Original Research article

Medical students' perception of Colors Influence on the Learning Process

ABSTRACT

Background: Human being are affected by the surrounding environment. One of the component of the environment is presence of various colors. Different colors exert different impact on human psychology and the state of human psychology affects the learning process.
Aims: We aimed to evaluate the perception of medical students about the different colors employed for the text and background that ease the process of readability and learning.
Study design: Cross-sectional study.
Place and Duration of Study: Faculty of Medicine at Northern Border University (NBU) between 1/1/2023 and 1/2/2023
Methodology: After the ethical approval, the questionnaire was circulated among the willing participants from the students of the Faculty of Medicine – NBU. There are two components of the questionnaire. The 1st part comprised a color chart in which there were one hundred different combinations of text and background colors. The 2nd part contains basic information such as the study year of MBBS and gender along with the questions regarding the color text that is easier to read & understand and the background color thatthey like most.
Results: One hundred and seventeen (117) medical students participated in this study (72 females and 45 males).The majority of students liked the black text with a white background while a small number liked the other text and background colors such as black and cyan, yellow and black, white and green, and black and yellow, respectively.
Conclusion: The perception of the majority of medical students is that the most easily read text is the text written with black color on a white background.

Keywords: Color Influence, Learning Process, Memory, Perception

1. INTRODUCTION

Readability and comprehension of the text are important components of the teaching and learning process. Ease in readability facilitates the understanding of the content of text regarding the knowledge. The state of mind is another factor that contributes significantly to the process of learning. The human brain is affected by the surrounding environment, andof which is color. The colors affect the learner's motivation towards the learning process[1].

The light is an energy which travels in the form of waves of varying wavelengths. The largest wavelength that a human eye recognizes is red color and the smallest wavelength thata human sees is violet color. The human eye cannot perceive the infrared and ultraviolet wavelengths of light. The different colors have different impacts on the functions of the brain such as memory and retention[2] and also affect the hypothalamus and pituitary gland secretions that influence the entire body functions. The color-based methods such as color coding have revealed better learning among the students as the color coding is effective for the memory retention[3]. These observations suggest that the different colors are associated with different effects on human psychology. The study of electroencephalogram (EEG) responses revealed that the beta wave intensity in the occipital region was reduced after the subject was exposed to the blue or green color as compared to the white and red color which suggested that the blue color produced a more relaxing effect on the human brain[4]. Similarly, when the person saw a blue color, beta two waves were observed in the parietal region and alpha one waves were observed in the occipital region as well as in the parietal regions. Beta two waves were noticed in the frontal region when the person was shown red color which revealed that different colors exert different impacts on the human brain. It has also been observed that color also exerts an influence on blood pressure, pulse rate, and skin temperature[5].
The appropriate selection of colors for the text and background can facilitate readability, reduce the unnecessary cognitive load, and enhance the retention of learning[6]. Since human psychology is influenced by genetic and cultural factors, it would be appropriate to evaluate the perception of the impact of different colors among the various cultures. The present study aimed to assess the perception of medical students about the color of text with a background color which influences easy readability.

2. MATERIAL AND METHODS

After getting approval from the Local Committee of Bioethics at Northern Border University, the questionnaire was circulated among the students of the Faculty of Medicine who consented to participate in the study. This questionnaire comprised two parts. The 1st part comprised a color chart in which there were one hundred different combinations of text and background colors. The 2nd part contained basic information such as the study year of MBBS and gender along with the questions regarding the color text that is easier to read and understand with the background color thatthey like. The questionnaire did not contain any questions regarding the personal identification of the participant such as name, age, address, email address, phone number, or ID number. For a better understanding of the purpose, the Arabic translation of the questionnaire was also made available to the participants. The sample size was calculated with a confidence level of 95% , margin of error 5% and a total number of students enrolled in the 4th & 5th year MBBS classes. The equation for the sample size calculation was applied which revealed the sample size of 115. A total of one hundred and fifty designed questionnaires were distributed among the students of 4th year and 5th year MBBS classes. After collecting the responses of medical students, the data was analyzed by the computer software.

