THE IMPACT OF THE BACKGROUND COLOURS OF ONLINE TEXTS ON STUDENTS' LEARNING PERFORMANCES

Hajnalka Kánya, PhD Student, Assist. Prof., PhD, Partium Christian University

Abstract: The main objective of the research project is to analyse the impact of colours on learning performances. Among many factors that influence learning performances of individuals, colours play an important role, especially by attracting attention and creating a favourable emotional arousal which can facilitate the learning process. In the digital era students use the computer and internet for learning purposes, and they use both printed texts and online texts for learning. In order to analyse the impact of background colours of online texts on students' learning performances I developed an experimental design, using a sample of students, who were presented on the monitor of a computer several words on different background colours, in order to be memorized. I chose the colours of the rainbow as background colours, as they appear in nature, and white background as a neutral colour, generally used as background for online texts. During the experiment the students received several words on each background colour, and after a limited time of memorising, they had to recall and write on a white paper as many words as they could. The results of the research can contribute to the improvement of the learning process and learning performances of students.

Keywords: perception, short term memory, long term memory, learning process, learning performances

1. THEORETICAL BACKGROUND

This paper presents the results of a primary research regarding the influence of the background colour on the learning performances, especially regarding the memory performances of individuals. From this point of view it refers to the impact on short term memory, through analysing the influence of the background colour of online texts on the short term memory. The purpose of my research was established based on my interest in improving the memory and learning performances of the individuals in general, and of the students especially.

Learning performances are influenced by a lot of different factors. Among these factors memorising capabilities play an important role. Relating to the purpose of the present research it can be formulated the following question: can be colours considered influencing factors of memory, memory performances and learning performances? If colours can be considered influencing factors, how they influence memory in general and short term memory in special?

Memory can be analysed at different levels: at social level (we can refer to collective memory, knowledge transmitted through generations), at psychological level (as a component of human psyche, or a psychic process), at neurological level (analysing different parts of the brain implied in the process of memorising), at cellular level (making studies at the level of neurons and synapsis), at molecular level (analysing molecular changes which form the basis for memorising). (Bonchiṣ , 2006, p. 279)

Through the history of psychology various theories were developed regarding the memory of individuals. In antiquity Platon and Aristotel were the pioneers who formulated theories related to memory. Platon considered human memory as a soft wax (like beeswax), and he thought that experiences of individuals have the role of imprinting different signs in it. In the conception of Aristotel associations represented the base of memory, as two different ideas being associated, remembering or reminding one of them can reveal its associated idea. (Bonchiş , 2006, p. 280)

There exist different definitions of memory. Memory can be considered a fundamental function of the human psychic, being involved in all psychological processes (Cosmovici, 1996, p. 134). Memory represents a process of the human psychic, which has the role of engraming, storing and updating in the form of recognising or reproducing the cognitive, affective and volitive experience, and which is a complex process of active, selective and intelligible reflection of human experience (Radu, 1991, p. 111). Memory can be considered o function of the brain, an ability to remember information (Bonchiş , 2006, p. 281).

Many times the process of memorising and learning are considered synonyms, but we must underline that learning assumes the capacity of the organism to change its behaviour in relation to the gained experience, being an activity of the individuals, while memory is a psychic process of cognition, being involved in the learning process, and learning has the role of moderator of the memory (Bonchiş , 2006, p. 282).

Professionals make distinction between the different types of memory: imaginative memory (has the role of conserving and reproducing representations), verbal-logical memory (has the role of conserving and reproducing different sentences, ideas), affective memory (has the role of evocating emotions related to different situations and moments), and motoric memory (has the role of developing abilities and skills) (Cosmovici, 1996, p. 134).

Depending on the forms of the memory we can make distinction between: sensorial memory, short term memory or working memory (some specialists make distinction between these two types of memory, others consider them the same), and long term memory (Bonchiş, 2006, p. 306).

Sensorial memory storages information for several hundredths of a second received by the receptor cells, in order to process this information, and is specific for different sensorial modalities (Bonchiş, 2006, p. 306). It is a volatile memory, overlapping the concept of post effect, as sensorial remanence (Aniţei, 2007, p. 314).

Traditional psychology considers that there exist differences between short term and long term memory regarding: duration, capacity, content, codification, storing, recalling and forgetting mechanisms (Bonchiş, 2006, p. 307). Cognitive psychology considers that short term and long term memory are two distinct states of the same system: long term memory is represented by all knowledge of the cognitive system to which access is selective, and short term memory is represented by activated knowledge from the long term memory (Bonchiş, 2006, p. 308). Short term memory can be considered a buffer system between sensorial memory and long term memory can be considered a working memory (Aniţei, 2007, p. 314). Long term memory can be of two types: episodic memory (remembering some events), and semantic memory (knowledge about the world) (Aniţei, 2007, p. 315).

