

Affirming Students' Attention and Perceptions on Prezi Presentation via Eye Tracking System

Mona Masood, Norshazlina Shaik Othman

Abstract—The purpose of this study was to investigate graduate students' visual attention and perceptions of a Prezi presentation. Ten postgraduate master students were presented with a Prezi presentation at the Centre for Instructional Technology and Multimedia, Universiti Sains Malaysia (USM). The eye movement indicators such as dwell time, average fixation on the areas of interests, heat maps and focus maps were abstracted to indicate the students' visual attention. Descriptive statistics was employed to analyze the students' perception of the Prezi presentation in terms of text, slide design, images, layout and overall presentation. The result revealed that the students paid more attention to the text followed by the images and sub heading presented through the Prezi presentation.

Keywords—Eye tracking, Prezi, visual attention, visual perception.

I. INTRODUCTION

SEVERAL teaching methods, styles, strategies, and software are used to design instructional materials for an effective visual presentation to ease the teaching and learning of a content. These various styles and strategies allow the users to create animated text and presentation that provides easy to grasp descriptions [1]. As examples, software such as PowToon, Google Drive Presentation, 280 Slides, SlideRocket, PowerPoint and Prezi are used to design instructional materials and deliver presentations effectively [2]. These are widely used by the educators to teach students [3]. Prezi in particular, is a significant tool to present visual and verbal textual materials to the students to make the processes of teaching and learning more effective and retainable [4], [5]. To confirm that the visual design is effective in capturing the students' attention, an eye tracking system is used to provide the empirical evidence for this purpose.

II. BACKGROUND TO THE STUDY

Message design is an important aspect when displaying information. The font, text, layout and images among others, play a role in engaging the viewers in interpreting the meaning of the display. The ability to negotiate, interpret, and infer meaning from the information presented in an image is thus referred to visual literacy [6]. These visualization skills could

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be learnt and developed through practice and hence, the instructional materials can be designed effectively in order to cater to the needs of individuals.

The most important aspect of an effective presentation is to prepare the presentation with the appropriate design, color, captions, and animations [7]. Irrelevant visual graphics and uninteresting information can halt or harm the process of learning [8]. It is advisable to mix visual graphics with an equal amount of text [9] as it can be used to provide cues for learning [7]. For maximum legibility, [7] recommends the use of sans serif fonts such as Arial as it is easier to read. It was also reported that colors capture the attention of the students; allowing them to organize content more easily [10]. Furthermore, a careful balancing of the layout design can give the presentation a dynamic and an unpredictable energy that will draw the readers' eyes [11] along with the use of an eye tracking system [12] to determine which part of the presentation captures the readers' attention. Reference [13] also opines that the eye tracking seems to be a promising and modern approach to achieve the objectives of the study.

Although there are many guidelines on the design of effective presentations found on the Internet, not many had empirical evidence to affirm students' attention and perception on the presentation material using an eye tracking device.

The eye tracking system has been used for two decades to carry out learning and information processing research [14]. It is useful to determine whether the characteristics under investigation attract user's attention and it may be a significant method through which students can benefit through visual presentations [15]. Moreover, it will assist to examine the students' visual attention in terms of their eye movement patterns during the Prezi presentation [16].

Compared to other presentation tools, Prezi is attractive and easy to use for effective communication [17]. They mentioned that it can be a useful tool for storing and creating digital presentations due to its capability to integrate images, texts, audio, video, and animations into a single presentation. Moreover, Prezi is also suitable for presentations on a virtual canvas with an extra advantage of zooming in and out [18]. The advantages of Prezi presentation is that it can be created using cloud based (SaaS) presentation software in the form of different slides. The presentation can be made more organized, interesting, visually attractive and easily remembered for the audience. The previous study done by [18] revealed that Prezi increases the interest level of the audiences to a great extent.

Furthermore, according to [19], Prezi is very famous among educators and students because the software is easy to learn and use. In addition, it can be operated and utilized by students and educators as well in any kind of settings such as conferences, video conferences, seminars, and classrooms.

Hence, a study on using Prezi as one of the attractive teaching aids helps us to generate useful information on visual design methods that can be applied to increase students' attention in learning. In addition, knowing their perception and the distribution of their visual attention, educators can design a good visual presentation to improve students' attention in learning. Therefore, the purpose of this study is to examine the students' attention and perceptions on a Prezi visual presentation via an eye tracking system.

