VISUAL AND GAME SUPPORTED GLOBAL WARMING AWARENESS PROJECT

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ABSTRACT

Climate change causes chain problems affecting each other in the world day by day. The problems caused by global warming not only endanger the natural resources necessary for human life, but also affect social life, cultures, socio-economic structure, In this project; Before the game, which is in the prototype stage, was developed, a test was made to groups of all ages. As a result of the test, it was seen that most of the people had insufficient knowledge about global warming, and as a result, it was aimed that as many people as possible could reach the right information while having fun with minimum effort.

Key Words : *Climate change, Game, Global warming*

1. Introduction

The aim of this project is to increase the sensitivity of people by supporting the information taught audibly in school with visuals and animations and observing the effects of global warming on the individual. Thanks to this game, the person will be able to have fun while learning about the threat waiting for themself and the world, and they will be able to comprehend the negative effects of global warming more effectively by directly observing the events that can be done unconsciously and invisible to the eye every day.

1.1. Global Warming

Climate change is formed by the increase of gases that hold heat, and these gases create a greenhouse effect in the world. The greenhouse effect is a beneficial effect for the world, but if this effect reaches to dangerous levels, it may cause global warming to increase. Due to these gases, carbon emissions are increasing in the world; therefore, the sensibility of the greenhouse effect increases. According to BBC data, Turkey has started to rank 15th among the first 15 countries in 2020 (BBC, 2020).In their new report, the world's leading climate scientists announced that the struggle to keep global warming below 1.5 degrees Celsius has become "now or never" (NTV, 2022).

Global warming, which started to increase as a result of the Industrial Revolution that started in 1760, poses a great threat to the world. The main source of many problems such as acid rain, famine that has started to appear in various countries, and the melting of glaciers is global warming. This trend must be stopped for both the present and the next generation. In order to stop this trend, all people in the world should be made aware, not just a certain group. Because, as the name suggests, this problem is not a national one, but a global one.

1.2. Games and Learning

Today, the dominance of technological devices in our lives has led to a significant strengthening of our visual memory. Such dominance of technology has prepared the environment for people to turn to visually rich and interesting games (Meb Akademi Uzem, 2020). For this reason, if the education shown in schools is not supported by visuals and interacted with the learning audience, it will most likely not attract the attention of the target audience and will not make learning fun, nor will it ensure that learning is permanent. In other words, changing learning methods and interests as a result of the benefits of technology play a role in increasing the importance of the game in education.

The game arouses curiosity and pushes the player to take lessons. It presents what needs to be known in an interesting way in front of the player. Concepts in the game are taught through a series of stories that help players learn faster. The immediate feedback people receive during the game not only accelerates and perpetuates learning, but also helps them feel confident about their newly acquired skills.

Game-based education enables learning by encouraging logical thinking that stimulates intellectual growth and problem-solving abilities. It guides the lives of individuals in different ways according to their content and helps to relate the learning experience to real life. For this reason, games are much more effective when compared to traditional education methods. The game; It attracts the attention of the player with interesting activities, enables them to learn the skills they need to perform in a daily context, and motivates them by giving positive feedback (Meb Akademi Uzem, 2020).

1.3. Awareness

Awareness; The state of being able to look at themselves and what are related to them from the outside with a different eye is the logical awakening process.

Individual awareness; It enables the person to see the negativity approaching and take action, and causes an important development in the formation of social awareness in case of interaction with the person's close environment.

From the past to the present, the people have governed their own behavior. Therefore, nature, over which humanity has dominated since its existence, takes shape and reacts according to the attitudes of the people living in that region rather than the authorities who are constantly in search of solutions to environmental problems. Scientists can come up with various solutions to a problem that directly concerns the environment, but they can have an impact to a certain level. A solution that can provide

permanence for a problem that concerns the environment in which the society lives can be provided with social awareness activities that will cause a change in the behavior of the society itself.Today, there are ongoing awareness-raising activities for global warming, but since global warming has not yet had a direct impact on people's lives, they do not realize this big problem that awaits them and do not do the necessary work. Since the education provided in schools mostly covers the environmental effects, it cannot attract the attention of young individuals and cannot confront them with the danger of the situation.