The model of memory based on combination of operations (processes) with the structures of the memory suggests that stimuli from the environment acts upon one or more analysers and gets to the sensorial memory, being filtered in the short term memory, and from there information can be used in fulfilling some current tasks or through processing, transforming this information they can be sent to the long term memory (Radu, 1991, p. 114).

The optimal conditions of memory refers to the motivation of the subject (from the perspective of the objective of the memory, of learning), the necessity of knowing the effects (the results of learning), understanding the content of the lesson which should be learned (logical processing), volition (intention to remember), repetition (of knowledge, but at different intervals of time, combined with reproduction trials), interactions between knowledge and skills (Cosmovici, 1996, pp. 146-151).

Pleasant events and stimuli are memorised involuntarily more easily, than unpleasant or neutral ones (Radu, 1991, p. 122). Information is voluntarily memorised more easily if the goals of the individual are more differentiated (in the form of special tasks), depending on the distance in time of the purpose (a longer period of time), if it is known the precision and succession of how information should be assimilated, if the individual makes effort in order to fulfil the proposed task, if efficient and proper processes are used for the tasks (Radu, 1991, pp. 122-123).

Many specialists analysed the memory in general, and short term memory in particular, from experimental approach.

In 1887 Jacobs conducted the first experimental research regarding short term memory (Aniţei, 2007, p. 314), using the method of limit-series, through which he tested the memorising limit of the individuals regarding a series of digits.

Colours are used in various fields for many purposes: for decorating, for highlighting, for attracting attention, for emphasizing the message etc. (Mustafar, Dzulkifli, 2012).

There were conducted different researches regarding the effect of colours on memory. Several researches studied the effect of colours of the main forms on memorising performances of individuals, for example those conducted by Pan, Kaya and Epps, Myers (Mustafar, Dzulkifli, 2012).

Other researchers analysed the effects of the background colours on memorising performances, for examples those conducted by Anella Kay Thompson (Thompson, 2011).

Jennifer V. Martinez, Crystal D. Oberle and Jon G. Thompson Jr. conducted a research on the effects of colours on the codification processes during the time of memorising and recalling the memorised content. They wanted to know if performances are influenced by using the same or different colour of paper for giving tests regarding contents learned on different colours of paper (Martinez et al, 2010).

Based on literature for developing the theoretical frame of the paper I concluded that it would be important to analyse the effects on short term memory of the colours of forms, diagrams, letters, words, sentences, paragraphs, background of the texts in general, and of online texts in particular. For the beginning, as a first step of the research I have focused on the influence of colours on short term memory for online texts.

For this purpose I used as background colours the colours of the rainbow, as they appear in nature (red, orange, yellow, green, blue, indigo and violet), and white background, as it is a standard background colour used for online texts. For each colour background I used

a list of 15 words printed on the background with black colour, in order to be memorised. This can be considered an original approach for the purpose of the present research.

The subjects, who participated in the research, were students at economy, in their first grade, from a university in Oradea. They had to memorise during 2 minutes the list of words printed online on a specific background colour, and after that during 1 minute they had to recall and write on a white paper as many words as they could. Recall of the memorised words was made through free reproducing, so the subjects couldn't see the listed words. Subjects had not to respect the order of the words as they were listed on the monitor.

Regarding the utility of the present research, as practical applications we could think of the following directions: improvement of the memory and learning performances of pupils, students, adults through changing the background colours of the text which should be memorised. The results of the research could be used for different ages of pupils, students, adults, in primary and secondary schools, in high-schools and universities. An important field of applications could be the case of pupils having learning disabilities.

2. METHODOLOGY AND RESULTS OF THE RESEARCH

The main objective of the research is to analyse the influence of the background colour of online text on the learning performances, by analysing the impact on memory performances.

I developed an experimental design (one factorial, intragroup design) to test the hypothesis: The background colour of online texts has influence on the memory performances of individuals.

The independent variable is measured on a nominal scale: colour, which is operationalised through the background colour of online texts. The independent variable has 8 different variants: white, red, orange, yellow, green, blue, indigo, violet.

The dependent variable is measured on an intervallic scale: short term memory, which is operationalised through the number of recalled words, using the technic of free reproduction, in 1 minute after a 2 minutes memorising process of the online words, presented on the monitor of a computer, on different background colours. The subjects could write down on a white paper all the remembered words, in what order they wanted. After that the subjects had 1 minute pause, after each used background colour.