III. RESEARCH OBJECTIVES AND QUESTIONS

The objectives of the current study are:

1. To investigate students' visual attention during a Prezi presentation using an eye tracking system.
2. To investigate the students' perceptions on the Prezi presentation in terms of text, slide design, images, layout and overall presentation.

The research questions are as follows:

- RQ1. How do students allocate their visual attention during a Prezi presentation using an eye tracking system?
 RQ2. What are the students' perceptions on the Prezi presentation in terms of text, slide design, images, layout and overall presentation?

IV. THEORETICAL FRAMEWORK

Several theories are related directly or indirectly to this study; Information Processing Theory [20], Dual Coding Theory [21], Cognitive Load Theory [22] and Cognitive Theory in Multimedia Learning [23]. The Cognitive Theory in Multimedia Learning [24] is employed to assist in the design and development of the presentation. Based on the cognitive theory in multimedia learning, four prominent multimedia elements were identified as the independent variables: text, slide design, images, and layout. The dependent variables are the students' attention and perception in learning. Therefore, the study looks at to what extent the independent variables influence the dependent variable through an eye-tracking system.

V. METHOD

This descriptive case study was designed to examine ten graduate students' attention and perception on a Prezi visual presentation via an eye tracking system, which will guide the educators in producing good visual presentation for the learners.

A. Population and Sampling

A convenient sampling technique was administered whereby ten graduate students who were enrolled at the Centre for Instructional Technology and Multimedia (CITM), Universiti Sains Malaysia (USM) volunteered to take part in the study. The ten participants (eight females and two males) were aged between 21 and 40.

B. Instructional Materials

The visual presentation was designed using the Cognitive Theory of Multimedia Learning [25] and the Contrast, Repetition, Alignment, and Proximity (CRAP) model [26].

The primary source of the content was adapted from [27] while the secondary source was adapted from slideshare, which is a free sharing source on the topic of Visual Communication. Fig. 4 illustrates the twenty-one Prezi slides that were prepared for the study (Appendix). Nevertheless, only nineteen slides were considered in the data analysis since slide 1 and slide 21 were the title and ending slides respectively.

C. Instrument

A close-ended questionnaire was administered by the researcher to investigate the students' perceptions towards the use of the visual presentation in their learning. Matrix items were included in the questionnaires based on a 5-point Likert Scale with the response options of 1= strongly disagree (SD), 2= disagree (D), 3= neutral (N), 4= agree (A), and 5= strongly agree (SA). The questionnaire was adapted from [28] and [29]. The items of the questionnaire were partially modified in line with the nature and objectives of the research study. The questionnaire consists of six sections: A. Demographic, B. Text, C. Slide Design, D. Images; E. Layout, and F. Overall presentation.

D. Reliability and Validity

The instrument was validated by two experienced content experts from USM. Experts judged and evaluated the appropriateness of the instruments, content and design of the visual presentation. The researcher incorporated the changes suggested by the experts accordingly. Prior to the actual study, a pilot test was conducted to establish the procedure of the study and the reliability of the instrument. Overall the reliability of the instruments was measure above 0.7 which was considered good as stated by [30] and [31] (Table I).

TABLE I
 RELIABILITY OF INSTRUMENTS (PILOT STUDY)

Section	Construct	No. Items	Cronbach's Alpha
B	Text	8	0.72
C	Slide Design	6	0.74
D	Images	10	0.80
E	Layout	10	0.76
F	Overall Presentation	7	0.90

Originally, section B (Text) had 10 items of which 2 had to be deleted due to the low reliability index obtained. With the 8 items suggested by the SPSS result, the reliability index was improved to 0.72. Similarly, section C (Slide Design) which had 9 items originally is decreased to 6 to improve the reliability index to 0.74.

E. Procedure

The study was carried out at the CITM as the research laboratory there was equipped with an eye tracking machine and other paraphernalia used for eye tracking purposes. The visual presentation was uploaded on the eye tracking system and a simple instruction was given to the participants about the whole process by the researcher. The participants were briefed about the eye-tracking machine on how it works and the kind of information that was recorded. They were informed that the eye tracking system through the experiment

will automatically record their eye movements. The researcher calibrates, adjust and regulate the participants' eye movements in order to validate the information given by the eye tracking system.

