concluded that the Turkish curriculum enriched with multisensory reading activities was more influential than the current Turkish curriculum.

Keywords: Multisensory Activity, Learning Environment, Reading Comprehension, Reading Comprehension Strategies, Reading Motivation.

1. Introduction

The subject of this research is the development of reading comprehension through learning environments enriched with multisensory reading activities. To keep up with the social development of our age, the individual must be open to continuous self-development and learning new information (Kuşdemir, 2014). It can be said that the mentioned social development will be achieved through strong communication skills between people. It is possible for people to acquire this skill only thanks to language (Aktaş, 2015).

1.1. Problem Statement

Language, defined as a complex process, includes four primary skills: listening, speaking, reading and writing. These skills are related both within themselves and with each other (Ministry of National Education [MoNE], 2019). It is necessary to have speaking and writing skills to be able to explain a language and listening and reading comprehension to be able to understand it (Çaycı & Demir, 2006).

Akyol (2007) defines reading as a constructing meaning process carried out in a regular environment where prior knowledge is used and based on effective communication between the author and the reader, in line with an appropriate method and purpose. Güneş (2015) defines the reading process as a complex process of seeing, perceiving, vocalising, understanding and structuring in the mind, which consists of the eye, voice and various brain procedures. Based on the definitions, it can be said that the reading skill is not made up of juxtaposing letters and symbols but will be possible with the readers' active participation in

the process through visual, auditory, tactile and taste senses. Studies have also shown that reading alone is not enough and have revealed the importance of reading comprehension along with reading comprehension. From this point of view, it can be said that understanding is a fundamental condition for learning, while reading can be mentioned as a way of comprehension and learning (Çavuşoğlu, 2019). Some of the studies conducted have also suggested the failure of children who cannot understand what they are reading in other lessons (Obalı, 2009; Gökçen-Özçelik, 2011; Deniz, 2013).

The problems experienced in reading comprehension also manifest in international exams. Considering the results of PISA 2015, evaluating science, mathematics and reading comprehension, it was concluded that the mean of Türkiye's reading comprehension ability lagged behind other countries. According to the result of the PISA, which measures the ability of the students to access the information in the given text, remember the information, interpret it and represent their thoughts in the field of reading comprehension, the average of all countries' reading comprehension was 460 while Türkiye remained below this limit with an average of 428 (MoNE, 2016). The conclusion to be drawn from this is that reading alone is not enough, and reading comprehension should be developed along with reading.

In order for reading to become meaningful, it can be stated that the individual should take an active role in the reading comprehension process with his/her metacognitive skills from the moment s/he learns to read. The process of learning new information by taking an active role can also be possible by perceiving and structuring it through the sense organs (Sidekli & Yangın, 2005). These receptors are the senses of sight, hearing and touch (Gülten & Gülten, 2004). Considering the effect of the senses in the learning process, it is inevitable that these structures should be emphasised markedly. Blending the activities applied in learning environments with various senses will increase the students' recollection of that subject to the same degree. For this reason, learning environments should be prepared in a way that appeals to many senses.

The diversity of the senses has led to the differentiation of learning. Although people learn similarly through their senses, the learning styles of each person are different (Aslam-Orkun & Bayırlı, 2019). This difference has brought about attempts to incorporate learning styles into the curriculum (Cassidy, 2004). Studies have shown that learning styles are used to determine the personality and abilities of students, predict their performance, and improve grade level in the learning and teaching process (Ehrman, 1999; Ehrman & Oxford, 1995; Reiff, 1992).

To solve the reading comprehension problem, it is essential for the senses to actively find a place in the educational environment and to plan the educational process by taking into account the students' learning styles for the realisation of learning. It can be said that the success of the reading process, which starts from the first grade of primary school, will be possible by using modern educational approaches in the teaching process, planning the learning process by considering the learning styles of the students, and enriching the learning environments with multisensory reading activities.

1.2. Related Research

With their study, Malekian et al. (2012) aimed to reduce the impact on first-grade students' spelling troubles with educational environments based on the Multisensory Frnald spelling model. The quasi-experimental method was used as a research method. In the study, which was conducted with 50 students, it was concluded that the Multisensory Frnald model did not have a significant effect on reducing the spelling mistakes of first-year students.

In their study, Warnick and Caldarella (2015) examined the effectiveness of a multidimensional phonetic-based reading improvement program for adolescent delinquents classified as inadequate readers living in an inpatient treatment centre. In the experimental method, in which the pre-test/post-test-control group was used, it was seen that 30 hours of multidimensional phonetic reading studies were carried out over eight weeks. As a result of the research, a significant difference emerged in favour of the multidimensional program.