The subjects of the experiment are first grade students at economics, from Oradea, between 19-21 ages, both male and female, having different levels of learning performances. 32 subjects participated to the experiment.

As experimental tools I used desktop computers with monitors, on which the subjects could see the black coloured words on different background colours (15 words for each colour). The used words were selected after studying different intelligence tests (CEDC, 1991 and Mitrofan, 2009), and I used different categories of words, both simple and complex ones, and common and scientific ones, in order to avoid distortion of the results. I used both concrete and abstract concept, taking in view the differences in encoding them. Each list of words was randomly selected for each background colour. The order of presenting the background colours was randomly selected, in order to avoid the distortion due to the order of presenting the colours.

Checking the normality of data distribution with the Kolmogorov-Smirnov Test, I concluded that in the case of each 8 background colours the data have normal distribution at the level of population, as statistical significance in each case is $p>0.05$ (white – 0.745, red – 0.396, orange – 0.205, yellow – 0.627, green – 0.394, blue – 0.200, indigo – 0.984, violet – 0.788).

Data were processed in SPSS program, and I obtained the following means and standard deviations:

White – 10.9688 words / 2.0396
Red – 11.6563 words / 2.1039
Orange – 11.8125 words / 2.4552
Yellow – 11.8125 words / 2.3886
Green – 11.2188 words / 2.2680
Blue – 10.8438 words / 2.1418
Indigo – 10.9063 words / 2.4803
Violet – 11.1250 words / 2.3105

The results show, that orange and yellow background have the most positive impact on memory performances of the subjects, and blue and indigo has the least positive effect on memory performances.

The results of the research indicate that short term memory, memorising performance, and learning performances of the subjects included in the experiment are influenced by the background colour of the online text which should be memorised. We can conclude that using appropriate colours for background of online texts we can improve the learning performances of individuals.

3. PSICHOLOGICAL INTERPRETATIONS

Memory in general, and short term memory in particular is influenced by diverse factors: motivation of the individual, understanding of the content which should be memorized, volition of the individual, repetition, interactions between knowledge and skills, environmental factors etc. (Cosmovici, 1996, pp. 146-151). From these factors I chose to analyse the background colours of the online texts. The influence of colours on memory was studied from different points of view by many specialists and researchers.

Smilek, D., Dixon, M.J., Cudahy, C. and Merikle, P.M. studied the impact of colour synesthetic experiences on memory. They found that some persons have colour synaesthesia for numbers, which mean that they associate numbers with different colours, and they use these colours to encode and remember different numbers (when they hear the number, they see the appropriate colour associated with each number in their mind). (Smilek et al., 2002)

Anella Kay Thompson studied the impact of the colours used for online texts on memory. She used three colours: white (considered a standard colour for texts), yellow (considered as a primary colour) and purple (considered a hybrid colour). The results of the research showed that the memory performances were higher in the case of yellow background in comparison with the purple background, but there were no significant differences in performances when yellow and white colours were used for background. (Thompson, 2011)

Jennifer V. Martinez, Crystal D. Oberle and Jon G. Thompson Jr. studied the impact of colours on encoding and recalling during the memorising process. They wanted to know if the performances of pupils are influenced by the colour of the paper used for encoding and the colour of the paper used for recalling the memorised texts during a test. For this purpose in case of some pupils they used the same colour of paper for learning and testing of the pupils, and for others they used different colours of paper. In one case they used red and green paper for learning, and the same coloured paper for testing. In another case they used white coloured paper for learning, and white, blue, green, yellow and pink coloured paper for testing. The results showed that the colours of the papers used for testing do not influence the performances of the pupils, but the colours of the papers used for learning has an impact on their performances. The performances of the pupils were significantly higher when they used green coloured paper for learning, in comparison when they used red coloured papers. (Martinez et al, 2010)

Mohamed Faiz M. Mustafar and Mariam Adawiah Dzulkifli designed a research in order to analyse the impact of the background colour on the memory performances of the students, based on the recall rate of some geometrical forms printed on coloured background (Mustafar, Dzulkifli, 2012).

Lynnay Huchendorf conducted a research in which were compared the impacts of background colours on memory, using warm colours (red, yellow), cold colours (green, blue) and white colour (considered a neutral colour). In the hypothesis it was considered that memory is facilitated by warm colours, but the results didn't show significant differences in performances in the case of use of different categories of colours (Huchendorf, 2007).

