

**TEACHING SENSE ORGANS SUBJECT WITH AN EDUCATIONAL GAME: SMELL AND REALIZE THE TASTE<sup>1</sup>**

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**ABSTRACT**

The aim of the study is to design an educational game related to understanding the relationship between tongue and nose subject in the unit of the “The Systems of Our Body and their Health” and the topic of “sense organs” in the science education curriculum at 6<sup>th</sup> grade level and take students’ views about it. This study was carried out through engaging students’ interest on the topic, increasing their motivation, providing students’ activity, ensuring associated with the daily life of the object, offering the opportunity by doing and living and having fun and teaching without misconception. The research was carried out with the phenomenological method which is one of the qualitative research methods. Criterion sampling of the purposive sampling method was used in this study. This study was conducted on thirteen students at 6<sup>th</sup> grade attending private school in Merzifon, Amasya. An educational game in the game theory was developed according to the theory of cognitive and energy in the dynamic game theory. Before performing educational game, researcher told a story related to daily life and give one sheet of paper to the students to complete at the end of the story. This helped to check out the students’ prior knowledge about the topic. At the end of the educational game, completing the end of the story activity was repeated to find out the difference between performed educational game and before it. The educational game was implemented to three groups of four with the help of a referee for thirteen 6<sup>th</sup> grade students. As a data collection tool after the application, semi-structured interviews were conducted with randomly five of the students who played the game and one of the students who did not. Semi-structured interviews recorded with a voice recorder were resolved by researchers. In the analysis of the study, content analysis of the qualitative research was used. The findings of the study provide telling a story engaged students to have a positive attitude and willingness for lesson before the educational game and after the educational game drawing the map of tongue showed that students learned the topic through educational game. It is concluded that students learned the subject by participating the educational game “smell and realize the taste”, and experienced learning by living, and arose interest and attention of the students for the lesson. At the end of the study, necessary recommendations about different topics which students have a difficulty to understand are given for willingness researchers.

**Keywords:** Educational game, science teaching, sense organs

**Introduction**

Keeping up with the current age is the most important fact for societies in order to survive in the future ages. According to Karamustafaoğlu (2018, p.2), people of the 21<sup>st</sup> century will be able to have questioning, critical thinking, innovative, self-improving, communicating affectively, entrepreneur and synthesizing different ideas. 21<sup>st</sup> century has the latest technology. By means of the technology that is renewing and improving constantly; education has an offer both affirmative and negative opportunities for teaching, communication, and motivation. With the help of the affirmative opportunities, negative ones can be blocked and reversed for preparing the new ages.

In the curriculum, it is observed that teacher-centered education is accelerating though learner-centered education from past to present. With the developing technology, it is an undeniable fact that it is an obligation. Teachers in the educational process are leader and stimulators for course; students are researcher, questioner, explicator, discussing on an event and getting new product (MoNE, 2018). The learning process involve basing on scientific research, exploring, asking questions, making an

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evidence, revealing an evidence-based product (MoNE, 2018). According to Çepni (2018, p.4), using the information is more important than knowing the issues and also it is expected that students can be drawn on the process of using information.

Koivisto and Hamari (2019) have analyzed eight hundred nineteen researches about gamification. Four hundred and sixty-two of them are examined; 46.7% of them is related to education and learning research. It is not easy that the Z generation children who are born into the technology are active and should be motivated in the closed areas especially in classes. Prensky (2002) thinks that the most important way of the education is eliminating the factors which are not proper to education. One of the most important way is games which have survived from past to present. In every society, games are always remarkable among all ages. The game has been interpreted differently in the literature. Some of them according to Danny Hillis is the gam ‘a genius learning path’ and also Korkmaz (2018) described the game as a “providing the child’s physical, mental, emotional and social development activities”. Although the definitions are various, Prensky (2001) classified the games under six titles which are rules, aims and objectives, feedbacks, difficulties/competition/challenges/contrast, communication, presentation and stories.

The activities that enable the learner to perform the actions of fun and thinking in the same time period are called educational games. Game based learning is a method of aiming at the realization of permanent learning. The main purpose is to give the objectives for students through the game. The full realization of game-based learning involves balancing the actions of fun and thinking. If the intrinsic motivation that is desired to be created in the student is achieved through balance, the game-based learning will be achieved.

