e-GİFDER ISSN 2146-3301
Gümüşhane Üniversitesi İletişim Fakültesi Elektronik Dergisi
Gümüşhane Üniversitesi İletişim Fakültesi Elektronik Dergisi | Gumushane Unıverstiy e-journal of Faculty of Communication

CİLT/VOLUME:10 SAYI/NUMBER: 1 MART/MARCH 2022

ANALYSIS OF BRAIN WAVES IN THE PROCESS OF READING THE BOOK WITHIN THE CONTEXT OF DIGITALIZATION OF THE PRINTED BOOK

Tamer BAYRAK[1]

Deniz YENGİN[2]

Sefa HARRANOĞLU[3]

ABSTRACT

Digitalization, being positioned as the essential element of our lives in consequence of globalization, has brought innovation to publishing as it did with numerous fields. Nowadays, digital books appear in addition to printed books. The means of producing, recording, and storing information are available on digital devices in which caused a change in the reading habits of the readers. Thus, providing opportunities for readers to further their reading by means of a tablet, computer, or mobile phone without utilizing the concept of books. However, the effects of reading habits, the sustaining the continuity of these habits and their encodings presents itself as a matter of significance that has to be researched. The emergence of the new media technologies, in particular, with utilizing the newest research methods it provided, ensured the acquiring of data that was undiscovered until that point. One of the devices of these methods that leads to the most significant, effective, and accurate results is the monitoring of the brain waves. The detection of the brain waves by utilizing EEG (Electroencephalography) plays a crucial role in various fields of research. The research of such has helped the advancement of the interpretations about individuals' moods, psychological and physical conditions. The features of electronic books and the frequencies of the reader's immediate brain waves who read George Orwell's Animal Farm in print and e-book form were studied in this research. The readers have read the first chapter in print and the second chapter through the e-book. A focus group study with three phases (pretest, monitoring the brain waves, and posttest) was conducted with 15 participants. The participants were between the ages of 18-36, consisting of 9 women and 6 men participants, and were arbitrarily chosen. The brain waves were monitored by using NeuroSky, a brain signal detection device. Analyses that were made were recorded by the Brainwave Visualizer, an android-based program, and the acquired data were analyzed.

Anahtar Kelimeler: Communication, New Media, Digitalization, Brain Signal Measurement, E-Book.

Araştırma Makalesi

Research Article

[1] Dr. Öğretim Üyesi
Çanakkale Onsekiz Mart Üniversitesi İletişim Fakültesi, Çanakkale, Türkiye

E-Posta
tamer.bayrak@comu.edu.tr
ORCID
0000-0003-0776-1606

[2] Prof. Dr.
Çanakkale Onsekiz Mart Üniversitesi İletişim Fakültesi, Çanakkale, Türkiye

E-Posta
deniz.yengin@comu.edu.tr
ORCID
0000-0002-6846-0770

[3] Yüksek Lisans Öğrencisi
İstanbul Aydın Üniversitesi İletişim Fakültesi, İstanbul, Türkiye

E-Posta
sefaharranoglu@gmail.com
ORCID
0000-0001-9679-3233

Başvuru Tarihi / Received
22.10.2021

Kabul Tarihi / Accepted
10.03.2022

BAYRAK, Taner; YENGİN, Deniz ve HARRANOĞLU, Sefa (2022). Analysıs Of Braın Waves In The Process Of Readıng The Book Wıthın The Context Of Dıgıtalızatıon Of The Prınted Book. Gümüşhane Üniversitesi İletişim Fakültesi Elektronik Dergisi (e-gifder), 10 (1), 32-58.

BASILI KİTABIN DİJİTALLEŞMESİ BAĞLAMINDA KİTAP OKUMA SÜRECİNDE BEYİN DALGALARININ ANALİZİ

ÖZ

Küreselleşmenin yansımaları sonucu hayatımızın vazgeçilmez bir parçası konumunda olan dijitalleşme birçok alanda olduğu gibi kitap yayıncılığı alanında da yenilikler getirmiştir. Artık günümüzde basılı kitapların yanında dijital kitapların da yer aldığı görülmektedir. Bilgiyi üretme, kaydetme ve depolama biçimleri dijital aygıtlar üzerinden yapılabilmektedir. Bunun bir sonucu olarak okuyucuların okuma alışkanlıklarında değişim yaşanmıştır. Bu da okuyuculara kitap kavramı olmadan tablet, bilgisayar ve telefon gibi cihazlar üzerinden okuma olanağı sunmuştur. Ancak okuma alışkanlığının etkileri, devamlılığının sağlanabilirliği ve kodaçımları araştırmaya değer konular olarak göz önündedir. Özellikle yeni medya teknolojilerinin ortaya çıkmasıyla birlikte araştırma bağlamında yeni tekniklerin kullanılması daha önce elde edilmemiş verilerin açığa çıkmasını sağlamıştır. Bu tekniklerin en önemli, verimli ve doğru sonuçlara ulaştıran araçlarından biri beyin sinyallerinin ölçülmesidir. EEG (Elektroensefalografi) tabanlı beyin sinyallerinin ölçümleri birçok alanda araştırmaların yapılmasında önemli bir rol oynamaktadır. Bu araştırmalar bireylerin ruh halleri, psikolojik ve fiziksel durumları hakkında yorumlar geliştirilmesinde etkili olmuştur. Çalışmada dijitalleşme ürünü olan elektronik kitabın özellikleri ve George Orwell'in Hayvan Çiftliği eserinin basılı ve e-kitap formatını okuyan okuyucuların anlık beyin sinyallerinin frekansları incelenmiştir. Okuyucular kitabın basılı formatında birinci bölümü, dijital formatında ise ikinci bölümü okumuşlardır. Bu bağlamda 15 kişilik grupla üç aşamadan (ön test, beyin sinyali ölçüm uygulaması ve son test) oluşan odak grup çalışması gerçekleştirilmiştir. Belirlenen kişiler 18-39 yaş aralığında rastlantısal seçilerek araştırmaya davet edilmiş 9 kadın ve 6 erkekten oluşmuştur. Beyin sinyali ölçüm uygulaması NeuroSky adlı beyin sinyali ölçüm cihazıyla yapılmıştır. Ayrıca yapılan analizler android tabanlı Brainwave Visualizer adlı program aracılığıyla kaydedilmiş ve elde edilen veriler analiz edilerek çözümlenmiştir.

Keywords: İletişim, Yeni Medya, Dijitalleşme, Beyin Sinyali Ölçümü, E-Kitap.

INTRODUCTION

The communication process that gained momentum with the effective use of the printing press, has greatly improved the communication channels coming later. At a time when literacy was quite low, the printing press, which increased the interest in the very subject of reading, became a leaping point for advanced technologies. And the development of printing techniques was directly followed by the period during which the newspapers became prevalent. With the first newspapers, the number of copies printed in Europe increased to tens of thousands and these numbers reached hundreds of thousands in some countries in the ensuing years. However, the greedy figures that increased their capital through this new and rapidly developing order, aimed to make as much profit as possible.

The world began to look more like a village with globalization (McLuhan: 2001). Under these conditions, the capital owners sought a way to maintain the order that profits them. And that resulted in attempts to take the media, which is considered as the fourth power, under their hegemony. As the media is in a continuous development, it has always changed itself every time with the help of technique. Cinema and television have come to the fore as another means of transferring information to distant places. The uses of time and space are both sharply differed and shaped (Bauman, 2018: 08). The transfer of image and sound over the same channel at the same time has played a significant role in this since that feature doesn't exist in radio and telegraph.