Taljaard (2016), in his study, touched upon issues like which multisensory technologies could be used in 'Science, Technology, Engineering, Art and Mathematics (STEAM) lessons and how these affect student participation and learning. The researcher gave a place for some of the multisensory activities that could be used to improve learning in STEM/STEAM education.

The study, titled "The Impact of Multisensory Instruction on Learning Letter Names and Sounds, Word Reading, and Spelling" by Schlesinger and Gray (2017), for second-grade children with typical development or dyslexia aims to investigate whether the use of simultaneous multidimensional structured language teaching promotes better letter name and sound production, word reading and word spelling. In the study conducted by Schlesinger and Gray (2017) to compare the effectiveness of multisensory and structured language interventions, it was concluded that both interventions had an overall treatment effect for participants with typical developmental and dyslexia.

In their study, Broadbent et al. (2018) concluded that by increasing the amodal properties of a stimulus, multisensory information facilitated adults' learning and modulated infants' attention. The study was conducted with 181 children aged 6-10 years using a new Multisensory Attention Learning Task (MALT). This study concluded that children up to 6 years old performed better on a random classification task after exposure to multidimensional cues (audio-visual) compared to limited sense (visual or auditory-only).

Labat et al. (2020), in their study titled "Multisensory Letter Integration and Implicit Learning of Reading with 5-Year-Old Children", aimed to investigate the implicit effect of graphonemic awareness learning on decoding skills. According to the results of experimental research on 5-year-old kids, it was seen that implicit learning was effective in distinguishing graphonemic writing in the younger age group, and audio-visual integration supported by motor skills gave more positive results in recalling information compared to classical education.

It is thought that this research will contribute to curriculum development specialists with the idea of designing education programmes by enriching them with multisensory reading activities. It's believed that multisensory reading activities will benefit teacher training programs to be planned and carried out by teachers. It has been thought that it will give teachers an idea at the stage of designing learning environments enriched with multisensory reading activities and implementing them with students. In addition, it has been concluded that it will contribute to publishing houses in selecting texts suitable for the age group, learning styles, and topicality and bringing these texts to the reader enriched with multisensory reading activities.

When the literature is examined, it stands out that multisensory studies are widely used in special education and language education. However, multisensory learning environments should be commonly used in the primary school. At the same time, no study in the literature investigates the effect of reading texts used at the primary school level on reading comprehension, reading comprehension strategy and reading motivation by adapting them to multisensory environments and multisensory learning. For this reason, it is essential to identify the effect of learning environments enriched with multisensory reading activities. It is thought that this study will contribute to the field.

1.3. Research Objectives

This research aims to detect the effect of learning environments enriched with multisensory reading activities on reading comprehension. Within the framework of this aim, the determined research problem is "What is the impact of learning environments enriched with

multisensory reading activities on reading comprehension?" The research sought answers to the following questions:

1- Does the effect of learning environments enriched with multisensory reading activities on students' reading comprehension show a significant difference in favour of the experimental group?

2- Does the effect of learning environments enriched with multisensory reading activities on students' reading comprehension strategies show a significant difference in favour of the experimental group?

3- Does the effect of learning environments enriched with multisensory reading activities on students' reading motivations show a significant difference in favour of the experimental group?

2. Theoretical framework

This section provides theoretical information about multisensory learning and multisensory reading activities, reading comprehension strategies and motivation.

2.1. Multisensory Learning

Individuals are influenced by environmental stimuli such as sound, image, smell, taste and movement at any moment throughout their lives. These stimuli coming to the sense organs undergo various changes to be remembered by becoming neural messages. The product put forward as a result of change manifests as activities and movements representing learning (Senemoğlu, 2018). Multisensory learning is a teaching strategy used to find a place for more than one sense in educational environments to carry out the educational processes of learners (Balcı & Çayır, 2017). Since this strategy foresees a holistic and multi-directional development, it is also associated with theories such as Brain-Based Learning, Multiple Intelligence Theory, and Cognitivism (Akpınar & Aydın, 2010). The aim is to develop the learner's strengths while trying to complete the missing points by simultaneously commissioning visual, auditory, kinesthetic/tactile strategies (Balcı & Çayır, 2017).

Multisensory learning emphasises how individuals will receive information more easily, focusing on the memory system. The memory system perceives environmental stimuli through the sense organs and keeps them in the sensory memory for a while. Having sensory memory allows the reader to remember the beginning of a sentence when it comes to the end of it, as well as enabling the reader to make sense of the sentence (Cemaloğlu & Yıldırım, 2004). At this point, what differentiates individuals is their reading styles. Revealing the strengths of individuals and using the appropriate method or technique are the main reasons for forming strong readers. Trying to improve students' reading comprehension with the wrong educational approach will also negatively affect the learning process (Moustafa, 1999). Based on the students' strengths, it may be possible to prefer multisensory learning to improve reading comprehension by paying attention to certain stages. In this regard, Moustafa (1999) states the steps that should be applied by the educator while using multisensory learning as follows:

-Identifies each student's preferred style or intelligence area to learn.