Ryan and Deci (2000) found out that students with a high intrinsic motivation is making better brain storming and finding a way to problems than students with a low intrinsic motivation. To provide intrinsic motivation, the steps of educational games should be followed carefully. These; introducing the game, explaining the rules of the game, implementing the game and evaluating the game. Kebritchi and Hirumi (2008) explained five reasons which are strengthening the communication within the group, receiving personal satisfaction and motivation, developing the multi-learning method, strengthening capabilities, using the ability of collaborative and making decisions why gamed based learning used for education.

It is realized from the international exam results that science lessons in Turkey cannot accomplish the objectives of the curriculum. In terms of the content examining, science lesson includes words of Latin constantly, probing the four process skills, including a lot of abstract concepts and using the skills of exposition frequently. Science lesson is viewed as a difficult subject for students, and from concrete to abstract principle can be used in teaching difficult topics and making sense of the objectives.

By means of educational game, science can be taught easily and more permanently. Educational games in the science education can be grouped into three categories such as the effect of the educational games on students' academic achievement, the impacts of students' attitudes and behaviors and teaching with educational game in the relevant national literature. Educational game improves students' academic success on science lesson and gives a positive attitude for science lesson (Bayat, Kılıçarslan and Şentürk, 2014; Coşkun, Akarsu and Kariper, 2012; Kaya and Elgün, 2015; Yıldız, Şimşek and Aras, 2016). In the research, teaching with educational games shows that it gives positive effect on teaching concepts (Aslan, Karamustafaoğlu and Kurt, 2018; Karamustafaoğlu, Pazar and Karamustafaoğlu, 2018; Karamustafaoğlu and Kaya, 2013; Karamustafaoğlu and Yurtyapan, 2016; Tezel and Karaer, 2017). In the international literature, educational games can be grouped into two such as the effectiveness of educational game and the effect of the creative thinking skills on science lessons. Teaching with educational game has a positive effect on learning and also educational game improves creative thinking skills of students in science lessons (Amr, 2012; Charlier & Fraine, 2012; Chmiel, 2012; Cicchino, 2013; Deater-Deckard, Chang & Evans, 2013; Li & Tsai, 2013).

Both national and international literature do not include any educational game in the unit of the “The Systems of Our Body and their Health” and the topic of “sense organs” in the science education curriculum at 6<sup>th</sup> grade level. To close the gap in the literature, researchers designed an educational game related to understanding the relationship between tongue and nose subject in the unit of the “The Systems of Our Body and their Health” and the topic of “sense organs” in the science education curriculum at 6<sup>th</sup> grade level and took students’ views about it.

There are multiple theories about the development of game. An educational game which is in the game theory was developed according to the theory of cognitive and energy in the dynamic game theory. Theory of cognitive is based on mental development of individual and mental development. According to the theory of energy, students have more energy in their bodies, and they can give it away with the help of the games.

The aim of the study is to design an educational game related to understanding the relationship between tongue and nose subject in the unit of the “The Systems of Our Body and their Health” and the topic of “sense organs” in the science education curriculum at 6<sup>th</sup> grade level and take students’ views about it.

### **Methodology**

This study was carried out with phenomenology which is one of the qualitative research methods. Phenomenology describes a common meaning in the form of a narrative research or the story of the experiences of several people (Creswell, 2018, p.77). It is a suitable method for investigating phenomena that are not fully understood although known (Yıldırım & Şimşek, 2013). One of its main features is to identify a heterogeneous group ranging from 3-4 to 10-15 people who have experienced a phenomenon in all aspects (Creswell, 2018, p.78). It reveals that individuals have both subjective and objective thoughts about their experiences. This is a description of ‘what’, how it is experienced by briefly discussing the essence of experiences (Creswell, 2018, p.78). Case studies may not reveal certain and generalized situations (Büyüköztürk, Çakmak, Akgün, Karadeniz & Demirel, 2018, p.22). In this study, the opinions of the students about educational play were taken and whether they could comprehend the subject was evaluated with two basic questions. For this reason, it was decided that the study should be carried out with phenomenology.

The educational game is designed in relation to the units, subjects and acquisitions of the 6<sup>th</sup> grade Science course of the Ministry of National Education (MoNE). The gains related to the educational game are shown in Table 1.