People have made various inventions throughout history and benefited from these inventions. From the nonverbal period to the internet age today, there have been great changes in communication. Results of these changes had positive effects on the quality of life and prosperity of societies. The mass communication process that started with the telegraph, now continues with telephone, electromagnetic wave transmission, radio broadcasting, television and finally new media (Balle and Eymery, 1991: 18). The mass media that is active in the daily practices of social life and have developed continuously throughout history; continues to change people's view of the world (Işıklar, 2017: 105). The world is currently in an era of uninterrupted change; and change offers the opportunity to improve, reprogram, and even redesign human practices (Leonhard, 2020: 35). Researchers conducting social, psychological, economic, political and cultural studies put forward the concept of new media in the 1970s. Yet, by the 90s, this term lost its original meaning from the 70s and reached different dimensions with technological developments where it took on different meanings (Kara, 2013: 11). Although media adopted the adjective "new", traditional media has not completely disappeared, but added some features to itself instead (Kozan, 2019: 24). This process has led to interaction between individuals or societies and has led to the rapid spread of information.

The tools used in the context of new media have played an active role not only in spending free time but also in business and daily life. Every stage of traditional media, from content production processes to publishing techniques, has been restructured with the opportunities offered by computers and the internet

(Bostancı, 2019: 19). In today's world where people benefit from technology more, technological activities have been made more visible in daily life. Even people who had no idea about the internet in the past and did not use the internet much in daily life, have experienced great transformations in their lives with the global internet revolution (Chayko, 2018: 4). Digitization has directly been an effective part of the communication and interaction process. One-way communication tools such as radio and television have turned into computer-based two-way communication (Neuman, 2018: 09). This innovation not only eliminated the separation of time and space but also it has brought many different societies closer to each other and created the opportunity for them to get to know each other. In a world without borders, people now exist in a virtual environment where a "replica of reality is prepared" (Yengin, 2012: 136).

People focus on the values produced when they evaluate the tools and behaviors associated with the digital environment. For instance, when someone wants to use popular applications actively, he/she gains access to information and values produced on this level from devices that can fit a person's hand. While sometimes we can quickly acquire the information produced by the guiding elements on social media, we may lose the opportunity to question the process at the point where we are affected. Now we can interact with dozens of resources within the possibilities provided by technology. Thus, we can obtain information that we did not know before. Nonetheless, it is in the hands of the dominant powers to affirm the value produced (Newpart, 2019: 52).

A. According to the uses and gratifications approach developed based on the active audience thesis, while the individual is equipped with conscious, rational, and voluntary qualifications, the mass media is moved to the object position. According to this approach, which is especially evident in the views of Herbert Marcuse, some artificial needs are created by the mass media, and formulas are offered to satisfy them. It is known that the basis of all these efforts lies in the purpose of encouraging consumption. This encourages today's consumption society as well as pushing people towards a standardization that consists of the same needs, the same need fulfillment formulas, and the same satisfaction forms (Güngör, 2016: 134-135). This approach, which points to the active role of the individual when using the media tool, states that

people use the media they want and its contents in order to meet their needs. In response, content producers are in a race to produce people's demands and even more. In this context, the uses and gratifications approach focuses on the problematic of why and why individuals use the media (McQuail ve Windahl, 1993: 110-112). The uses and gratifications approach also explains the transformation of the passive viewer into an active viewer. This transformation is also described as a paradigm shift in the field of communication (Güngör, 2016: 129). For the media that emerges in the transformation process, the audience is important in two respects. One is a consumer because he is in one of the basic systems of capitalist society. The second is positioning as a commodity produced for sale (Yaylagül, 2017: 165-166). This situation helps the active audience to be positioned in new media environments in the context of use and satisfaction.

B. Changing devices in the light of technological developments have altered the habits of people. Mobile devices are one of the most significant examples of this situation. These devices have changed the way of reading books by introducing the e-book format. When we look at e-book applications, it is clear that the application's history dates back to the Gutenberg project founded in 1971. The project initially aimed to create an electronic library with ten thousand e-books (Hart, 1992: 66 qtd. Farrokhı, 2015: 27). Initially presented as picture books, the e-books were then shaped themselves according to the internet network. An E-book is a format of reading a printed book from the screen in the form of a certain file on various electronic devices such as computers, tablets, and phones. It was first defined as the electronic version of a traditional media product, a printed book, which did not include features such as interaction (Kelley, 2016: 6). After acquiring new media features like interaction, multimedia and digitization, the e-book has taken on a new format by presenting components such as painting, printing, sound and motion.

E-books have many advantages, and the noblest of these advantages is the fact that they provide the desired book to the reader via the internet without any physical or environmental restrictions. Moreover, e-books removed the disadvantages such as books being out of stock, and they are more reasonable in price than printed books and contribute to nature as well since their production requires no trees to be cut down. In addition to all these, the e-book platform

provides ease of distribution which results in easier promotion for books written by independent authors. When we discuss the studies on e-books, it is seen that the focus is on the effect of e-books on people and the expected developments shortly. During the research process of this study, 9 female and 6 male participants, aged 18-39, and residing in Istanbul, were randomly invited within the context of the focus group and read the printed and digital versions of the same book. Then, the attention and meditation (relaxation) values of the readers were measured and compared with each other by using a brain signal monitoring device called NeuroSky. This device can detect the user's mental fatigue, brain waves, blinks. This product contains a ThinkGear chip that provides the interface between users' brains and robot systems. This chip is a technology in every Neurosky product that allows the device to interact with brain waves (Ülker and Tabakcıoğlu, 2018: 27). Within the scope of the study, the participants were first given a pre-test, then a brain signal measuring device and a post-test. In the pre-test, participants were asked how often they read e-books and printed books, how they felt, and which ones they thought would be highly focused. Following this test, the participants read the printed and digital format of the same work consisting of two pages with a brain signal monitoring device attached to their heads. Readers read the first chapter of the book in print format and the second chapter in digital format. The book chosen as a sample in the study was George Orwell's Animal Farm, a book with simple and understandable narration. The data collected in the measurements shed light on the effect of both print and digital reading in terms of attention and meditation, which was followed by interpretation of the said data by classifying them through charts.

The attention and meditation metrics found in the research are of great neuroscientific importance. Attention and meditation values, which are mentioned here and express cognitive activity, are used to explain the raw brain wave data of Alpha, Beta, Delta, Theta, Gamma waves produced by the human brain, obtained through the sensors in the forehead and ear. These data are necessary in order to understand through which brain waves the person is focusing, understanding, analyzing and concluding.

BAYRAK, Taner; YENGİN, Deniz ve HARRANOĞLU, Sefa (2022). Analysıs Of Braın Waves In The Process Of Readıng The Book Wıthın The Context Of Dıgıtalızatıon Of The Prınted Book. Gümüşhane Üniversitesi İletişim Fakültesi Elektronik Dergisi (e-gifder), 10 (1), 32-58.