The lack of awareness-raising activities manifests itself even in very simple problems that we witness in our daily lives. For example:

According to the 2016 data of the World Health Organization (WHO), diseases caused by environmental pollution cause 12.6 million deaths every year (AA,2017).

According to the data, the vast majority of people also fail to fulfill their responsibilities to the environment, which has been repeated to them since their childhood.

As mentioned before, this indifference of people to the situations taught to them aurally, the visual memory strengthened as a result of the dominance of technological devices in our lives, and the tendency of people to learn with visuals for the same reason.

Games supported by visuals and animations are more preferred by young people and if this situation is used in a positive way, this deficiency in education can be closed.

When used correctly, games are entertaining and instructive. Especially today, in these times when people are preparing their own end step by step, people need an instructive resource that will meet their orientation for "awareness", which is the most important factor in order to stop the terrible scenarios we are approaching. For these reasons, the game is of great importance today.

1.4. Awareness with Game

In the designed game, both the entertaining and instructive functions of the games were utilized. The game, which assigns the player to ensure the satisfaction of the public and to take care of the city, which consists of four areas, in this way, gives the player a fun time and instills a sense of responsibility; In addition, it is aimed that the gamer is informed about the problem by providing the operation of the game through questions.

1.5. Main Goal in The Game

The player's goal is to keep the satisfaction rate (percentage rate) and population as high as possible. The person who can answer the most questions correctly out of the two players and who can meet these two criteria the most, wins the game. The reason for choosing the population number as one of the main criteria is that the message to be given in the game is transferred to the player with numerical data. The reason why the satisfaction rate is determined as the main criterion is that the player can understand the changes created by global warming better by adopting their city.

Apart from these two criteria that will determine the winner in the game, 4 instructive criteria have been determined in order to observe that global warming has a direct effect on the life of the individual with a chain plot. These criteria are not taken into account when determining the winner, but they are necessary so that the basic criteria can be observed concretely.

1.6. Visuality in Game

One of the main differences in teaching with games is to attract attention with visuals. For this reason, it is aimed to effectively convey the problems that may be caused by globalwarming with striking visuals in the game, and to raise awareness by arousing the empathy of the player by processing the effects of all problems through an avatar.

To appear in the game; Avatar images were created, standing at the head of the dried- up lake in swimming clothes, standing across the barren field, looking into the space in front of it, and watching the food warehouse that was emptied as a result of animal deaths. With these visuals, it is aimed that the player can observe a possible life and bring the player face to face with his future.

1.7. Life at The Game

The four areas chosen to be in the game are among the most basic elements that make up a city. In addition, these areas were thought to be the areas that would best tell the player that global warming directly affects human life. These four areas are designated as schools and hospitals (required public areas), farms and fields (food supply sources), tourist attractions (lakes, seas, oceans, forests), and accommodation.

Hospitals:

Even if global warming is unobservable, it directly affects human health. It is an obvious fact that a disruption caused by global warming – which can happen in food supplies, water resources, farms or fields – causes serious health problems. For example, evidence that fires resulting from global warming affect human life with a chain effect are given below:

The world has entered a vicious circle. As global warming increases, forest fires increase. Global warming increases as forest fires increase (Milliyet, 2021). As a result of the combustion of natural biomass after forest fires, thousands of separate pollutants and components such as carbon dioxide, water vapor, carbon monoxide, hydrocarbons and other organic chemicals, nitrogen oxides and trace minerals are released (Euronews, 2021). According to the research published in the European Heart Journal, this number is more than the number of people who die from tobacco consumption in the world. Scientists said that about 800,000 people in Europe end their lives an average of more than 2 years earlier each year due to polluted air (BBC,2019).

Many people are hospitalized as a result of these negativities that are not directly diagnosed as "global warming". However, especially in recent days, due to the health problems it causes, "global warming" has started to be diagnosed as a diagnosis.