**Table 1.** Grade, unit, subject and acquisition related to the developed educational game.

<b>Grade</b>	<b>Unit</b>	<b>Subject</b>	<b>Acquisition</b>
6	Systems and Health in Our Body	Sense organs	F.6.6.2.2. Demonstrates the relationship between the senses of smell and taste with an experiment he designed.

### **Working group**

The game developed was applied to 13 students attending 6<sup>th</sup> grade of a private school in Merzifon district of Amasya. These students were selected from the sixth grade in the institution where the researcher was a teacher and the number of students was higher. In the selection, purposeful sampling was used. Purposeful sampling is a method used in qualitative research. These people will be able to give willing responses to the phenomenon (Creswell, 2018, p.156). According to the objectives of the study, it is expected to give an opportunity for deep research by selecting rich situations in the direction of knowledge (Büyüköztürk, Çakmak, Akgün, Karadeniz and Demirel, 2018, p.92). Following the implementation of the developed game, twelve players who played the game and one student who did not play the game were evaluated.

### ***Data Collection Tools***

To get the opinions of the students, a semi-structured interview was conducted with five students who played the game and one student who did not play the game. The interview is a form of oral communication between at least two people (Büyüköztürk et al. 2018, p.158). In semi-structured interviews conducted, students' opinions were taken with four open-ended questions.

### ***Data Analysis***

Question and answer interviews with the students were recorded in audio recordings. After the audio recording was reported by the researchers, analysis was performed. The data were analyzed using content analysis method. According to Şimşek and Yıldırım (2006), the basic process in content analysis is to bring together similar data within certain concepts and themes and interpret them in a way that the reader can understand. During the analysis process, the data were coded and the concepts and themes reflecting the views of the participants were determined. The codes are tabulated in terms of themes and presented with frequency, percentage and participant codes. The codes of the students in the educational game were determined as S<sub>1</sub>, S<sub>2</sub>,...S<sub>13</sub>. Table is made according to the determined code, theme and frequencies. This table is described according to the themes and then interpreted.

### ***Developed Educational Game and Application Process:***

<i>The name of the game:</i>	Smell and realize the taste
<i>Places to play:</i>	Class and laboratory
<i>Number of players:</i>	12+1 students
<i>Materials:</i>	<ul style="list-style-type: none"><li>➤ Twelve opaque glasses</li><li>➤ Pickle juice</li><li>➤ Salt</li><li>➤ Granulated sugar</li><li>➤ Four medium sized lemons</li><li>➤ A rag to close players' eyes Appendix 1 &amp; 2</li></ul>

*Preparation of Materials:* Four of the twelve glasses are named as number one, four as number two, four as number three and four as number four. The color of Group1 is green, Group 2 is pink, Group 3 is orange. group name and player numbers such as Group 1 player 1, Group 2 player 2 are written on it. Each of the numbered cups is mixed with ten tablespoons of sugar and 100 ml of water. Each of the two glasses is mixed with ten tablespoons of salt and 100 ml of water. Each of the three glasses is mixed with one medium lemon juice and 100 ml water. Each of the four cups is mixed with 50 ml of bitter pickle juice and 100 ml of water.

### ***The Rules of The Game***

1. The game is played with three groups of four students.
2. The names of the groups are called Group1, Group2 and Group3.
3. The students in the groups are determined by drawing lots.
4. One of the students is assigned as a printer by drawing lots.
5. The groups play the game in sequence. This sequence is determined by lot.
6. The order of the students in the group is determined by drawing lots.
7. Twelve cups that do not show inside are prepared.
8. Each student will have a cup and will use it until the end of the game.
9. The game consists of two steps; In the first step of the game, the pupil must play with a cloth.
11. For the first step, the eyes of the student should be checked strictly, and the game should be started in this way.
12. A total of three questions are asked per student, one in the first stage and two in the second stage.
13. One group per student is asked for the first step and four questions in total. A group can complete the first step with a maximum of four points.
14. In the second stage, two questions are asked to each student. By taking one point for each question, the student can complete the step with a maximum of two points and a maximum of eight points in this group.