1. Brain signal measurement in book reading process

Mobile brain signal measurement devices that promise a new research method in the context of scientific research are seen as important tools in terms of detecting the individual's instant stress factor, as they measure the focus of attention and reveal the intensity of brain signals. Measuring devices consist of quite a variety of tools, and are now mobile, that is, portable and can work with the help of software with a single laptop computer. However, there are also types of these devices that are quite advanced, which require a powerful computer to work, and have complex measuring apparatus. A communicator who researches with these devices, which requires multidisciplinary support especially in terms of measurement, must receive support from a medical specialist who knows how to interpret brain frequencies. Nevertheless, when we look at mobile measuring devices it is fair to say that this support is negligible, considering the data obtained in the presence of the information shared by the manufacturer and for limited use can be interpreted.

When the history of these devices is analyzed, the work of a medical doctor named Richard Caton stands out. Caton made measurements on monkeys and rabbits by opening their skulls and reaching directly to their brains. These measurements made electrical brain signals applicable (Malmivuo et al., 1995). Hans Berger, who recorded human EEG data for the first time through the electrodes he placed on the scalp, laid the foundations of more modern EEG devices that are still used today with the development of technology that can measure brain waves (Schomer and Lopes Da Silva, 2004). The EEG study applied by Berger via a galvanometer can now be performed on digital devices such as NeuroSky, which are more sensitive and have higher analysis power.

Table 1. EEG Wave Types and Frequency Ranges

Wave Types	Frequency range
Delta Wave	0.5 - 4 Hz
Theta Wave	4- 8 Hz
Alpha Wave	8- 13 Hz
Beta Wave	13- 30Hz

In the case of EEG, waves seen in various frequency ranges are named according to the letters in the Greek alphabet from slow to fast (Yarımoğlu, 2018:

9). In this sense, fluctuations are respectively classified from slow to fast as delta, theta, alpha and beta. The fact that these fluctuations are in different intervals such as appearing slow or fast is affected by many variables including problem-solving, insomnia, calmness, age, gender and being healthy. Delta waves are the slowest brain waves in the 0.5 - 4 Hz. range. They are the fluctuation of brain frequencies that are seen in every healthy age group and mostly active in the deepest and dreamless sleep state. When they are higher than 4 Hz, they cause problems such as learning difficulties and lack of attention, and when lower than 0.5 Hz, these waves can cause sleep problems. Theta waves are slow brain waves in the 4 - 8 Hz. range. These waves are present in all age groups and they are in the parietal (the region roughly located at the upper back area of the skull) and temporal (located on the sides of the brain) parts of the brain. Theta waves are stated to be associated with deep calmness, relaxation and pensiveness. When they are above 8 Hz, they cause problems like depression. When they are below 4 Hz. they can cause problems such as stress. Alpha waves are brain frequencies defined first in EEG that is in 8 - 13 Hz. range and they are more easily recognized than other brain waves. It is stated that these frequencies, which occur in the occipital lobes of the brain, are active in situations such as relaxation and comfort in individuals. High levels of alpha frequencies cause loss of energy in the individual while lower frequencies can cause problems such as sleep difficulties and stress. Beta waves are fast brain waves that are in the 13 - 30 Hz. range. Beta fluctuation that is evident in the parietal and frontal parts of the brain is active in healthy individuals during conditions including alertness, vigor, and concentration. When they are above 30 Hz. level they may cause problems like stress and anxiety, and when they are below 13 Hz. level they may cause problems such as attention deficit.

2. Research Findings

2.1. Research Pre-Test and Findings

The pre-test of the research firstly aimed to determine the predisposition of the participants to technology, the frequency and style of using media tools, and the level of traditional media tool's habits. Then, it was aimed to understand the

tendency of the participants to e-book technology, to learn their awareness between traditional printing and electronic books, and to predict their reactions during the research phase. In this part, data were also collected for the post-test that was going to be applied at the end of the research. Participants consisted of 9 women and 6 men between the ages of 18 and 39, who were invited by random selection. It is not known whether these people did any e-book reading before the test. Participants were taken to the test area one by one, on the same day and independently of each other. In order to prevent any influence and contact of the participants with each other after the test, a waiting room was allocated and the participants were allowed to rest until the end of the research.

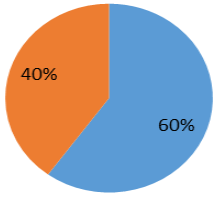
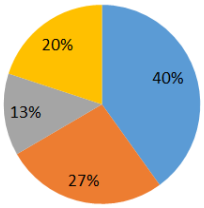
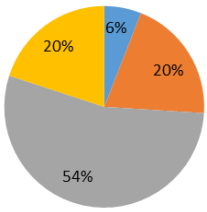
Table 2. Participant Gender and Age

Code	Gender	Age
P1	F	21
P2	F	19
P3	M	33
P4	F	24
P5	F	39
P6	M	37
P7	M	23
P8	F	27
P9	M	18
P10	F	29
P11	M	39
P12	F	23
P13	F	26
P14	M	30
P15	F	29

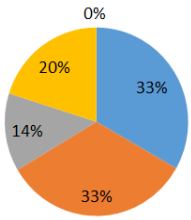
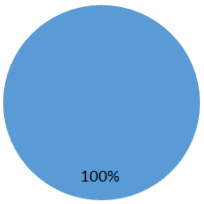
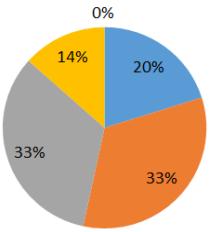
In addition to the basic demographic questions, the participants' familiarity with technology was tried to understand in general. Participants were also asked whether they had read a traditional printed book and experienced e-book technology. In this context, 10 questions in total, including demographic questions, were asked to the participants in the pre-test, and after each participant answered the questions independently from the other participants, the participants were taken to the application area at once. The questions asked to the participants, the percentages of their answers and the literal answers were classified in the table.

BAYRAK, Taner; YENGİN, Deniz ve HARRANOĞLU, Sefa (2022). Analysıs Of Bram Waves In The Process Of Readıng The Book Wıthın The Context Of Dıgıtalızatıon Of The Prınted Book. Gümüşhane Üniversitesi İletişim Fakültesi Elektronik Dergisi (e-gifder), 10 (1), 32-58.

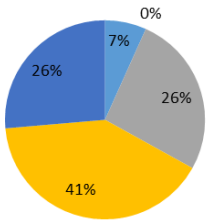
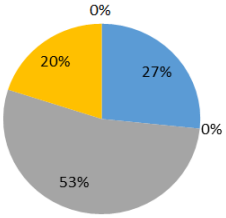
Table 3. Pre-Test Questions, Charts and Answers

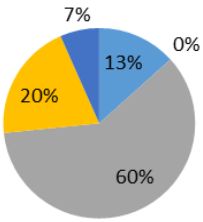
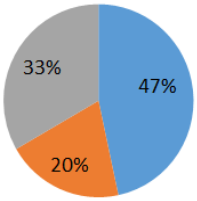
Questions	Charts	Answers
What is your gender? A) Female B) Male		Within the scope of the pre-test, information was obtained from 9 female and 6 male participants.
What is your age? A) 18- 24 B) 25- 19 C) 30- 34 D) 35- 40		All age groups specified in the survey participated in the survey. The majority of the individuals participating in the survey consisted of the 18-24 age group. The number of participants in this age range is 6.
What is your education status? A) Primary School B) High school C) Bachelor's Degree D) Master's Degree		The education levels of the participants vary from one person to another. According to these, 3 of the participants are master's graduates, 8 people are university graduates, 3 people are high school graduates and 1 person is primary school graduate.