A Canadian doctor diagnosed "climate change" for the first time in history to an elderly patient who had difficulty breathing due to the extreme heat in the country, and announced that the patient was suffering from clşşşşimate change (Euronews, 2021).

Schools:

Schools; they are one of the basic places in a city for the construction of the future in society and therefore for the development of efforts to stop global warming. If the education in schools can provide the right learning, science and awareness will dominate the society.

Farm and Field Areas:

In a city, people's food is largely derived from livestock and farmland. If the functioning of these two is not carried

out correctly, the problems that will arise in food supply or product efficiency will negatively affect human life.Global warming, the rapid drying of wetlands, and the resulting decrease in agricultural production pose a serious threat to the nutrition of the world's population. It is estimated that the world population, which was approximately 7 billion 500 million in 2016, will exceed 9 billion in 2050. The Food and Agriculture Organization (FAO), affiliated to the United Nations, warns that if the global warming level exceeds 2 degrees, the number of 800 million people suffering from hunger and 1 million 200 thousand people living in poverty will increase (Retail Turkey, 2017).

Problems such as excessive rains caused by global warming, unexpected weather events and infertility of the soil will cause disruption in these areas and directly affect human health.

The global climate crisis deeply affects the ecological balance… The deterioration of the ecological balance brings with it significant yield losses in agricultural productivity... We see the greatest impact of global climate change with the increase in temperature. The increase in temperature greatly affects plant growth. The reason for the increase in temperature is expressed as carbon emissions (TRT, 2021).

Tourist Attractions:

Many factors such as drought, fires, disasters and high temperatures caused by global warming are destroying many places that attract attention by the society and foreigners. These areas also include areas that are necessary for life, such as public parks, freshwater lakes and forests.

The decrease in water resources due to climate change will have a negative impact on agricultural production. The total amount of water in the world is 1.4 billion km3, of which 97.5% is salt water and the remaining 2.5% is fresh water. With the increase in population in the world, the amount of usable water per capita is gradually decreasing. With the pollution of clean and drinkable water resources, water scarcity is increasing day by day (Apelasyon,2016).

Accommodation Area:

The direct effect of global warming on human life with this chain of events can be observed in accommodation areas. The progress of climate change in today's way will cause a visible negative change in accommodation areas. Animals are affected by high temperatures, the fields become unproductive due to weather events, dry water sources dry out as a result of drought and air pollution as a result of fires.

2. Method
2.1. Research Method

This research is a research in the causal comparison method, which is the subtitle of quantitative research, in terms of aiming to reveal the existing situation.

Causal comparison is a research method that tries to determine the causes of an emerging or previous situation, the variables that affect these causes, or the consequences of an effect (Metin, 2014).

2.2. Universe & Sample

All provinces of Turkey were included in the research universe in the pre-test phase. In the final test phase after the game was played, the research universe was chosen as the province of İzmir. The sample that can represent both universes was selected by easy sampling method.

The purpose of easy sampling includes everyone who wants interested (Kılıç&Ural, 2011).

2.3. Data Collecting Process

The scale is a list of questions prepared according to a certain plan in order to understand the feelings, thoughts and experiences of certain people or groups on a subject. The questionnaire, on the other hand, does not give a symbolic numerical data, but rather gives results that can be interpreted differently from person to person.

In this project, after various researches, the scale in the thesis prepared by Gökdere, M., Sontay, G., Usta, E. (2015) was used. 22 questions about global warming and 17 questions about global warming, which are perception determination questions, were included in the scale, and a total of 39 questions. The data collection process was carried out in an online way. The data were carried out in two stages, which are the pre-test and post-test stages.

2.4. Game Design

Programs such as Adobe Photoshop CC 2020, Adobe XD CC 2022, Adobe Illustrator CC 2021, Figma were used in the production of the game's interface, menu, character and map visuals. The use of minimalist, eye-catching and compatible themes/colors is one of the most important goals of the game's visual design process. The primary colors used (#8580f6, #84c990, #ffffff) have been prioritized to provide an experience that is both modern and simple and evokes nature. Another important point is that the fonts used in the same way can be compatible with each other in the game, thus creating a theme. The main fonts used in the theme are as follows: Inter Font Family, Gotham Rounded Bold, SF Pro Display.