-Uses the learning styles inventory to determine which students' learning style and intelligence area is dominant.

-Begins to plan learning activities to integrate learning styles.

The educator's planning of learning activities is based on the purpose of integrating learning styles. For this purpose, Mercer and Mercer (1993) mention the quadruple method of VAKT (Visual, Auditory, Kinesthetic, Tactile), which includes multisensory learning. The four elements in the VAKT method correspond to the actions of watching, hearing, writing and seeing (Murphy, 1997, p.1). Multisensory learning also follows a path that integrates these activities into the learning process. The best learning occurs when a new concept is presented to students with multisensory learning, which includes the quadruple method (Murphy, 1997, p.19).

2.2. Multisensory Reading Activities

The first step of the multisensory process is to identify students' learning styles to support their learning skills in educational environments. The next step is to plan the appropriate learning activities related to the recognised learning styles of the students. While planning the activities in the learning process, all kinds of technological tools and materials suitable for the subject should be preferred (Aslan & Görgen, 2015). With these materials, children activate their senses and participate actively in learning. In this way, permanent and meaningful learning is provided (Çelikkaya, 2013). The activities used in the multisensory approach that enable students to take an active role in the learning process can be discussed under the headings of visual (maps, posters, information maps, charts, graphics, images, cartoons, short films, natural objects, puzzles, photos), auditory (music, riddles, jokes, reading texts), tactile/kinesthetic (drama, puzzles, games), smell and taste.

Evidently, the reading comprehension problem that students often experience during the primary school process cannot be solved by considering uniform educational planning and standardised learning styles. To solve the reading comprehension problem, actively involve the senses in the academic environment and plan the educational process by considering the students' learning styles. It can be said that the success of the reading process, which starts from the first grade of primary school, will be possible by using modern educational approaches in the teaching process, planning the learning process by considering the learning styles of the students, and enriching the learning environments with multisensory reading activities.

2.3. Reading Comprehension Strategies

As much as the importance given to reading comprehension, the methods, techniques and strategies used to improve reading comprehension are also of great importance in the process. The mentioned strategies and procedures allow students to understand what they are reading pointedly and to be active in the process. In this process, since the techniques and methods used by students before, during and after reading facilitate reading comprehension, teachers had better include reading comprehension strategies in the teaching process and guide students to use them (Epçaçan, 2009).

After the students are allowed to skim the text before reading and make predictions about the content of it, it is time to read the text. During reading the text, fluent reading is one of the primary strategies facilitating comprehension. Mason (2013) emphasises that the three-step 'think while reading' technique enables students to question their reading speed, connecting information and rereading sections. In this way, while students act by considering their reading speed, knowledge and context with this technique, they realise comprehension by rereading if there are points they do not understand about the text (Fırat, 2019). Students' making inferences about the paragraphs, establishing a connection between the passages, and visualising what is read in the mind are other strategies that strengthen comprehension in the reading process. To use these strategies, it is necessary to allow students to analyse the text by interrupting their reading and asking related or unrelated questions (Brum et al., 2019). A note-taking strategy can be used to establish a connection between students' concrete knowledge and new abstract knowledge. This tool facilitates the learning of newly encountered words in the context and thus the development of word-hoard, the permanent education of students repeatedly exposed to new terms, and the realisation of comprehension by ensuring the connection between the word and the content (Hairrell et al., 2011).

2.4. Reading Motivation

Reading motivation is essential for the emergence of desire, interest and curiosity towards reading, the formation of attitude and behaviour, the valuing of the reading act by the reader and the continuation of the reading habit (Katrancı, 2015). During reading, readers who devoted themselves to the reading text stated that they developed motivation towards reading due to various goals and that they were involved in the social environment by using

the knowledge they gained from their past experiences and sharing what they read (Baker & Wigfield, 1999). From this point of view, both the individual's influence on himself/herself and the society's influence on the individual can be mentioned for reading motivation. Wang and Guthrie (2004) focused on a new model using the Reading Motivation Scale consisting of two main categories and eight dimensions. It is observed that intrinsic motivation in the reading process consists of curiosity, interest and preference for the difficult. In contrast, extrinsic motivation consists of dimensions such as recognition, note-taking, adaptation, social dimension and competition. Teachers have much work to do to reveal students' intrinsic and extrinsic motivations in the reading process. In this way, desired goals related to reading can be achieved.

3. Method

3.1. Research Method

The current study aimed to determine the effect of learning environments enriched with multisensory reading activities on reading comprehension. For this purpose, the research was carried out using the quasi-experimental method. The quasi-experimental method is research conducted with an intervention in one of the experimental and control groups (Kırbaş & Çevik, 2017).