BAYRAK, Taner; YENGİN, Deniz ve HARRANOĞLU, Sefa (2022). Analysıs Of Bram Waves In The Process Of Readıng The Book Wıthın The Context Of Dıgıtalızatıon Of The Prınted Book. Gümüşhane Üniversitesi İletişim Fakültesi Elektronik Dergisi (e-gifder), 10 (1), 32-58.

How often do you use traditional media (TV, newspaper, radio, etc.?) A) Usually B) Often C) Sometimes D) Rarely E) Never		In order to compare the frequency of using new media tools, the participants were asked how often they use traditional media tools. The majority of the participants use traditional media tools. Among the participants, there is no one who has never used traditional media tools.
How often do you use new media tools? A) Usually B) Often C) Sometimes D) Rarely E) Never		While the frequencies of using traditional media tools are shown at different levels among the participants, all of the participants use new media tools a lot.
How often do you read print books? A) Usually B) Often C) Sometimes D) Rarely E) Never		In order to compare the frequency of reading books on digital media, the frequency of reading printed books was asked. According to the chart, it is seen that the majority of the participants read with a printed book. There is no participant who has never read a printed

BAYRAK, Taner; YENGİN, Deniz ve HARRANOĞLU, Sefa (2022). Analysıs Of Bram Waves In The Process Of Readıng The Book Wıthın The Context Of Dıgıtalızatıon Of The Prınted Book. Gümüşhane Üniversitesi İletişim Fakültesi Elektronik Dergisi (e-gifder), 10 (1), 32-58.

		book.
How Often Do You Read Books on E-Books? A) Usually B) Often C) Sometimes D) Rarely E) Never		According to the graphic, it is seen that the majority of the participants read few or no books on e-books. This indicates that the participants don't have the habit of reading books in digital environments.
How do you feel when reading a Printed Book? A) I would be happy B) I get Stressed C) I pay attention D) I get distracted E) I get bored		It is aimed to measure the attention and relaxation level of the participants. In this context, the participants were asked how they felt while they were reading the printed book. According to the graphic, 8 participants pay attention while reading from the printed book. However, it is also observed that 4 of the participants were happy and the other 3 people were distracted while reading.

How do you feel while reading an e-Book? A) I would be happy B) I get Stressed C) I pay attention D) I get distracted E) I get bored		The participants were asked how they felt when they read from the digital book, and the majority of them stated that they paid attention. This suggests that individuals give their attention both in print and digital media. In addition, the participants stated that neither of the reading forms made them feel stressed.
Which media tool do you think is effective in terms of focus? A) Printed Book B) Electronic Book C) Both		Since the focus level of the participants would also be measured, they were asked which media tool was effective in terms of focus. Participants said that mostly printed books would not cause focus problems.

According to the pre-test results, it was understood that the participants were familiar with traditional media, but they were new to adopting digital resources such as e-books. The participants have the habit of reading, albeit from different education levels. In general, it is noticed that factors such as stress, distraction and boredom do not pose a problem during reading. Although new technologies attract attention, it is fair to say that the effect of traditional printing will continue. In this sense, e-book technology clearly needs time to increase its effectiveness as well as all other new

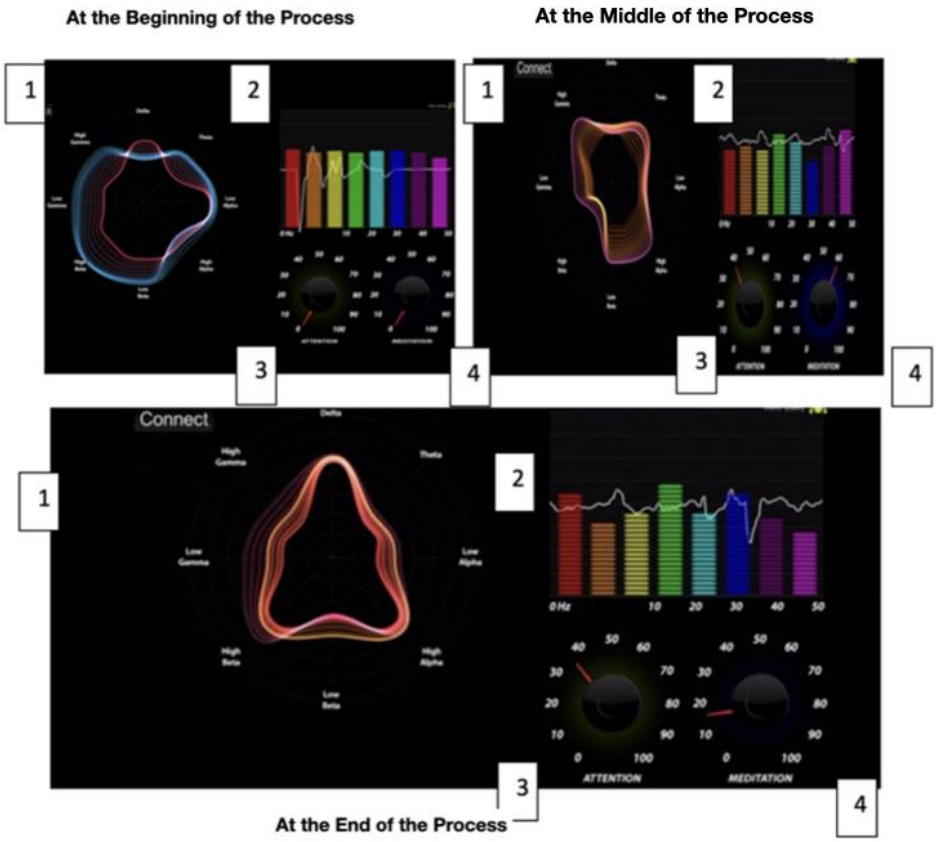
media technologies. Notwithstanding, we can foresee that the effectiveness of the printed book will not disappear completely. Finally, it's also perceived as a great advantage that e-book has a large digital library that can be accessed from a single device.

3. Findings Obtained Following the Printed Book Research

During the initial measurement part of the study, the participants read the first part of the Animal Farm book consisting of 2 pages, with a measuring device attached to their heads. And then, the data received from the users during the reading of the book were shown in figures. In Figure 1, the measurements of the first participant were taken and added to the study as an example. All participants' brain signals were measured. First, the brain signals of participants were measured while they were reading the printed book. Then, the brain signals of participants were measured while they were reading the e-book.