The images used in the game were first designed in a vector environment in Illustrator, so that the visual quality could support all platforms, regardless of their size. In order for the player not to be bored, eye-catching, simple but remarkable character designs were preferred. In addition to aesthetics, the game provides instant access to the solution of the questions in terms of providing an effective learning process.
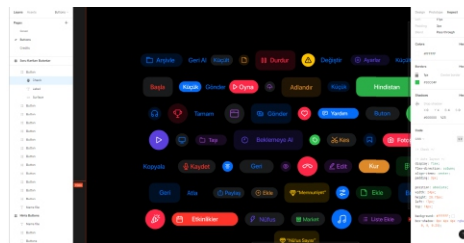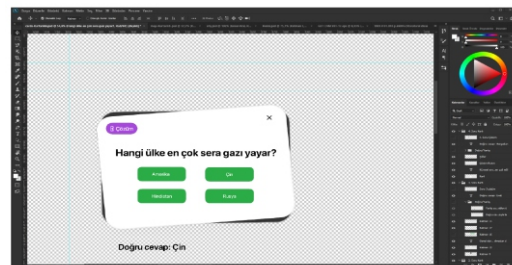

Fig. 1: Images From The Game Design Process

2.5. The Stage of Transforming the Designs into Games

After the designs are completed, the game engine chosen for the creation of the game is Unity. It is designed as a 2D (2D project) with vector designs. The "Start Menu" in the above image is designed as Stage 1, the Map and the part where answers to the questions are given as Stage 2. "Amount of food per person", "Amount of water per person", "Air pollution rate" etc. specified in the operation part of the game. Variables that take value according to the progress of the game are defined in Stage 2. Questions are defined as different objects in Unity. In order not to ask the questions asked again, these question objects contain a control variable. When the player answers a question, the "Ask" variable will take the value 0 instead of 1. Thus, it was ensured that the questions did not repeat themselves. 8 The answers to the questions change the values of basic criteria and instructive criteria. When these changes reach a certain size, visual changes occur on the map. While making visual changes, methods such as animation triggering and light regulation were used.

2.5. Participants

There are 299 people in the pre-test study.

According to figure (2a), there are 161 men and 138 women in the study.
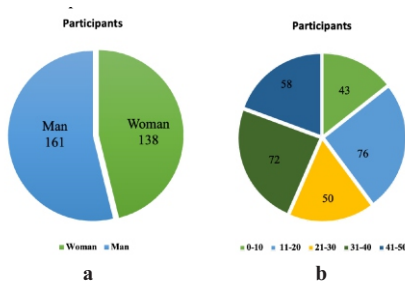

Fig. 2: a and b)Participants by gender and age (pretest data)

According to figure (2b), there are 43 people between the ages of 0-10, 76 people between the ages of 11-20, 50 people between the ages of 21-30, 72 people between the ages of 31-40, 58 people between the ages of 41-50.

According to figure (3), in the study, 108 from İzmir, 74 from Ankara, 34 from Istanbul, 30 from Manisa, 8 from Aydın, 8 from Antalya, 4 from Muğla, 4 from Balıkesir, 3 from Kayseri. 3 from Samsun, 3 from Bursa, 2 from Sakarya, 2 from Ağrı, 2 from Afyonkarahisar, 1 from

Edirne, 1 from Adana, 1 from Sivas, 1 from Yalova, 1 from Bingöl, 1 from Muş, 1 from

Çanakkale, 1 from Eskişehir, 1 from Erzurum, 1 from Giresun, 1 from Kahramanmaraş, 1 from Isparta, 1 from Kocaeli, 1 from Kütahya, 1 from Ordu , 1 person from Konya, 1 person from Zonguldak, 1 person from Ardahan, 1 person from Niğde.