15. If all group members answer all the questions correctly, they can complete the game with a maximum of twelve points.
16. If, during the game, the contestants assist the group mates, the assisting group is deemed to have received zero (0) from that step.
17. At the end of the game, points are added and the group with the most points is determined.
18. Students who are ranked first according to their points are given a representative award.

#### *The Process of Playing Games*

Before starting the game, the teacher tells a story to the students in order to draw attention to the lesson, but the end of the story is not completed (Appendix-1). After the lecture, each student is given a blank piece of paper. Students are told to write their names on paper. Students are asked to write the end of the story they are listening on. It is said by the teacher that they have five minutes to do so. After the students complete the writing process, the cards are collected to be dealt at the end of the game.

First, the rules of the game are explained to the students. A printer is determined by lot. Then, the students and the order of the students during the game are determined by drawing lots. After this stage the game can begin. The scoreboard is drawn by the printer and group names are written on the board. The game can be started by the teacher after the writing process is completed.

The teacher prepares 12 glasses that do not reveal the inside. These glasses have numbers from one to four and group numbers; e.g.: Group 1 - Student 1. Since the students will smell and taste the substances in those glasses, each student must have a glass and the students will have a single glass until the end of the game. The teacher calls the first group and instructs them. The teacher closes the first player's eye with the help of a cloth. Thereafter, the pupil's eyes are tested whether they see through the cloth. After it is decided that they did not see, the teacher took the student's glass over the table and made the student smell it. After the student sniffed, the teacher asked him to describe how the substance smelt. The student's answer was written on the blackboard by the printer. These procedures were repeated for each student and each group. This completes the first step of the game. Then the second stage of the game started without checking the answers.

In the second step, the tastes of the substances they smell in the previous step were examined. After the students tasted it, the first question was how it tasted and then with which part of the tongue you felt taste more, the answers were written on the board by the printer. This process was repeated for each student and each group. When these operations were completed, the second stage of the game was completed.

The teacher asks the students to sit down before proceeding to calculate the final score. The teacher says that there is sugary water in the number 1 bar, salty water in the number 2 glass, water with lemon in the number 3 glass and bitter pickle water in the number 4 glass. In the light of this information, the answers of the first question asked in the first part of the game and in the second part are checked and the score calculations of the students are made and the results are written on the board by the printer. The teacher then gives the students the information about which flavors we take more intensively in which part of the tongue. In the light of this information, the printer checks the students' answers with the help of the teacher and the final question points are written down by the printer on the blackboard. Then the general scores of the groups are calculated. The representative of the game is determined by the winner and the prize is given by the teacher.

The papers distributed in the introductory part of the course are redistributed according to the students' names at the end of the lesson and the students are asked to complete the story again by thinking what they have done in the game. After this process is completed, a piece paper is given to the students to get their thoughts about this game. They are asked to answer the questions on the paper. In order to find out whether the student has learned the subject or not, a mini-scale that includes questions related to the subject is applied (Appendix-2).





Picture 1. Examples from application

### Findings

The opinions of the students about the educational game 'Smell and Realize Taste' developed in the study are presented below.

The rules of the game are explained to the students before the game starts. The game lasted one lesson (forty minutes). The students were asked to close their eyes before starting the game. At the beginning of the game, a story suitable for the game was told in order to draw the attention of the students and the end of the story was not completed. The students were then asked to complete this story with their prior knowledge. For this purpose, a paper was distributed to the students and they were asked to complete the story.

#### *Findings for students to complete the story before the game*

Eight of the students completed the story in a negative way. Two students completed the story as follows: 'Ahmet likened the smell to a wrong meal, so he could not eat (S<sub>7</sub>); 'Well, mother, Ahmet said. He couldn't eat when he sniffed the dinner. Because it had a very mixed smell (S<sub>8</sub>). The other students completed the story as if it were their favorite food, and they could guess the food correctly from the smell. The two students completed the story as follows. *I immediately shouted, stuffed leaves! My favorite food is leaf wrap. Mom says it's true. I ate the whole pot in a minute (S<sub>3</sub>); 'The child says he has rice and belly for dinner and eats (S<sub>5</sub>).*

#### *Findings for students to complete the story after the game*

After the educational game applied; it was seen that the students completed the story by resembling an educational game. Two of these answers are as follows: '*... Ahmet sniffed first. Then he closed his eyes and tasted the food. He finally knew the food and ate it (S<sub>2</sub>); 'This time his mother closed Ahmet's eyes and wanted him to guess the dish. She added that he would eat it if he knew. Ahmet knew it and ate it. (S<sub>7</sub>).*

**Findings from the interviews**

A total of four open-ended questions were asked to the students at the end of the game. The answers given by the students to the first question are presented in Table 2 on the theme, category and code-frequencies.