3. RESULTS AND DISCUSSION

After the distribution of 150 proformas among the students, a total of 117 medical students completed the questionnaire which included 72 females and 45 males. The response rate is 78%.According to the majority of students' perception, the best text color that is easily readable is black text with a white background. A minority liked the other text and background colors such as black and cyan, yellow and black, white and green, and black and yellow, respectively. The results are shown in table 1.

Table 1. The perception of medical students regarding the easy readability of text color with the background color

Text colors	Female		Male		Total	
	N	%	N	%	n	%
Black text &white background	35	48.6	23	51.1	58	49.6
White text & blue background	7	9.7	4	8.9	11	9.4
White text & black background	4	5.6	4	8.9	8	6.8
Black text & cyan background	6	8.3	0	0.0	6	5.1
Black text & blue background	3	4.2	2	4.4	5	4.3
Yellow text & black background	2	2.8	2	4.4	4	3.4
White text & green background	1	1.4	2	4.4	3	2.6
Blue text & cyan background	2	2.8	1	2.2	3	2.6
Black text & yellow background	3	4.2	0	0.0	3	2.6
White text & cyan background	2	2.8	0	0.0	2	1.7
Blue text &white background	2	2.8	0	0.0	2	1.7
Yellow text & cyan background	1	1.4	1	2.2	1	1.7
Black text & green background	0	0.0	2	4.4	2	1.7

Yellow text & blue background	0	0.0	1	2.2	1	0.9
Yellow text & green background	1	1.4	0	0.0	1	0.9
Green text & orange background	0	0.0	1	2.2	1	0.9
Orange with & white background	1	1.4	0	0.0	1	0.9
Red text & white background	0	0.0	1	2.2	1	0.9
Red text & orange background	1	1.4	0	0.0	1	0.9
White text & maroon background	0	0.0	1	2.2	1	0.9
White text & magenta background	1	1.4	0	0.0	1	0.9
Total	72	100.0	45	100.0	117	100.0

The human brain is affected by the surrounding environment,one of which is color which influences the learner's motivation toward learning. The different colors have different impacts on the functions of the brain such as memory and retention. Ease in readability facilitates the understanding of the content of written learning matter. In the present study, the student's preference for the text color is black with a white background. Environmental factors play a role in the learning process[7.] The color is also an important component of the environment. A study revealed that memory in learning is affected by the color[8]. Using the various colors in the teaching and learning process has been made easy by the availability of electronic teaching material to the learner. The digital learning resources are cost-effective as compared to the printed learning material. E-learning has emerged as a very beneficial technique in the teaching process[9-10]. Even the learning on social networks also improved the comprehension of the subjects among the students[11].

It would be quite useful to apply appropriate colors in digital teaching. The contrast color is better perceived by the brain. So the use of contrast color in the text and background may yield better results for learning. The contrast level will depend upon the level of difference among the colors. The colors close to one another will have a low level of contrast while the colors opposite to one another will show a high contrast level. The black text on a white background and white text on a black background will reveal a high contrast level. In this regard, contrasting colors may be used in the lectures/presentations for better and easier readability.

The limitation of the present study includes the conduction of study in one center in a city. Multicenter study may yield more information regarding the impact of different colors among the various cultures. The present study is carried out in medical college while involvement of different colleges with a more diversity of subjects may also show interesting findings.

4. CONCLUSION

According to the medical students' viewpoint, the easiest-to-read text is a text written with black color on a white background. This shows that high-level contrast will affect the readability of the content

CONSENT

All authors declare that written informed consent was obtained from the participants for publication of this article. A copy of the written consent is available for review by the Editorial office/Chief Editor/Editorial Board members of this journal.

ETHICAL APPROVAL

All authors hereby declare that all steps have been examined and approved by the local bioethics committee at Northern Border Universitywith decision number (9/43/h).

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