The research was conducted with the pre-test/post-test control group design pattern. In this model, two separate groups should be selected, one of which is experimental and the other is the control group, which is formed by random method. Measurements should be made with both groups before and after the experiment (Karasar, 2018, p.132).

Information about the research design is given in Table 1.

Table 1. Research Design

Groups	Pre-Test	Educational Tool Used	The Time	Post-test
Experimental (4/C)	Reading Comprehension Test	The Turkish curriculum, enriched with multisensory reading activities	Six weeks	Reading Comprehension Test
	Reading Comprehension Strategies Scale			Reading Comprehension Strategies Scale
	Reading Motivation Scale			Reading Motivation Scale
Control (4/A)	Reading Comprehension Test	The existing Turkish curriculum	Six weeks	Reading Comprehension Test
	Reading Comprehension Strategies Scale			Reading Comprehension Strategies Scale
	Reading Motivation Scale			Reading Motivation Scale

3.2. Participant

The research participants were randomly selected fourth-grade students studying in a private primary school in the 2020-2021 academic year. The fourth-grade students in the study group

were 9-10 years old, and four girls and eight boys from the 4/A class and ten girls and eleven boys from the 4/C class were included in the research. In the first years of primary school, decoding and comprehension are at an elementary level, and complex skills are focused on in the last years of primary school (Özdemir & Kıroğlu, 2019). To contribute to the development of this complex structure of reading comprehension, fourth-graders were included in the scope of the research.

Information about the study group of the research is given in Table 2.

Table 2. Information of Study Group

Branches	Gender	*f*	%
4/C	Girl	10	47.62
	Boy	11	52.38
4/A	Girl	4	33.33
	Boy	8	66.67
	Total	33	100.00

Since the numbers of the experimental group (f=21) and the control group (f=12) were less than 30, the non-parametric Mann-Whitney U test was used to see whether there was a significant difference between the pre-test scores of the groups. According to Yılmaz and Yılmaz (2005, p.179), non-parametric tests should be preferred instead of parametric tests when comparing samples with less than 30 people. Since the number of groups constituting the sample was less than 30, the normality test was not applied, and the Mann-Whitney U test was used.

According to the pre-test results of the "Reading Comprehension Test", "Reading Comprehension Strategies Scale", and "Reading Motivation Scale", it can be said that the experimental and control groups are two equivalent groups.

3.3. Data Collection

The information of the data collection tools permitted and used for the research is in the list below.

1. "Reading Comprehension Test" developed by Yurdakal and Susar-Kırmızı (2018)

The Reading Comprehension Test is a 19-item scale with four options developed by Yurdakal and Susar-Kırmızı (2018). As a result of the statistical analyses, Cronbach's Alpha value of the scale was 0.874, the Spearman-Brown coefficient was 0.856, and the Guttman Split Half coefficient was 0.852. While the lowest score to be obtained from the test is 0, the highest score is calculated as 95.

2. "Reading Comprehension Strategies Scale" developed by Susar-Kırmızı (2006)

Reading Comprehension Strategies Scale is a 26-item scale developed by Susar-Kırmızı (2006). A five-point Likert-type scale was used as always, very often, sometimes, very rarely, and never to determine the students' participation level. The lowest total score from the scale is 26, and the highest is 130. Cronbach's Alpha reliability coefficient for the whole scale is 0.88.

3. "Reading Motivation Scale" developed by Yıldız (2010)

The Reading Motivation Scale was developed by Wang and Guthrie (2004) and adapted into the Turkish version by Yıldız (2010). A Likert-type scale was used with a four-point ranging from *very different from me, a little different from me, a little like me, a lot like me*. The lowest

total score to be obtained from the scale is 21, and the highest total score is 84. Cronbach's Alpha internal consistency coefficient for the whole adapted scale is 0.86.

4. Reading Texts

5. Multisensory Reading Activities

To determine the effect of learning environments enriched with multisensory reading activities [visual (maps, posters, information maps, charts, graphics, images, cartoons, short films, natural objects, puzzles, photos), auditory (music, riddles, jokes, reading texts), tactile/kinesthetic (drama, puzzles, games), smell and taste] on the reading comprehension of primary school 4th-grade students, the reading comprehension test, reading comprehension strategies scale and reading motivation scale were applied as a pre-test to 2 different randomly selected groups from the fourth-grade of primary school. The students were assisted with each item in the content of the scales. The researcher carried out the whole study, and all data were obtained during the distance education course with digitally prepared scales. For the scales used as a pre-test, students were asked to do silent reading, and the number of paragraphs read by students was not interfered with, taking into account accidental errors. To examine the students' reading comprehension, the test results applied to the experimental and control groups were reported.