**Table 2-**Theme, category, code and frequencies of the answers to the first question

Theme	Category	Code (Frequency)
The opinions of smell and realize the taste	Affirmative	Very enjoyable (1)
		Good (2)
		Nice (4)
		Very nice (3)
		Liked very much (1)
		Have a lot of fun (6)
		Thank you very much (2)
		Excellent (1)
		Instead of the lessons, always play this type of games (4)
		A bundle of fun (4)
		Liked (2)
		Very good (1)
		Let's play again (1)
		Laughed (1)
		Negative
	Nauseating (1)	
	Dizziness (1)	
	Split by number of people (1)	
	Using different materials (1)	
		Fear (1)
		Bad taste (2)
		Tang (1)

When Table 2 examined, it is seen that students expressed positive opinions about smelling and tasting game. One of the students answered this question: *'I wish we could always play these games instead of lessons. I think it was fun. No matter what the game is, I love playing games, I have a child spirit. I think you had better make them all with different substances in the smell and discover game because others can cheat... (S<sub>4</sub>)'*

When the answers given to the second question were examined, it was understood that students guessed the taste of the lemon and pickle juice when they smelled and the reason for their predictions was that the scents of the liquids were very intense. Other students also said that they could not guess scent, and the reason was that salty water and sugary water did not smell. The answers of the two students who answered this question were as follows: *'... no, I couldn't guess because it didn't smell ... Sugary water (S<sub>7</sub>)'; '... Yes, because it smelled sour (S<sub>9</sub>)'*

For the third question, students drew a tongue model. It was seen that many students drew the tongue model correctly and few students drew it wrong. The drawings of the two students are presented in Figure 2 below.



**Picture 2** Tongue drawings of two students

It was observed that many students could not answer the fourth and final question clearly. Four students responded that the nose and tongue work in the same place in the brain, and that the language does not taste when the flu is present, and that the most compatible pair of sensory organs are the nose and tongue. The two students answered this question: *'I have never heard of it before. But I think that the nose and tongue may be the most compatible pair of sensory organs (S<sub>1</sub>)'; 'Because the nose is clogged, we cannot enjoy it because the nose and tongue are evaluated in the same place in the brain (S<sub>6</sub>)'*.

### Discussions

The aim of the study is to design an educational game related to understanding the relationship between tongue and nose subject in the unit of the "The Systems of Our Body and their Health" and the topic of "sense organs" in the science education curriculum at 6<sup>th</sup> grade level and take students' views about it.

Before starting the educational game, one of the researchers told students a story to complete at the end of the story and ask them to write these on a paper. After the application, same story was told again, and students completed it again. Storified the educational game enables researchers to learn the prior knowledge and to check it whether changed or not. Moreover; this provided students' mind active permanently. According to findings of students' prior knowledge on completing story activity before application, most of the students have a prior knowledge about sense organs and the estimation skills of students is high. In the Prensky' study (2001); twelve elements of games explained. Twelve of them is that games contain a story and as if participants of the game took part in it. Coşkun, Akarsu and Kariper (2012) investigated the effects of the educational game included science stories on science lessons' academic achievement. The findings show that an educational game includes science stories has a positive effect on learning. Şen-Gümüş (2009) researched teaching with science stories in the science lessons on the students' attitude of both science lessons and the image of scientists in the master's thesis. This thesis shows that students who were taught with science stories interested more than other students. Dincel (2005) searched the method of narration and experiment in science lessons on the students' conceptual understanding and academic achievement. In this study, there is no significant difference that's way students can't use their imagination skills adequately.