Each participant was seated in front of the eye-tracking machine approximately 60cm away from the monitor and was tested individually at a time, as only one set of eye tracking equipment was available in the lab. Each participant was given the same amount of time between 20 to 30 seconds per slide depending on the slide they viewed (as the length and amount of information varies per slide). Once completed, they were required to answer the questionnaire and return it to the researcher. The study was conducted in five different sessions; two participants for each session. The sessions were completed in five days.

VI. DATA ANALYSIS

It took 8 to 10 minutes for each student to view the Prezi presentation using the eye tracking machine not including the calibration time. For testing the students' visual attention, the Area of Interest (AOI) was created in order to control how broad or narrow where participants focus. Each slide was divided into several AOIs such as slide title, headings, sub heading, images, text, caption and white space (Fig. 1). The different segments of the slide were tagged as sign posts to understand the students' AOI and capture the visual attention maintained on a single location. The Dwell Time (DT) is the aggregate duration of time specified for the AOI which is associated with several fixations, whereas the gaze time consists of a small amount of time taken from these fixations. A fixation occurring outside the area of interests marked the end of the gazes [32]. A gaze duration heat map indicates the accumulated time each participant spends fixating at certain segments of the stimulus relative to the total time the participant spends looking at the stimulus.

Based on the Key Performance Indicator (KPI) images, consolidated results of DT and Average Fixation (AF) of 10 participants are presented in Table II. Different segments such as slide title, heading, sub heading, text, images and caption were considered to measure DT and AF. White spaces situated on the slides were also considered to know whether the student focuses on these spaces. The time stated in Table II for each participant is measured in seconds. The percentage is also calculated from DT values. Mean values of each participant and each segment of the slides were calculated for DT and AF as well. Students' maximum time for DT and AF was 3.15 (slide 2) and 0.24 seconds (slide 13) respectively on slide title, whereas the minimum time for DT and AF was 0.54 (slide 19) and 0.12 seconds (slide 7) respectively.

With regards to headings, participants' maximum and minimum value of DT was 2.69 (slide 15) and 0.75 seconds (slide 19) respectively. Similarly, the students' DT and AF values were different in all segments. It can be concluded from the data that the participants' number of fixation AOI was greater in text area as compared to other segments of the visual presentation.

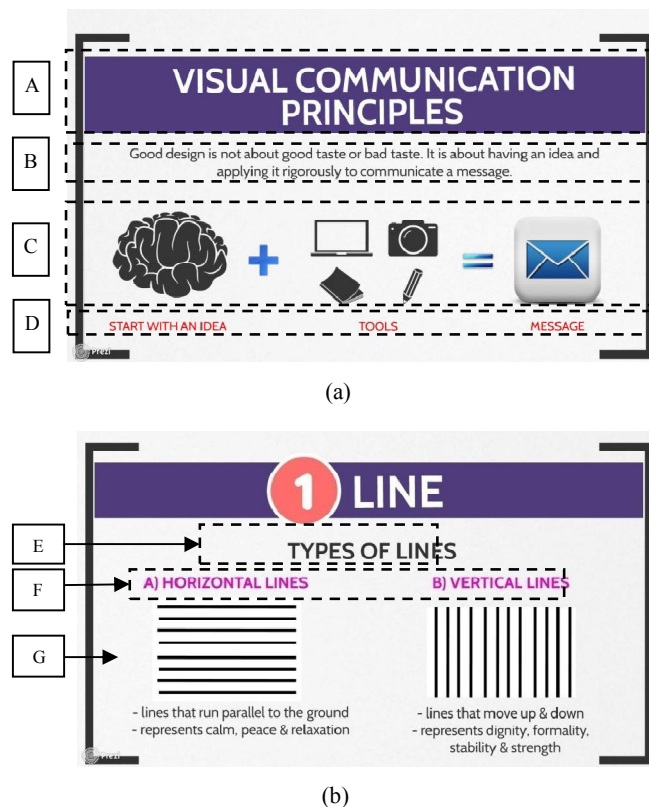


Fig. 1 Area of Interest (AOI): A. Slide Title, B. Text, C. Images, D. Caption E. Heading, F. Sub heading, G. White Space

The DT value of text area was 22.86 seconds (slide 10). It indicates that the participants pay attention on textual materials on the visual presentation. Similarly, the AF values of text and images were greater than other segments of the visual presentation. The highest value for these segments was 0.44 seconds (slide 20) for text and (slide 8) for images.