Fig. 3: Participants by Cities

There are 155 people in the final test study after playing the game. According to figure (4a), there are 89 males and 66 females in the study.

According to figure (4b), there are 33 people between the ages of 0-10, 38 people between the ages of 11-20, 32 people between the ages of 21-30, 27 people between the ages of 31-40, and 25 people between the ages of 41-50.
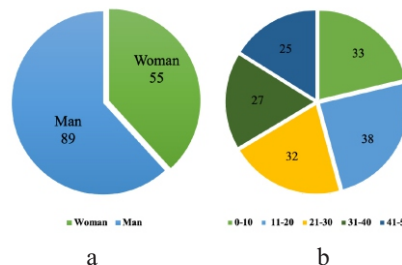

Fig. 4: a and b Participants by Gender and Age

Table 1: Work planning by time chart

Job description	Months				
	September	October	November	December	January
Literature Review	X	X	X		
Data Collection and Analysis		X	X	X	
Programming the Application		X	X	X	
Project Report Writing			X	X	X

2.6 Game Flow

When the player enters the game, the player will see a menu that reflects the theme of the game with its colors and will be able to learn about the basic features of the game. When the play the game option is pressed, the player will be directed to the map, which forms the basis of the game, where they can observe the effects of global warming. Apart from the basic criteria that will determine the winner in the game - satisfaction rate and population, instructive criteria have been determined in order to observe that global warming has a direct effect on the life of the individual with a chain plot. These criteria are not taken into account when determining the winner, but they are necessary so that the basic criteria can be observed concretely. These criteria are as follows: amount of food per capita (initially determined as 1000 kg.), amount of water per person (initially determined as 1000L.), air pollution rate (initially determined as 0%.), total number of trees (initially 1000 trees. The number of people in the hospital (initially determined as 0 people.), the number of product varieties produced in the field (initially determined as 1000 varieties.), the total number of farm animals (initially determined as 1000 animals.).

The effects of these determined instructive criteria on the playgrounds are as follows:

Schools and Hospitals: In cities where schools cannot be active, development and public satisfaction cannot be mentioned. For this reason, the number of people in the schools of the person who answers the questions correctly increases, which causes an increase in the basic and instructive criteria that enable the game to be won by improving awareness and technology. In the wrong

answer, there is a decrease in the criteria for the same reasons.

The existence of hospitals, on the other hand, is intended to reinforce the view that is intended to be told to the player with numerical data and to make the learning permanent. For this reason, answering the questions correctly or incorrectly and thus changing environmental conditions will cause a decrease in the number of people in the hospital.

Farm and Field Areas: Global warming greatly affects human health in this area, as in other areas. For this reason, in case of incorrect answers to the questions, increases and decreases are observed in instructive criteria such as the amount of food per capita, the number of people in the hospital, the number of product varieties produced in the field and the total number of farm animals.

Areas Attracting Tourists: The disappearance of these socioeconomically important public areas, which are preferred by people for entertainment and activity, will undoubtedly reduce the satisfaction of the people. In addition, the changes in the lakes, forests and parks included in these areas, besides affecting the basic criteria; It also affects instructive criteria such as the amount of water per capita, 11 air pollution rates, the total number of trees and the number of people in the hospital.

Accommodation Area: The player has a king avatar symbolically in the accommodation area. This area is intended to be the player's living space. Thus, if the player does not take steps to stop the impending threat, he will be able to observe the effects of the disaster that awaits him in his own living space. In addition, some features have been added so that the player can adopt this virtual environment as a living space. Thanks to these features, the player will be able to decorate his house, take care of his garden, and in case of wrong answers, he will be able to see concretely the effects of the decisions he made after losing the decor items he installed in the house.

2.7. Cards

At game; cards have been prepared in order to ensure effective learning, to comprehend information visually as well as verbally, and to make learning permanent.

Prepared question cards contain questions that determine the flow of the game. In this way, the player will be able to learn about the subject verbally as well as visually. Besides, it is thought that the information that causes changes about the player's own city will attract the attention of the player more. Solution buttons are placed in the upper corners of these question cards, where the answer can be learned. In this way, the player will be able to immediately learn the information; will be able to receive instant feedback with changes taking place in the city.