3.1. First Participant's Data

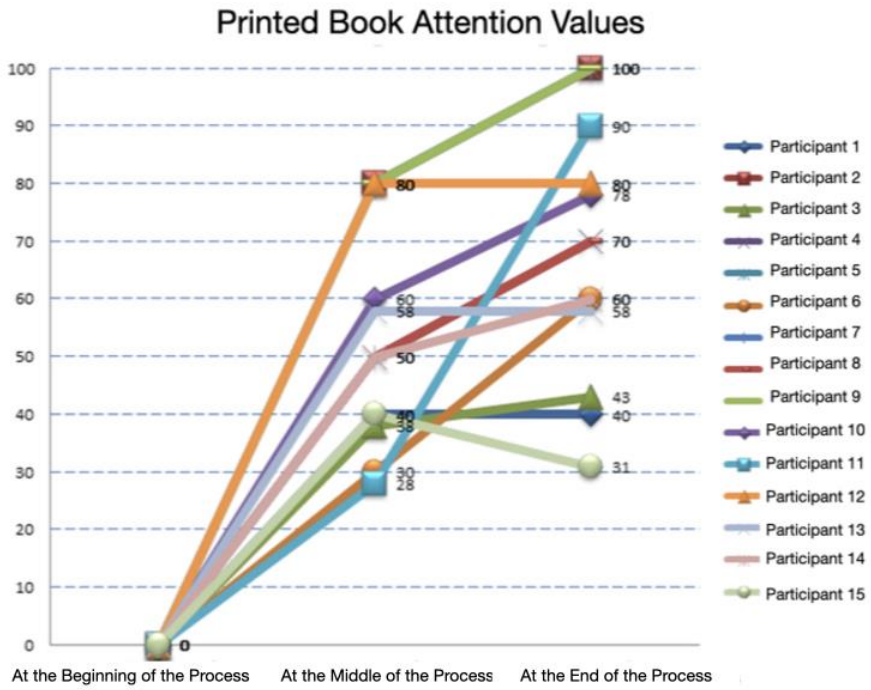
Figure 1. First Participant's Data in Printed Book Research



BAYRAK, Taner; YENGİN, Deniz ve HARRANOĞLU, Sefa (2022). Analysıs Of Braın Waves In The Process Of Readıng The Book Wıthın The Context Of Dıgıtalızatıon Of The Prınted Book. Gümüşhane Üniversitesi İletişim Fakültesi Elektronik Dergisi (e-gifder), 10 (1), 32-58.

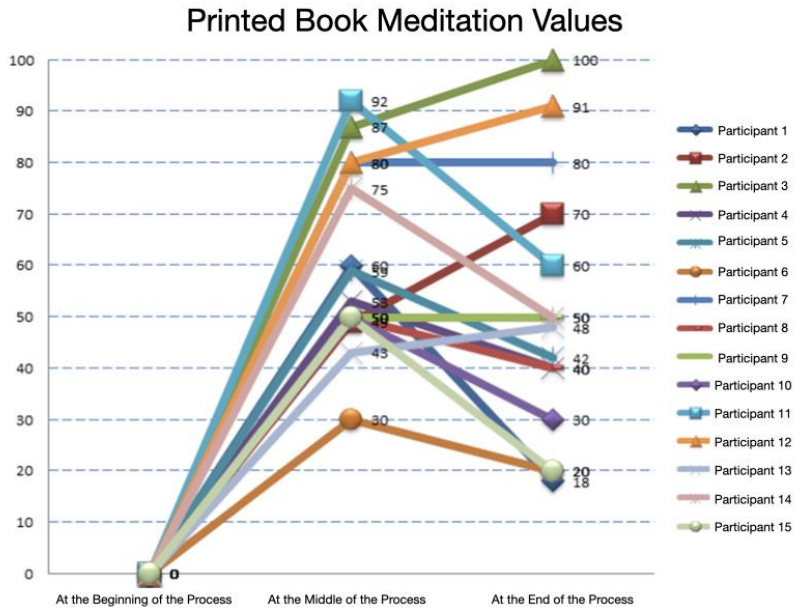
As seen in Figure 1, the first participant's attention and meditation levels were initially neutral. In the later seconds of the study, with the increase in the reading time, a noticeable increase was observed in the measurements of attention and meditation. In the middle of the process, the attention value shown in the third data was measured as 40, and the relaxation value, which is the fourth data, was recorded as 60. It is observed that the participant who finished the research in 2 minutes and 12 seconds, kept his/her attention value at a constant level, her relaxation value decreased rapidly, remaining around 18. Also, the participant's alpha fluctuation in the first data and the second data increased well above the normal level towards the last part of the study. This situation indicates that the energy of the participant decreased and he/she got tired during the reading process. Considering the data of the other participants in the printed book research, it was seen that the values were generally close to each other. In this case, it is understood that reading from the printed book has almost the same effects on the reader, and there will be partial differences in these effects depending on the interest of the reader. The attention and meditation values obtained throughout the printed book research are given in the figures below.

Graphic 1. Printed Book Attention Values



The attention values of the individuals participating in the printed book reading study showed differences during the brain frequency measurement (Figure 2). According to the figure, while only one participant's attention value decreased in the process, the attention value of ten participants increased. And the attention values of the remaining four participants remained stable. Among the participants, only four participants reached the attention value of 90 to 100. The fifteenth participant has the lowest attention value with a value of 31. The average attention span of the individuals participating in the research is 70.6. It is seen that the brain frequencies beta and delta play an active role in increasing and decreasing the attention value. Additionally, it was observed that the attention values of the participants who frequently read books were high. This shows that habit is an important factor in attention. It was also observed that the age and education difference between the participants had no effect on low or high attention values.

Graphic 2. Printed Book Meditation Values



Meditation values of individuals participating in the printed book reading study showed differences during brain frequency measurement (Figure 3). While the meditation value of only four participants increased, the meditation value of nine participants decreased. The relaxation value of the two participants remained stable. Among the participants, only two participants had 90 to 100 meditation values. In the

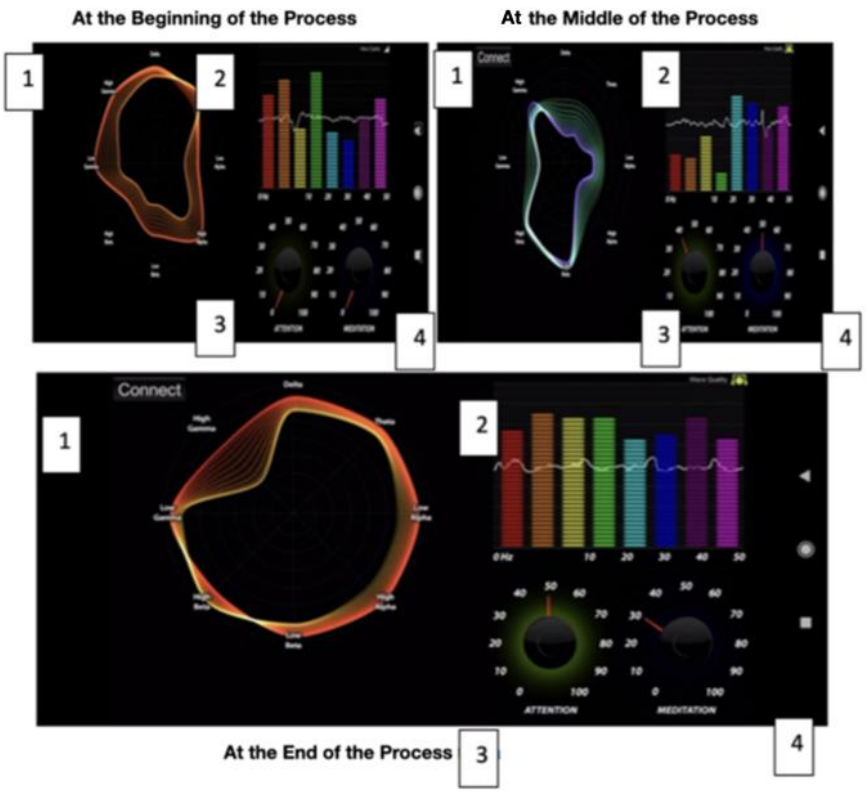
study, the first participant had the lowest meditation value with 18 values. The meditation average of individuals participating in the research was 50.6. It is seen that the frequencies of alpha and theta played an active role in increasing and decreasing the attention value. On top of that, it was seen that the age and education difference between the participants had no effect on the low or high meditation values.