After the pre-test studies, the same texts were used in the experimental and control groups for six weeks, and Turkish courses were carried out. While the process continued with the Turkish curriculum enriched with multisensory reading activities planned by the researcher in the experimental group, it was carried out following the existing Turkish curriculum in the control group. At the end of 6 weeks, the reading comprehension test, the reading comprehension strategies scale and the reading motivation scale, applied as a pre-test to the two groups, were used again as a post-test, and the results were reported.

In the process, the Turkish curriculum's listening/watching and reading outcomes were considered in both experimental and control groups. The researcher himself planned the six texts selected to be used in the research process by being enriched with multisensory reading activities in the experimental and control groups. In contrast, the classroom teacher carried out them by following the existing Turkish curriculum.

The steps of the process related to the activities of the Turkish course applied in the experimental and control groups are listed below:

Preparation:

- In the experimental group, various pieces of music such as birds, nature, water and various scents such as orchids, lavender and basil were included in the learning environment. Digital puzzles, concept networks, visuals and crosswords were used in keyword studies. During the review and prediction processes, students were given room to describe them with drawings.
- In the control group, various scents and pieces of music were not included in the learning environment. The control group was asked to find the keywords from the text. In the review and prediction processes, they were asked to make inferences from the visuals of the text.

Comprehension:

- Non-verbal music was used in the listening/reading process in the experimental group. In the studies of unknown words, words were tried to be guessed by animating them with body language movements using visuals and drawings. Then, the predictions and dictionary meanings were compared with the help of the dictionary. The images related to the paragraphs of the text were presented to the children, and comments were made on which paragraphs the visuals may belong to by making inferences from the images.
- In the control group, non-verbal music was not used in the listening/reading process. In the studies of unknown words, students were asked to find the meanings of words directly from the dictionary.

Text Review:

- In the experimental group, students were made to watch short films on various subjects. Afterwards, they were asked to find out which short film related to the text topic they read. The relationship between the cartoons and the text was questioned by showing various cartoons. The subject was provided to be reinforced with visuals and song support to improve the word hoard.
- The control group was asked what the subject of the text was. The necessary information was transferred to the students by the teacher to improve the word hoard.

Learning Through Text:

- In the experimental group, up-to-date news about the text was shared, and a video of the news was presented with its visuals. The relationship of the shared news with other courses was questioned. A reading book related to the text and a song associated with the book's content was given to children as a research topic, and they were asked to think about the similarities between the book and the song. They were allowed to present the relationship between two texts to their friends through visuals, music, projects, videos, short films, and drama.
- In the control group, different texts related to the existing one were presented to the students, and the similarities and differences between the texts were questioned.

Self-Expression:

- In the experimental group, students were asked to develop various solutions for a problem specified related to the text to determine the purpose, method and technique. They were allowed to share their answers with their friends by choosing one of the methods they wanted. In this way, students were allowed to express themselves.
- In the control group, for the students to determine the goals, methods and techniques, they were asked to do the specified work on the text and share it with their friends.

Measurement and Evaluation:

- In the experimental group, the measurement and evaluation phase was completed using the "Process Observation Form" for the teacher to control the process and the "Self-Assessment Form in Reading" for the student to evaluate himself/herself.
- In the control group, the "I Evaluate Myself" test was used, in which non-text questions were included.

3.4. Data Analysis

In the distribution of the groups forming the sample and the students in these groups by gender, frequency and percentage were used. In the reliability calculations of the Multiple-Choice Reading Comprehension Test, KR-20 were used. Mean and standard deviation values and analysis were used to evaluate the Reading Comprehension Test, Reading Motivation and Reading Strategies Scale pre-test and post-test.

Mann-Whitney U test, one of the non-parametric methods, was applied to analyse the difference between independent groups. The Mann-Whitney U Test tests whether the test results obtained from two related samples differ significantly or not (Büyüköztürk, 2016, p.165).

3.5. Validity and Reliability

The Reading Comprehension Test is a 19-item scale with four options developed by Yurdakal and Susar-Kırmızı (2018). The statistical analysis results show that the scale's Cronbach's Alpha value was 0.874, the Spearman-Brown coefficient was 0.856, and the Guttman Split Half coefficient was 0.852. Tukey's Nonadditivity value was p=0.667. From this point of view, the test is a Likert-type summable scale regarding the options and scoring it contains. While the lowest score that can be obtained from the test is 0, the highest score is calculated as 95. The Reading Comprehension Test was applied to 33 students during the research process. The

data on the reliability coefficient of the Reading Comprehension Test after the application are shown in Table 3.

Table 3. Reliability Coefficient

The number of students	The number of items	KR-20
33	19	0.72

According to Table 3, the reliability coefficient (KR-20) obtained from the applied test was calculated as 0.72.