On the other hand, students' lowest DT and AF value was 0.54 seconds (slide 19) and 0.12 (slide 7) for slide title. The mean values of DT and AF indicate that the participants concentrate more on the text and less eye fixation can be found in the slide title. The highest mean values for DT and AF were 9.79 and 0.26 seconds for text while the lowest mean values of DT and AF were 1.24 and 0.19 seconds for slide title. It can be concluded that the students focused more towards text followed by images, sub heading, caption, white space, heading and slide title.

TABLE II
RESULTS ON AREA OF INTEREST

Slide No.	Slide Title		Heading		Sub Heading		Text		Images		Caption		White Space	
	DT	AF	DT	AF	DT	AF	DT	AF	DT	AF	DT	AF	DT	AF
2	3.15 (15.8%)	0.22	-	-	-	-	7.98 (39.9%)	0.23	3.73 (18.6%)	0.20	1.48 (7.4%)	0.18	1.50 (7.5%)	0.19
3	2.46 (11.7%)	0.21	-	-	-	-	9.64 (45.9%)	0.22	3.32 (15.8%)	0.22	1.54 (7.3%)	0.26	1.45 (6.9%)	0.21
4	1.64 (12.6%)	0.21	-	-	-	-	-	-	4.45 (34.3%)	0.23	3.34 (25.7%)	0.25	2.02 (15.5%)	0.20
5	1.34 (6.4%)	0.22	-	-	-	-	12.83 (61.1%)	0.25	2.33 (11.1%)	0.22	-	-	1.63 (7.8%)	0.19
6	0.81 (3.4%)	0.18	1.04 (4.3%)	0.23	2.66 (11.1%)	0.21	7.87 (32.8%)	0.29	4.40 (18.3%)	0.24	-	-	3.62 (15.1%)	0.21
7	0.58 (2.9%)	0.12	1.83 (9.1%)	0.24	3.58 (17.9%)	0.23	4.68 (23.4%)	0.21	4.27 (21.4%)	0.26	-	-	1.81 (9.1%)	0.21
8	0.77 (5.9%)	0.17	1.69 (13.0%)	0.24	2.14 (16.4%)	0.32	2.39 (18.4%)	0.21	2.65 (20.4%)	0.44	-	-	1.40 (10.6%)	0.18
9	0.91 (7.0%)	0.22	-	-	-	-	6.50 (49.7%)	0.25	2.57 (19.8%)	0.20	-	-	1.10 (8.4%)	0.23
10	0.80 (1.8%)	0.15	2.08 (4.6%)	0.22	5.03 (11.2%)	0.25	22.86 (50.8%)	0.25	4.89 (10.9%)	0.22	-	-	2.23 (5.0%)	0.19
11	1.39 (6.0%)	0.20	-	-	-	-	13.81 (60.1%)	0.26	2.95 (12.8%)	0.23	-	-	1.34 (5.8%)	0.18
12	0.82 (5.5%)	0.22	-	-	-	-	-	-	7.48 (49.9%)	0.26	2.77 (18.5%)	0.25	1.57 (10.5%)	0.21
13	1.26 (9.0%)	0.24	-	-	-	-	-	-	5.66 (40.5%)	0.22	2.88 (20.6%)	0.26	1.90 (13.6%)	0.22
14	0.69 (5.3%)	0.14	-	-	-	-	-	-	5.69 (43.8%)	0.23	2.76 (21.2%)	0.24	1.93 (14.8%)	0.25
15	1.13 (3.4%)	0.14	2.69 (8.2%)	0.24	3.25 (9.9%)	0.21	13.75 (14.6%)	0.40	3.82 (11.6%)	0.27	-	-	2.80 (8.5%)	0.23
16	1.19 (6.6%)	0.20	-	-	-	-	8.05 (44.6%)	0.26	4.68 (26.0%)	0.30	-	-	1.72 (9.5%)	0.19
17	0.70 (2.4%)	0.17	0.97 (3.4%)	0.31	3.27 (11.3%)	0.27	13.89 (47.9%)	0.25	4.52 (15.6%)	0.23	-	-	1.45 (5.0%)	0.20
18	1.76 (11.2%)	0.20	-	-	-	-	7.31 (45.7%)	0.24	2.41 (15.0%)	0.26	-	-	2.30 (14.5%)	0.21
19	0.54 (2.0%)	0.14	0.75 (2.8%)	0.17	2.15 (8.0%)	0.22	5.11 (18.9%)	0.20	5.45 (20.2%)	0.22	5.45 (20.2%)	0.24	2.73 (10.1%)	0.21
20	1.68 (5.6%)	0.18	1.30 (4.3%)	0.20	3.64 (12.1%)	0.26	10.22 (34.1%)	0.44	2.91 (9.7%)	0.21	-	-	3.93 (13.1%)	0.21
Mean	1.24 (6.55%)	0.19	1.54 (6.21%)	0.23	3.22 (12.24%)	0.25	9.79 (39.19%)	0.26	4.11 (21.88%)	0.24	2.89 (17.27%)	0.24	2.02 (10.07%)	0.21