4. Findings Obtained Following the E-Book Research

In the second part of the study, the second part of the Animal Farm consisting of 2 pages, was read by the participants with a measuring device attached to their heads. The brain signals emitted by the participants while reading e-books were measured and figures were prepared accordingly. In Figure 4, the measurement results of the first participant were added to the study as an example. All participants' brain signals were measured.

4.1. First Participant's Data

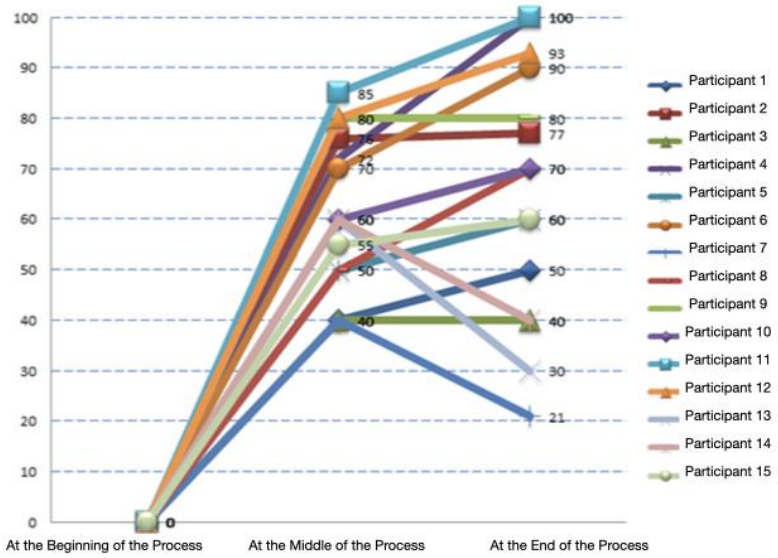
Figure 2. First Participant's Data in E-Book Research



BAYRAK, Taner; YENGİN, Deniz ve HARRANOĞLU, Sefa (2022). Analysıs Of Braın Waves In The Process Of Readıng The Book Wıthın The Context Of Dıgıtalızatıon Of The Prınted Book. Gümüşhane Üniversitesi İletişim Fakültesi Elektronik Dergisi (e-gifder), 10 (1), 32-58.

As it can be seen in Figure 4, the attention and meditation values of the first participant who read through the e-book were observed to be neutral. In the course of the research, an increase was observed in the values of the participant. In the middle of the research, the attention value is measured 40 according to data number three, and the meditation value -test, he/she paid more attention to the e-book in the measurement. As a result of the e-book research, the attention and meditation values of the participants are given in the figures below.

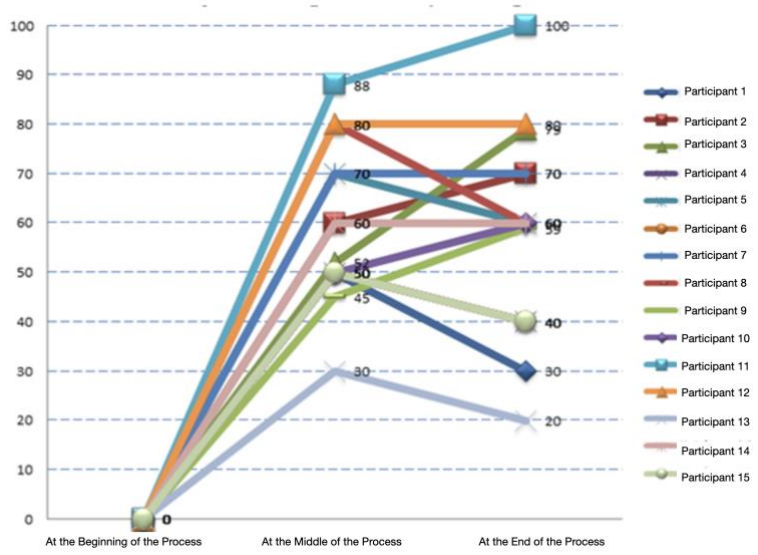
Graphic 3. E-Book Attention Values



The data provided by the individuals participating in the reading study on the e-book in the measurement of the brain signal showed differences as it did with the printed book (Figure 5). In this context, while the attention value of only three participants decreased during the process, the attention value of ten participants increased. The attention value of the remaining two participants remained stable. Among the participants, only four participants reached the attention value of 90 to 100. In the study, the seventh participant has the lowest attention value with a value of 21. The average attention span of the individuals participating in the research is 67.4. It is seen that the brain frequencies beta and delta play an active role in increasing and decreasing the attention value. The attention values of the participants were quite high although most of them stated that they did not have the habit of reading from e-books in the pre-test.

BAYRAK, Taner; YENGİN, Deniz ve HARRANOĞLU, Sefa (2022). Analysıs Of Braın Waves In The Process Of Readıng The Book Wıthın The Context Of Dıgıtalızatıon Of The Prınted Book. Gümüşhane Üniversitesi İletişim Fakültesi Elektronik Dergisi (e-gifder), 10 (1), 32-58.

Graphic 4. E-Book Meditation Values



Differences were observed in the brain signal measurement values of individuals participating in the e-book reading. In this context, while the meditation value of five participants increased in the process of reading, the meditation value of seven participants decreased. The meditation value of the remaining two participants remained stable. Among the participants, only the eleventh participant had a relaxation value between 90 and 100. In the study, the thirteenth participant was determined to have the lowest meditation value with 20. The meditation average of individuals participating in the research was 57.8. It is seen that alpha and theta frequencies play an active role in changing the meditation value.

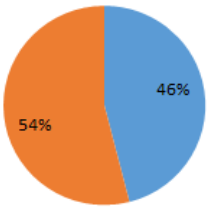
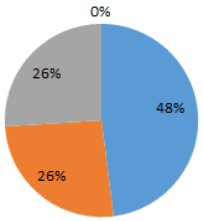
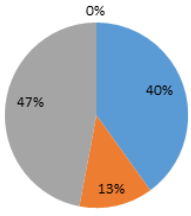
When the results of the brain signal measurements made in the two parts of the research are examined, it is seen that there are similarities between the reading processes of printed books and e-books. For instance, the measurements are taken from the participants in the printed book reading process, the average of the general attention value is 70.6. The average e-book attention value parallels it with 67.4. These rates are close to each other. Based on this, no significant difference was found between the printed and e-books in terms of attention, and it was noticed that the participants did not experience a serious loss of attention in terms of reading the e-book. When it comes to the meditation values, which

BAYRAK, Taner; YENGİN, Deniz ve HARRANOĞLU, Sefa (2022). Analysıs Of Braın Waves In The Process Of Readıng The Book Wıthın The Context Of Dıgıtalızatıon Of The Prınted Book. Gümüşhane Üniversitesi İletişim Fakültesi Elektronik Dergisi (e-gifder), 10 (1), 32-58.