In addition to the question cards; cards that verbally explain the changes that will take place in the city appear on the screen right after the question is answered and the answer is learned by these cards; the main idea of the game and the chain of negatives caused by global warming in the city was explained to the player directly and verbally. In this way; the events taking place in the city and the changes on both basic and instructive criteria can be showed to the player in more understandable way.

3. Results

In the pre-test phase, 43% of the 22 information-determining questions about global warming were answered correctly, while 57% were incorrectly answered

In 17 perception-determining questions about global warming, 54% of people answered "I agree", while the remaining 46% answered "I am undecided" or "I do not agree".
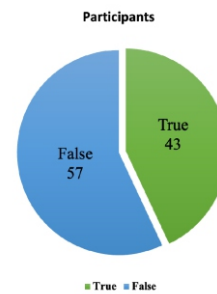

Fig. 5: True-False Graph of the First 22 Problems (Pre-test)

In the final test stage after playing the game, 78% of the 22 questions about global warming were given correct answers, while 22% were incorrectly answered.

In 17 perception-determining questions about global warming, 73% of people answered as "agree", while the remaining 27% gave answers as "undecided" or "disagree" (Fig. 6).
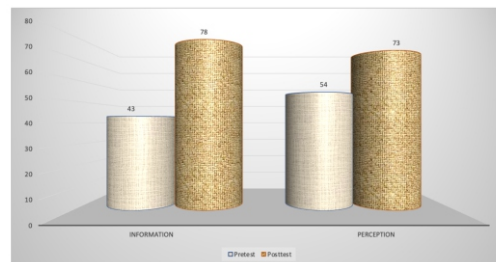

Fig. 6: Graph of the final test

4. Conclusion

The game is intended for every individual of the society, regardless of age. This situation is also seen in the scale made. Data were obtained from each individual between the ages of 0-50, both in the pre-test and post-test phases. As a result of the pre-test, it was seen that more than half of the people did not have the necessary knowledge about global warming, and most of them did not work on this issue.

Considering that these data are obtained from a wide age group, it is possible to say that both the education given in schools about global warming and awareness activities for adults are insufficient.

It is thought that this situation is caused by the absence of visuals in ongoing works so the learning can't be permanent, and the way that global warming issues are told, that people can not adopt the information and emphatize.

In addition to informing the society, in order to encourage people to develop solutions to the global climate change problem, the gaming industry, which is the leading use of technological tools today, has been utilized; Protect Your City with the objectives of "effective, fun minimum effort/maximum learning, learning that appeals to everyone"! developed. In order to achieve these goals, the methods mentioned in the project were developed and the game was played with a sample that could represent the universe.

After the game was played, a final test was administered to these people. As a result of the applied test, a great

difference is observed between the pre-test data and post-test data both in knowledge and perception question parts. That shows that the improved game, increased the awareness about global warming.The applied method is similar to the method of the studies conducted by Bakar Fındıkçı (2021) and Kınam Dokuzlar&Uçar (2018).

"Questionnaire" was used as a data collection tool in the project. Although it is easy to answer the questions, the disadvantage of the project is that some people may answer randomly. However, since the number of data in the project is high, the project is not affected by this disadvantage.

5. Suggestions

Problems related to global climate change and its effects on people are increasing; poses a great risk to all of us. That's why, to develop solutions is a great importance.

● Effective visuality and an accessible, user-friendly game flow should be given importance in order to attract people's attention in advertising, marketing and games which are made for social awareness.

● The place of this type of visually oriented games in education can be increased and they can be played as an activity in schools, at the end of the relevant units.

● The game; The number of questions will be increased, the features that will personalize the city will be increased, and more people can access the game by being developed and implemented in a way to interact with other players.

● The game can be put on official education platforms and provide more students to get information.

● The game can be transformed into more individual-oriented works that are presented with more impressive visuals by transferring to virtual reality platforms.

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