The Reading Comprehension Strategies Scale is a 26-item scale developed by Susar-Kırmızı (2006). To determine the students' participation levels, a five-point rating was made in the form of "Always, Very Often, Sometimes, Very Rarely, Never" with a Likert-type scale. The lowest total score that can be taken from the scale is 26, and the highest total score is 130. Cronbach's Alpha reliability coefficient for the entire scale is 0.88.

The Reading Motivation Scale was developed by Wang and Guthrie (2004) and adapted into Turkish by Yıldız (2010). A four-point rating was made using a Likert-type scale as "Very Different From Me, A Little Different From Me, A Little Like Me, Very Like Me". The lowest total score that can be taken from the scale is 21, and the highest total score is 84. Cronbach's Alpha internal consistency coefficient for the whole adapted scale is 0.86.

To determine the research problem, all six texts used were selected from the Turkish textbook of the private school where the research was conducted. Expert opinions on the usability of the texts were received. The readability formula Ateşman (1997) created regarding the readability of the texts to be used in the research process was applied. The readability levels of the texts are shown in Table 4.

Table 4. Readability Levels of The Texts

Selected Texts	Formula Result	Readability Levels
Without Water	52.85	Moderately Difficult
Environment	79.62	Easy
Recycling Will Be Amazing	40.12	Difficult
My Beautiful Anatolia	68.70	Moderately Difficult
Timiti and the Lion	51.76	Moderately Difficult
My Dear Country	73.77	Easy

Before preparing multisensory reading activities appropriate to the selected reading texts, it aimed to determine the learning styles of the experimental group to which the method would be applied. For this purpose, the 94-item Learning Styles Scale developed by Şimşek (2007) was used. The scale consists of 4 basic dimensions and sub-dimensions related to these dimensions. These dimensions were discussed as environmental (sound, light, warmth, sitting style), emotional (motivation, reliability, responsibility, structurality), sociological (individual, pair group, three groups, team, learning with adults, learning in various ways) and physiological (perceptual visual, auditory, tactile, food, time, mobility). The data obtained from the scale applied to the experimental group of 21 people to determine their learning styles are shown in Table 5.

Table 5. Learning Styles Results of the Experimental Group

Basic Dimensions	%
Environmental Preferences	%55.35
Emotional Preferences	%53.33
Sociological Preferences	%65.07
Physiological Preferences	%64.56

After the learning styles were determined, multisensory reading activities were planned considering the learning styles of the experimental group. Expert opinions were received during the preparation process for multisensory reading activities.

4. Findings

The first hypothesis of the research was determined as "The effect of learning environments enriched with multisensory reading activities on students' reading comprehension shows a significant difference in the experimental group." Considering the statistical results obtained from the mean and standard deviation values of the experimental and control groups' reading comprehension test, the mean score of the experimental group regarding the post-test was M= 73.33, and the standard deviation score was SD= 12.68. On the other hand, the control group's mean score regarding the post-test was M= 61.67, and the standard deviation score was SD= 15.57.

To determine the effect of learning environments enriched with multisensory reading activities on students' reading comprehension, the Turkish curriculum enriched with multisensory reading activities was applied to the experimental group. The control group carried out the Turkish course based on the existing Turkish curriculum. The statistical results regarding the difference between the reading comprehension post-test scores of the two groups are given in Table 6.

Table 6. Mann-Whitney U Test Results According to the Reading Comprehension Post-test of Groups

Groups	*f*	Mean Rank	Sum of Ranks	U	Sig.
Experimental	21	19.67	413.00	70.000	0.035
Control	12	12.33	148.00		

$p < 0.05$

The results of the Mann-Whitney U test concerning the reading comprehension's total post-test scores of the groups showed a significant difference between the reading comprehension post-test scores of the students in the experimental and control groups. The difference was in favour of the experimental group ($U=70.000$, $p < 0.05$). Considering the mean rank and sum of ranks, it can be said that learning environments enriched with multisensory reading activities effectively increase students' reading comprehension.

The second hypothesis of the research was determined as "The effect of learning environments enriched with multisensory reading activities on students' reading comprehension strategies shows a significant difference in favour of the experimental group." Considering the statistical results obtained from the mean and standard deviation values of the experimental and control groups' reading comprehension strategies test, the mean score of the experimental group regarding the post-test was M= 83.43, and the standard deviation score was SD= 16.52. On the other hand, the control group's mean score regarding the post-test was M= 72.42, and the standard deviation score was SD= 13.56.

To determine the effect of learning environments enriched with multisensory reading activities on students' reading comprehension strategies, the Turkish curriculum enriched with multisensory reading activities was applied to the experimental group. The Turkish course based on the existing Turkish curriculum was carried out in the control group. The statistical results regarding the difference between the two groups' reading comprehension strategies' post-test scores of the two groups are given in Table 7.