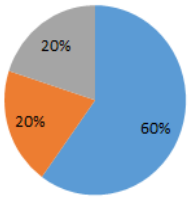
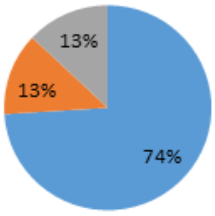
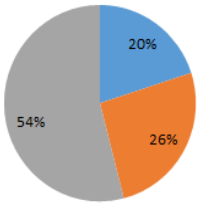
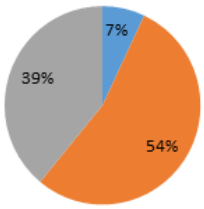
means relaxation, the overall meditation average of the participants in the printed book is 50.6. In parallel, the e-book general meditation average is 57.8. Again, when these ratios are considered, there is no significant difference between the ratios. Based on meditation, it was observed that the participants both read the e-book and the printed book with the same comfort levels.

5. Questions Asked to Participants within the Scope of the Post-Test

Table 4. Post-Test Questions, Charts and Answers

Did you feel any difference in the way you read with the brain-monitoring device attached? A) Yes B) No		The answers given by the participants to this question are almost divided into two. According to the graphic, 54% said that they did not feel any difference, and 46% said that they did.
How did you feel while reading the printed book? A) Fully focused B) Distracted C) Comfortable D) Stressed		Almost half of the participants stated that they were completely focused while reading the printed book. The remaining participants are divided into two. While 26% of the participants stated that they were comfortable, the other 26% said they were distracted.
How did you feel while reading the e-book? A) Fully focused B) Distracted C) Comfortable D) Stressed		It was determined by the brain signal measuring device that the majority of the participants felt comfortable and focused while they were reading the e-book. 47% of the participants stated that they felt comfortable and 40% stated that they were completely focused.

BAYRAK, Taner; YENGİN, Deniz ve HARRANOĞLU, Sefa (2022). Analysıs Of Bram Waves In The Process Of Readıng The Book Wıthın The Context Of Dıgıtalızatıon Of The Prınted Book. Gümüşhane Üniversitesi İletişim Fakültesi Elektronik Dergisi (e-gifder), 10 (1), 32-58.

While reading, did you enjoy the printed book or the e-book more? A) Printed book B) Electronic Book C) Both		According to the answers given in the question of preferred media tool, majority of the participants enjoyed the printed book more. When asked verbally about the reason, the participants stated that it was important for them to touch the pages and the book.
Do you think that reading a printed book or reading an e-book is beneficial in terms of keeping the information in mind? A) Printed book B) Electronic Book C) Both		The participants were asked which media tool was more beneficial in terms of keeping the information in mind, and 74% of the participants' answer was printed book.
In which platform did you feel free? A) Printed book B) Electronic book C) Both		54% of the participants felt free in both the printed book and e-book platform. This situation indicates that the two platforms show parallelism in terms of meditation.
Which platform do you think is more comfortable during the reading process? A) Printed book B) Electronic Book C) Both		When the participants read from the e-book, they stated that the e-book is more comfortable because of the possibilities such as enlarging the texts as they wish, adjusting the screen brightness as they wish, and quickly moving to the next page by swiping the screen.

Within the scope of the post-test, the thoughts of the participants after the study were tried to learn. The readers were first asked whether they could read

comfortably with the device attached to their heads. The participants orally expressed that they could read comfortably overall despite feeling a difference. In the light of these, the measurement was not exposed to any form of significant external effect. Judging by the answers given by the participants in the post-test, the participants not only feel like adopting the printed book more but also found it better in terms of attention. This showed that the participants were primarily skeptical of new media technologies. Participants who think that the printed book is more useful in terms of keeping the information in mind, evaluate the e-book tool as the same electronic tool as smart phones that offer fast consumption. In line with the post-test, the biggest advantage of the e-book is the comfort it provides. On top of that, e-books are portable tools where tombs can fit into an electronic tablet that's only three cm in width and seventeen cm in length. Technical features such as adjusting the brightness of the screen according to the intensity of the ambient light, enlarging and reducing the texts, and the option to read aloud are among the important advantages of the e-book as well. However, the most important advantage is that thousands of books can be available in electronic format merely with the help of internet technology. E-books, which have access to a huge digital library archive, promise easy use through a single tablet.

CONCLUSION

Communication constitutes a vast part of our lives, and it has always been a fundamental need since the beginning of humanity. Communication is a phenomenon with a pretty old history; thus, it is too diverse to be expressed with a single definition. The invention of new communication tools depending on the development of technology in this diversity has led to the emergence of new channels in communication. New media is a concept that has gained a place in social life with the development of internet technology. As a result of this concept, there have been changes both in communication and in many areas. These changes have increased the quality of life of the individual and have had positive effects on the welfare of society. However, these facts don't prove that the new media is completely harmless, and in some cases, the negative features are strikingly more dominant. There are many rehabilitation and health programs for the new media, which is the cause of

various physical and mental disorders. New media problems grow day by day. Therefore, multidisciplinary research on this issue is a necessity for the well-being of future generations.

The diversity of new media technologies is increasing gradually. The new media, which aims to transform, digitize and make practical all the habits that people have acquired for centuries, transform communication with these tools. And the e-book is the result of this transformation. The E-book is a technology that is released in tablet format, has functions like a smartphone, and is developed only for reading, and it targets people's reading habits, Thanks to internet technology, e-books have easy access to archives containing tens of thousands of books in digital format. The types of this technology have a wide range of different types as well as a big consumption market. Since e-book, which is actually a tool on its own, is integrated into frequently consumed tools such as smartphones, the spread of tools that are solely in e-book format has been limited. Today, a standard-featured smartphone can also be transformed into reading tools in e-book format. As its name suggests, the e-book has an electronic structure, effects of which are unclear, unlike the printed book. The main purpose of the research was to understand the effects of this technology. As opposed to the other disciplines, communication studies contain data that needs interpretation. Therefore, communication studies have long periods of finding, classification and analysis. Still, the obtained data should be supported by articulated studies, the data should be tested and applied repeatedly. It is crucial to test the results obtained as a after this research with other studies and to share them with other researchers. In this context, conducting research with as many tools and methods as possible with the support of new media technologies will provide meaningful data for the solution of problems.

Brain signal measurements, which are a new and effective method in communication research, are used for various researches in many fields from health to engineering. These studies provide information about individuals' mood, psychological and physical states. Thus, EEG-based brain measurements have become available in all areas with the advancement of technology. As a consequence of these developments, this measuring method has also been used in communication studies, and it has

become productive research support for many problems that have emerged with the media's taking the title of new media.

In this study, printed books and e-books were compared to new communication technologies. A brain signal measuring device was placed on the heads of the participants and the data obtained while they were reading was stored. In this direction, the effects of the printed book and e-book use of individuals between the ages of 18-40 were investigated. Individuals participating in the research were given a 2-page book chapter of George Orwell's "Animal Farm". The participants read the first part of the book in printed form, and the second part of the book was read in the e-book form. Participants read in a quiet environment and at a white table. A pre-test just before the measurement and a post-test just after the measurement were made, making it possible to support the stored data and make inferences about the reasons for the selected options.

The reason for choosing this book in the research is that its explanation is simple and understandable. Pre-test, brain signal measurement, and post-test were performed on fifteen participants, respectively, and answers were received to the questions addressed. While the attention values of the participants increased in the continuation of the reading, the meditation values were generally high at the beginning of the reading and decreased from the last part of the reading. According to these data, it was concluded that attention values were inversely proportional to meditation values, and although attention increased, meditation decreased over time. The alpha, beta, delta, gamma, and theta fluctuations of the participants showed that they became increasingly concentrated while reading the text, but they had problems in feeling comfortable. Within the scope of the pre-test, it was evaluated that the participants who read books frequently, in other words, whose inclination to read books was higher, performed better with higher levels of attention.