When Table 2 examined, most of the students liked the game and they would like to play this kind of game in the lessons. According to making a literature review, the opinions about the students demonstrate collaterally. Korkmaz (2018) investigated promoting with educational game which developed science lessons on students' attitudes and achievements. Information from students show that this type of lesson is more enjoyable, lessons are more instructive and educational games help reinforcing the topic except the fun of course. Groff (2018) made an investigation about the area of game-based learning on integrated and effectiveness. This study remarks that students can learn the subject by experiencing individually, the area of game-based learning has more than one benefits, and it will have more benefits which haven't made out. In the study of Howard-Jones, Demetriou, Bogacz, Yoo and Leonards (2011), with the aid of educational game, the prize of the learning of scientific information is intrinsic motivation. By this means, educators and developers of game can explain how the games help learning. Bayırtepe and Tüzün (2007) found out that teaching with educational game can decrease students' stress, students have fun while playing. For this reason, students can have high attention and interest on lesson.

Before the application, telling a story helps students to have affirmative effect on lesson. In Yıldırım's study (2017), the effects of gamification in education on students' sense show that in the gamification, the process of time is important especially while arranging the process researchers pay attention to the students age, learning areas, the environment, limitation, planning the time needed and designing the educational game for appropriate context. Güneş (2015) explained that the game would be chosen for the purpose, objectives and activities. Before starting the educational game (smell and realize the taste), the rules of the game clarified. For this reason, students played the game without any difficulty. Prensky (2001) stated that games have six factors. One of the factors is the rules. Rules can specify the purpose of the games, make a limitation to motion and provide the process of game.



At the end of the game, researchers wanted students to draw a model of tongue. Given no knowledge about a model of tongue, most of the students drew a model properly. This can show that the education becomes real with an educational game. This finding is promoted by interested literature. Güneş (2015) made an investigation about the approach of the game; the advantages of the games subsume under three main topics which are easing the ability of read& write, stimulating the learning and ensuring the independence and active learning on the ability of learning.

According to findings, students apprehend the topic with the educational game. Topçu, Küçük and Gökteş (2014) dwell the educational computer games on objectifying the topics. And also, Tortop and Ocak (2010) researched the same topic. Both researches show that participating in this type of games enhances the learning and motivates and helps students to perceive the topic easily. Karamustafaoğlu, Pazar and Karamustafaoğlu (2018) made a research about teaching with educational game. This helps students to promote their own learning with teacher guidance. Meşe and Dursun (2018) underlined that educational game can reveal students' feelings not only in a positive but also negative ways in their study. Games can enhance students' interest on the lesson and can create competition environment. Girard, Ecella and Magnant (2012) analyzed nine studies about the educational game. This study demonstrated that educational game is a new tool and it will be used for teaching in the future.

### Results and Recommendations

According to the findings, it is concluded that students learned the subject by participating the educational game "smell and realize the taste", and experienced learning by living, and arose interest and attention of the students for the lesson. Also, students would like to play these types of games in the lesson instead of teacher centered teaching. In terms of the results of this study, necessary recommendations about different topics which students have a difficulty to understand are given for willingness researchers below.

- Pickle can be diluted with water more than the materials used in the game (100 ml of water used in the game is mixed with 50 ml of bitter pickle water)
- Other substances may be used instead of salty water and water with sugar in it used in the game. (Students are forced to guess because they are odorless.)
- Items in the glasses can be different for each group.
- Substances can be used in solid form instead of liquid state.
- More than one referee can be employed in the game.
- A study on student achievement of the designed educational game can be made.
- The designed game can be adapted to other achievements of the sensory organs.

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### **Appendix-1**

This story should be told by researcher to players below. Players should complete the story both before the application of game and after the application of game.

Ahmet came back home from school. While he was taking off his shoes in front of the door, he smelt a delicious meal. When he took his shoes off, run and arrived the kitchen and asked his mum "mum, what is for dinner? The taste of the meal was smelling very yummy.". His mum answered smilingly "Please, smell carefully. If you guess it, you will eat the dish.".....

### **Appendix-2**

Semi-structured interviews questions.

1. What do you think about the smell and realizing the taste of game? Please, write all your ideas.
2. When your eyes were closed, you smelt the meal. Did you make a true guess about the taste of food? What may be your reason for true or wrong estimation?
3. Please, draw a tongue model. Show the flavors were more concentrated on it.
4. Among people who are cold, it is a common belief that my mouth does not taste. What is your opinion about it?