Table 7. Mann-Whitney U Test Results According to the Reading Comprehension Strategies' Post-test of Groups

Groups	*f*	Mean Rank	Sum of Ranks	U	Sig.
Experimental	21	19.60	411.50	71.500	0.041
Control	12	12.46	149.50		

$p < 0.05$

The results of the Mann-Whitney U test concerning the groups' reading comprehension strategies' total post-test scores showed a significant difference between the reading comprehension strategies' post-test scores of the students in the experimental and control groups. The difference was in favour of the experimental group ($U=71.500$, $p < 0.05$). Considering the mean rank and sum of ranks, it can be said that learning environments enriched with multisensory reading activities are effective in the development of the reading comprehension strategies of the students.

The third hypothesis of the research was determined as "The effect of learning environments enriched with multisensory reading activities on students' reading motivation shows a significant difference in favour of the experimental group." Considering the statistical results obtained from the mean and standard deviation values of the experimental and control groups' reading motivation, the mean score of the experimental group regarding the post-test was $M= 65.00$, and the standard deviation score was $SD= 7.42$. On the other hand, the control group's mean score regarding the post-test was $M= 58.00$, and the standard deviation score was $SD= 10.44$.

To determine the effect of learning environments enriched with multisensory reading activities on students' reading motivation, the Turkish curriculum enriched with multisensory reading activities was applied to the experimental group. The control group carried out the Turkish course based on the existing Turkish curriculum. The statistical results regarding the difference between the reading motivation post-test scores of the two groups are given in Table 8.

Table 8. Mann-Whitney U Test Results According to the Reading Motivation Post-test of Groups

Groups	*f*	Mean Rank	Sum of Ranks	U	Sig.
Experimental	21	19.67	413.00	70.000	0.036
Control	12	12.33	148.00		

$p < 0.05$

The results of the Mann-Whitney U test concerning the reading motivation's total post-test scores of the groups showed a significant difference between the reading motivation post-test scores of the students in the experimental and control groups. The difference was in favour of the experimental group ($U=70.000$, $p < 0.05$). Considering the mean rank and sum of ranks, it can be said that learning environments enriched with multisensory reading activities effectively develop the students' reading motivation.

5. Discussion

As a result of the quasi-experimental applications, it was concluded that learning environments enriched with multisensory reading activities used in the experimental group

were effective in increasing reading comprehension compared to the existing Turkish curriculum applied in the control group**.** It is observed that the results obtained from the studies in the literature and the research findings are similar.

In the research conducted by Vickerv et al. (1987), the basic techniques of the multisensory program for alphabet technique, dictionary skills, reading, spelling and handwriting were compared with the curriculum. As a result of the research, it was concluded that the tendency of the mean scores to increase was due to the multisensory program. In their research, Joshi et al. (2002) questioned the effect of the multisensory approach to improve reading comprehension, and they stated that there was a significant difference in reading comprehension in the experimental group compared to the control group. In a different study conducted by Warnick and Caldarella (2015), it was concluded that the reading comprehension of the inadequate readers, who were determined as the pre-test/post-test control group, improved in the experimental group with phonetic reading studies using a multisensory program. The result showed that significant differences emerged in favour of the multisensory program. In a study conducted by Broadbent et al. (2018), it was found that children's performance improved after being exposed to multidimensional (audio-visual) cues despite limited sense (only visual or auditory). Similarly, the study by Kurt-Karakaş (2019) concluded that reading comprehension increased in the Turkish learning-teaching process supported by multiple stimuli. In their experimental research, Labat et al. (2020) concluded that the audio-visual method supported by motor skills provides an advantage in remembering information compared to classical education.

In this study, enriching the learning process with visual, auditory, tactile and gustatory senses can be shown as the reason for the increase in reading comprehension. These activities actively increased reading comprehension by activating students' multiple senses in the learning process.

As a result of the quasi-experimental application, it was detected that learning environments enriched with multisensory reading activities used in the experimental group effectively increased reading comprehension strategies compared to the existing Turkish curriculum applied in the control group**.** It is observed that the results obtained from the studies in the literature and the research findings are similar.

Campell et al. (2008) conducted research to help students acquire basic decoding strategies in the reading process, and it was concluded that the addition of complementary multidimensional components to the reading program by using multisensory methods (kinesthetic/audiovisual/tactile) at the 2nd-grade level could be used as an effective teaching strategy. Moustafa (1999) found that multisensory approaches and learning style theories in developing strategies were practical for different learners in primary school. Besides, his research emphasised the necessity of considering learning styles and mentioned that it could be implemented with a multisensory approach. In her study, Susar-Kırmızı (2006) included activities that allow the active use of the senses, such as creating songs and photo frames and writing poems based on the text's main idea while students were working on reading strategies. According to Beydoğan (2009), the reader's mental efforts with these activities support them to gain depth about the theme covered in the text. This way, the reading task can be saved from monotony, and reading comprehension strategies can be developed.