Atkinson and Shiffrin proposed a model of memory formed by 3 components: sensorial encoding component, short term memory and long term memory. They considered that information passes the sensorial memory into short term memory, and from short term memory arrives in long term memory, and the environment must contain stimuli which facilitate attention (Mustafar, Dzulkifli, 2012). From this point of view the results of my research can be explained by the fact that some colours can facilitate attention, while others can inhibit attention, and thus have impact on short term memory.

Farley and Grant considered that taking in view the psychological significance of the colours, we can consider colours as stimuli which can generate different types of emotional arousal in individuals, as a result attention and emotional arousal can influence the individuals' memorising processes, and learning processes (Mustafar, Dzulkifli, 2012). From this point of view we can explain the results of my research by considering some colours as stimuli which create a favourable emotional arousal having a positive impact on learning performances, while other colours create an unfavourable emotional arousal.

4. CONCLUSION

The present paper has the main objective to present the results of a primary experimental research regarding the influence of colours on learning performances of individuals.

The main contribution of the paper is the use of a variety of colours in order to analyse how colours influence learning performances. In the experiment were used 8 colours: white as

the standard colour used in general for online texts, and the 7 colours of the rainbow, which are reflected in nature.

Colours have different psychological effects on individuals, especially by attracting attention and creating a specific arousal, and as a result performances of the individuals will vary depending on what colours are they exposed to.

I used ANOVA method for repeated measurements in order to compare the results on memory performances in the case of the 8 different background colours used for online texts.

The results of the research show that short term memory is influenced by the background colours of the online text which should be memorised.

As directions for future researches we can mention the followings: analysing the impact of the colours of texts printed on standard coloured background on learning performances, and the combination of different background and text colours on learning performances in order to determine the optimal combination for the highest learning performances for different groups of individuals with specific characteristics (for example students at different specialisations, in different and differentiated contexts).

Based on researches made on representative samples for different categories of individuals (for example children with special learning needs, children with learning disabilities, etc.) we could develop optimal combinations of background colours and texts colours in order to increase the performances of these categories of individuals.

REFERENCES

Aniţei, M. (2007). *Psihologie experimentală.* Editura Polirom, Iaşi.

Bonchiş, E. (coord.) (2006). *Psihologie generală*. Editura Universităţii din Oradea, Oradea.

CEDC (Centrul pentru Educaţie şi Dezvoltarea Personalităţii) (1991): *Teste pentru Abilităţi Intelectuale Generale.* CEDC, Bucureşti.

Cosmovici, A. (1996). *Psihologie generală.* Editura Polirom, Iaşi.

Huchendorf, L. (2007). The Effects of Color on Memory. *UW-L Journal of Undergraduate Research X.* downloaded from http://www.uwlax.edu/urc/jur-online/PDF/2007/huchendorf.pdf la data de 08.01.2013. accessed at 12.11.2013.

Mitrofan, N. (2009). *Testarea psihologică. Aspecte teoretice şi practice.* Editura Polirom, Bucureşti.

Mustafar, M. F. M., Dzulkifli, M. A. (2012). The Effect of Ground Colour on Memory Performance. *8th International Postgraduate Research Colloquium: Interdisciplinary Approach for Enhancing Quality of Life IPRC Proceedings.* pp. 102-114, downloaded from http://bsris.swu.ac.th/iprc/8th_index.html accessed at 12.11.2013.

Martinez, J. V., Oberle, C. D., Thompson, J. G. (2010). Effects of Color on Memory Encoding and Retrieval in the Classroom. *American Journal of Psy chological Research.*Vol. 6, Nr. 1, pp. 24-31, downloaded from http://www2.mcneese.edu/ajpr/vol6/AJPR%2009-16%20Martinez%2012-21%20rev.pdf accessed at 12.11.2013.

Radu, I. (coord.) (1991). *Introducere în psihologia contemporană.* Editura Sincron, Cluj-Napoca.

Smilek, D., Dixon, M.J., Cudahy, C., Merikle, P.M. (2002): Synesthetic Color Experiences Influence Memory. *Psychological Science* Vol. 13, Nr. 6, pp. 548-552

downloaded from http://web.missouri.edu/~rouderj/3010/readings/smilek.pdf accessed at 12.11.2013.

Thompson, A. K. (2011): *Memory Retention and the Effects of Background Color in Non-Traditional Students in Online Education Settings (Thesis – Master of Science in Psichology, Kaplan University).* Downloaded from http://gradworks.umi.com/1511569.pdf accessed at 12.11.2013.