With regard to the participants' heat map (Fig. 2) and focus map (Fig. 3) of the number of fixations, the responses were analyzed qualitatively. Fig. 2 indicates that the participants gaze at the text of the slide for a longer time followed by the least time on the captions of the figure included in the slide. In addition, they focused for a shorter time on the title of the slide.

Similarly, the focus map (Fig. 3) illustrates gaze patterns over the stimulus image visualized as a transparent map. Focus map helps to understand the possibility of attention distribution on the screen to know how long a user focus on a certain segment of the visual presentation and where a user finds certain information on the screen. The focus map provides an alternative way of looking at the students' intensity.

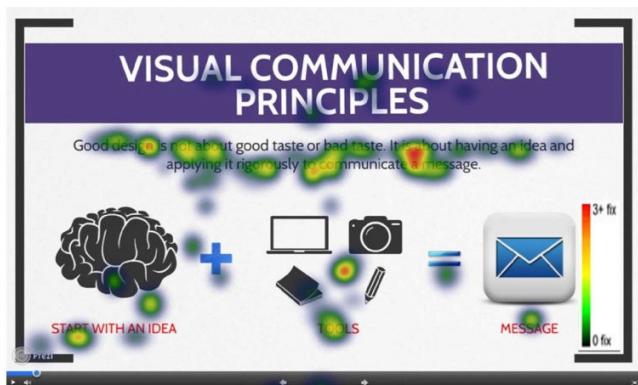


Fig. 2 Heat map of a participant's gaze fixation



Fig. 3 Focus map of a participant's gaze pattern

The area that is more transparent indicates most viewed section. Fig. 3 shows that the participant focuses more on sub headings of the slide and captions of different colors as well. In addition, their gaze duration was least at the main heading and text area.

Table III illustrates the results regarding the participants' perception about the text presented through Prezi. Results indicate that almost all the participants either agreed or strongly agreed with all the items except item 8. It showed that the overall use of text in the Prezi presentation was appropriate, readable, and comprehensible to the participants. The participants were relatively more inclined to 'strongly agree' as compared to the response option of 'agree' (see item 1-7) On the other hand, 90 percent of the participants strongly disagreed and only 10 percent disagrees with slides that contain text only (refer to item 8). Therefore, it can be inferred that the majority of the participants preferred the combination of text and images to be used in the slides for the Prezi presentation.

TABLE III
PARTICIPANTS PERCEPTION ON PRESENTED TEXT

No.	Item	SD (%)	D (%)	N (%)	A (%)	SA (%)
1	All titles and text are easy to read throughout the presentation.	0	0	0	20	80
2	The font sizes of the texts used in the presentation are appropriate throughout the presentation.	0	0	0	20	80
3	The length of the text is appropriate and to the point for me.	0	0	0	60	40
4	Background and color enhance readability of the text.	0	0	0	30	70
5	Background and text match each other very well.	0	0	0	20	80
6	The text guides the audience and serves as an aid.	0	0	0	10	90
7	Lecturers should be careful not to put too much text on each slide.	0	0	0	50	50
8	I prefer slides that contain text only.	90	10	0	0	0

Table IV represents the results of the participants' perception regarding slide design of the Prezi presentation. Six different items were included in the presentation about slide design. With reference to item 1, 90 percent of the students strongly agreed that each slide was clean and easy to read without being laden with too much information. Similarly, in items 2 and 3, 70 percent strongly agreed that the slide design was appropriate to the text, other graphics and use of colors that effectively supported memory. Furthermore, 80 percent of the participants strongly agreed that the slide design had an appropriate use of white space while the rest of the 20 percent agreed with the statement. As item 5 is concerned, 60 percent of the participants strongly agreed and 40 percent agreed with the lecturers who use a plain white background for the presentation slides. Contrarily, 70 percent of the participants disagreed and 30 percent strongly disagreed with the bright colored backgrounds of slides to be used for the Prezi presentations (item 6).