In this study, enriching the learning process with visual, auditory, tactile and gustatory senses can be shown as the reason for the increase in reading comprehension strategies. These activities actively increased reading comprehension strategies by activating students' multiple senses in the learning process.

In the learning process, students develop strategies such as estimating the content of the texts, questioning the main idea, finding the topic, taking notes, and underlining essential points. The texts should be enriched with multisensory reading activities such as music, pictures, photographs, posters, banners, and drama to support these strategies.

As a result of the quasi-experimental applications, it was found that learning environments enriched with multisensory reading activities used in the experimental group were effective in increasing reading motivation compared to the existing Turkish curriculum applied in the control group**.** It is observed that the results obtained from the studies in the literature and the research findings are similar.

In their study, Khurshid and Ansari (2012) concluded that using contemporary learning methods and techniques was more effective than traditional ones. They also found that modern learning methods and techniques took the students' characteristics into account more and increased their interest. Özerbaş and Öztürk (2017) also concluded that the digital story they used in the Turkish course affected the academic success of the students, as well as had the same effect on their motivation. It can be concluded that the significant difference between the post-test motivation scores of the control and experimental groups showed the positive impact of the visual, auditory and kinesthetic elements of the multisensory method, such as sound, image and movement. In their empirical study, to reveal the effect of multiple stimuli on word acquisition, Gorjiana et al. (2012) found a significant improvement in the experimental group in which visual, auditory, tactile and kinesthetic activities were applied. Based on the research results, while planning the learning processes, it should aim to consider individual differences, design learning environments by appealing to more than one sense and increase the active participation of students. In this way, students' interest and motivation will also increase (Yıldırım, 2020).

In this study, enriching the learning process with visual, auditory, tactile and taste senses can be shown as the reason for the increase in reading motivation. These activities actively increased students' reading motivation by activating multiple senses in the learning process.

6. Conclusion

The effect of learning environments enriched with multisensory reading activities on students' reading comprehension shows a significant difference in the experimental group. The findings confirmed the first hypothesis. The significant difference between the mean scores of the experimental group's reading comprehension skill post-test and those of the control group can be explained by the contribution of learning environments enriched with multisensory reading activities. Similarly, the effect of learning environments enriched with multisensory reading activities on students' reading comprehension strategies post-test mean scores shows a significant difference in the experimental group. The findings confirmed the second hypothesis. The significant difference between the mean scores of the experimental groups' reading comprehension strategies post-test and those of the control group can be explained by the contribution of learning environments enriched with multisensory reading activities. Concerning reading motivation, the effect of learning environments enriched with multisensory reading activities on the mean scores of the students' reading motivation post-test shows a significant difference in the experimental group. The findings confirmed the third hypothesis. The significant difference between the mean scores of the experimental groups' reading motivation post-test and those of the control group can be explained by the contribution of learning environments enriched with multisensory reading activities.

Limitation

This research is limited to the learning plans enriched with multisensory reading activities prepared by the researcher and implemented in the 2020-2021 academic year for six weeks. Also, it is restricted to the data obtained from 33 students studying in 4/A and 4/C classes from Primary School and measurement tools.

Recommendation

The suggestions offered for educators and researchers in line with the data obtained from the research are given below:

- Based on the findings that learning environments enriched with multisensory reading activities improve primary school 4th-grade students' reading comprehension, reading comprehension strategies and reading motivation, it can be suggested that teachers support the teaching-learning process in primary school Turkish courses with multisensory activities.
- Pre-service and in-service training can be given to primary school teachers and teacher candidates about learning environments enriched with multisensory reading activities.
- This study covers six weeks. Increasing the working time of new research can reveal more effective, detailed and comprehensive research.
- By changing the sample group specified as primary school 4th grade for the research, new research studies can be conducted at all levels, including kindergarten, primary school, secondary school, high school and university.
- In addition, besides the experimental method, different research studies can be conducted using qualitative data collection tools (observation form, interview form, etc.) for further studies.
- Before the educational process, it is necessary to determine the students' learning styles and plan the learning process by enriching it with multisensory activities accordingly.
- It should be attentive to ensure that the texts selected for the learning process are up-to-date, attractive, understandable and legible for the age group.
- The texts selected for the learning process should be enriched with linguistic, visual and auditory multisensory reading activities.
- New research can be conducted on the effect of learning environments enriched with multisensory reading activities on listening and writing skills, besides the effect of reading comprehension.
- The number of studies regarding how learning environments enriched with multisensory reading activities affect reading comprehension strategies can be increased.
- The number of studies regarding how learning environments enriched with multisensory reading activities affect reading motivation can be increased.

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Conflict of Interest

The researchers declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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