Participants were asked to read the second part of the book in e-book format. The E-book section consists of 2 pages, the same as the printed book. The reading duration was recorded both in print and digital format as well. The tablet is set to airplane mode to prevent any notifications or calls while reading on the e-Book. When the data of the same participants who read from the e-book were examined in the brain signal measuring device, results were generally close to the results of

reading a printed book in terms of both attention and meditation values. What needs to be focused on here is that the level of attention and the level of meditation are inversely correlated. While the level of attention generally increased, the level of meditation decreased over time.

Although the frequency of reading from the printed book expressed by the participants in the pre-test was higher than the frequency of reading from the e-book, it was observed that the values in print and digital reading in the brain signal measurement data were close to each other. As a result, it is understood that though few books are read in the digital environment, individuals can easily adapt to new media tools. In this case, according to the answers from the pre-test and post-test, it has been evaluated that the importance of new media tools such as smartphones already taking place in daily life is great. Although the individuals participating in the research stated that they prefer to read through printed books, they stated that they realized the advantages of reading over e-books. It is thought that this is due to the fact that the participants have the opportunity to practice reading practices they are familiar with on smartphones on e-books. Adjusting the brightness according to the ambient light and having options such as enlarging or reducing the text has been one of the most attractive elements of the e-book.

According to the uses and gratifications approach developed on the basis of the active audience thesis, the individual is consciously equipped with technique and technology, but the communication tool is objectified. Artificial needs related to human's daily life are produced and the individual is directed as if he/she needs these technologies. The e-book is the tool that was developed as a product of this approach and emerged as a result of aggressive technique. The development of these products is no longer surprising in capitalism, which compels people to standardize and become copies of each other. It is also vital to investigate the effects of these products on users. Because especially young individuals, who use these technologies unaware of their effects, start to drown in the technology ocean, where the economy is constantly developing, transforming, becoming more brutal and aggressive in today's world. In connection with the effects of this technology, research made on the new individuals of the new generation, who will transform the social life structure in the future, will make it easier for us to understand the destruction of the technique.

Being in the center of our research, the e-book has shown that all the habits that people have acquired are the target of new media developers. The individual, who has moved from a passive viewer to an active viewer, increases his demands for new media technologies. On the other hand, the producer always aims to have new consumption markets with or without demand. Some inventions that are not seriously necessary are offered for use in order to expand the volume of use and satisfaction. It is a fact that this situation encourages societies that are constantly encouraged to consume, can never reach satisfaction and ignore global world health for production. The fact that this has evolved into a serious problematic is a subject that is frequently handled in today's academic studies. In this context, the digital and touch plane continues to be the transformative factor of the traditional structure.

REFERENCES

BALLE, Francis. ve EYMERY, Gerard. (1991). Yeni Medyalar, (Transl. Mehmet Selami Şakiroğlu), İstanbul: İletişim Yayınları.

BAUMAN, Zygmunt. (2018). Küreselleşme, (Transl. Abdullah Yılmaz), İstanbul: Ayrıntı Yayınları.

BOSTANCİ, Mustafa. (2019). Sosyal Medya Dün Bugün ve Yarın. Konya: Palet Yayınları.

CHAYKO, Mary (2018). Süper Bağlantılı, (Transl. Deniz Yengin, Berkan Bayındır, Tamer Bayrak), İstanbul: Derin Yayınları.

FARROKHI, Neshat. (2015). Eğitim Amaçlı E-Kitaplarda Tasarım Sorunları: Türkçe Öğrenimi İçin Bir E-Kitap Uygulaması, Hacettepe Üniversitesi Güzel Sanatlar Enstitüsü, Yayınlanmış Yüksek Lisans Tezi.

GÜNGÖR, Nazife. (2016). İletişim Kuramlar Yaklaşımlar. İstanbul: Siyasal Kitabevi.

IŞIKLAR, Gülnur. (2017). Yeni Medya Analizleri, (Editörler), Suat Gezgin ve Ali Efe İralı, Konya: Eğitim Yayınevi.

JENKİNS, Henry. (2019). Cesur Yeni Medya Teknolojiler ve Hayran Kültürü, (Transl. Nihan Yeğengil), İstanbul: İletişim Yayınları.

KARA, Tolga. (2013). Sosyal Medya Endüstrisi, İstanbul: Beta Yayınları.

KELLEY, Adam. C. (2011). Designing An E-Book For A Fifth Grade Classroom, USA: California State University.

KOZAN, Büşra. (2019). Küreselleşme Bağlamında Türkiye' deki Yeni Medya Uygulamaları, İstanbul Üniversitesi Sosyal Bilimler Enstitüsü, Yayınlanmış Yüksek Lisans Tezi.

LEONHARD, Gerd. (2020). Teknolojiye Karşı İnsanlık, (Transl. Cihan Akkartal), İstanbul: Siyah Kitap.

MALMİVUO, Plonsey., MALMİVUO, Jaakko. and PLONSEY, Robert. (1995). Bioelectromagnetism: Principles and Applications of Bioelectric and Biomagnetic Fields, USA: Oxford University Press.

MCLUHAN, Marshall. ve POVERS, Bruce. (2001). Gobal Köy, (Transl. B. Özcal Düzgören), İstanbul: Scala Yayıncılık.

MCQUAIL, D. ve WINDAHL, S. (1993). İletişim Modelleri, (Transl. Mehmet Kücükkurt, M.), Ankara: İmaj Yayınları.

NEUMAN, W. Russell. (2018). Dijital Fark Gündelik Hayatta Dijitalleşme ve Medya Etkileri Kuramı, (Editörler), Gökçe Metin, İstanbul: The Kitap Yayınları.

NEWPART, Cal. (2019). Dijital Minimalizm, (Transl. Cansen Mavituna), İstanbul: Metropolis Yayıncılık.

SCHOMER, Donald. and LOPES DA SİLVA, Fernando. H. (2004). Niedermeyer's Electroencephalography: Basic Principles, Clinical Applications and Related Fields, USA: Lippincott Williams and Wilkins.

TABAKCIOĞLU, M. ve ÜLKER, B. (2018). "Neurosky Biyosensör Kullanarak Beyin Dalgaları, Dikkat ve Meditasyon Değerlerinin Ölçülmesi ve Değerlendirilmesi", Gaziosmanpaşa Bilimsel Araştırma Dergisi, 7 (1), 25-33.

YARIMOĞLU, Şükrü. I. (2020). Stroop Etkisinde Seçici Dikkat ve Dikkat Eksikliği-Eeg Frekans Bantları, Üsküdar Üniversitesi Sağlık Bilimler Enstitüsü Yayınlanmış Yüksek Lisans Tezi.

YAYLAGÜL, L. (2017). Kitle İletişim Kuramları: Egemen ve Eleştirel Yaklaşımlar, Ankara: Dipnot Yayınları.

YENGİN, Deniz. (2014). Yeni Medya ve Dokunmatik Toplum, İstanbul: Derin Yayınları.

Yazarların çalışmaya katkı oranları eşittir.

Çalışma kapsamında herhangi bir kurum veya kişi ile çıkar çatışması bulunmamaktadır.