TABLE IV
PARTICIPANTS PERCEPTION ON SLIDE DESIGN

No.	Item	SD (%)	D (%)	N (%)	A (%)	SA (%)
1	Each slide is clean and easy to read without being overly "busy" with too much information.	0	0	0	10	90
2	The slide design is appropriate to the text and other graphics.	0	0	0	30	70
3	The slide design uses color effectively to aid memory.	0	0	0	30	70
4	The presentation has an appropriate use of white space.	0	0	0	20	80
5	I prefer it when lecturers use a plain white background for the presentation slides.	0	0	0	40	60
6	I prefer bright colored backgrounds for the presentation slides.	30	70	0	0	0

TABLE V
STUDENTS PERCEPTION ON IMAGES

No.	Item	SD (%)	D (%)	N (%)	A (%)	SA (%)
1	The presentation includes appropriate images to illustrate the topic.	0	0	0	30	70
2	The presentation used images effectively to enhance and support learning.	0	0	0	30	70
3	The images used help me to relate to the key ideas.	0	0	0	30	70
4	Images presented help me recall the material after the lecture.	0	0	0	10	90
5	I generally find visual elements such as images and illustrations helpful in presentation.	0	0	0	30	70
6	I prefer presentation that contains images only.	40	60	0	0	0
7	The images used in the presentation increase my interest in a course.	0	0	0	20	80
8	I want more images to be used in the presentation.	0	20	40	30	10
9	The images used are related to the subject being taught.	0	0	0	40	60
10	The images used in the presentation help me to understand the content of the course.	0	0	0	20	80

The data presented in Table V indicates that 70% of the participants strongly agreed that the presentation with appropriate images assists to illustrate the topic, supports to enhance learning and helps them to relate to the key ideas (items 1, 2, and 3). For item 4, 90 per cent of the participants strongly agreed that the images presented in the presentation helped them recall the material after the lecture was over while the rest of the participants (10%) agreed with the statement. On the other hand, 40% and 60% of the participants strongly disagreed and disagreed respectively that they prefer presentations which contains images only. It indicates that the majority of the participants do not like a presentation that consists of images only. Moreover, 80 percent of the participants strongly agreed that the images used in the presentation increase their interest in a course and help them

to understand the content of the course (refer to item 7 and 10), whereas, 60 percent of the participants strongly agreed that the images used were related to the subject being taught (refer to item 9). With reference to item 8, the majority of the participants (40%) were neutral regarding more images to be used in the presentation however, only 20 percent of the participants disagreed with the statement

TABLE VI
STUDENTS PERCEPTION ON LAYOUT DESIGN

No.	Item	SD (%)	D (%)	N (%)	A (%)	SA (%)
1	The layout of the presentation includes placeholders such as title and bulleted list accordingly.	0	0	10	40	50
2	The layout design of the slide helps me to understand a subject as a whole.	0	0	0	50	50
3	The layout design of the slide does not distract my attention during courses.	0	0	0	50	50
4	I can understand the important points about the subject from the layout design of a slide.	0	0	10	40	50
5	The layout design is well balanced.	0	0	0	40	60
6	The layout design helps me to focus on the important information.	0	0	0	60	40
7	The layout design helps me to recall the important information.	0	0	0	50	50
8	The layout design is easy to follow.	0	0	0	20	80
9	The layout design is well structured.	0	0	0	10	90
10	The layout design looks appealing to me.	0	0	10	20	70

Table VI shows that 50 percent of the students strongly agreed with different placeholders such as the title and bulleted list. They also strongly agreed that the layout design of the slide helped them to understand a subject as a whole and the layout design of the slide did not distract their attention during courses. They further concurred that they understood the important points about the subject from the layout design of a slide and the layout design helped them to recall the important information as well. Moreover, 60 percent of the students strongly agreed and 40 percent agreed that the layout design was well balanced. Furthermore, 60 percent of the participants agreed and 60 percent strongly agreed that the layout helped them to focus on the important information. 80 percent of the participants strongly agreed that the layout design was easy to follow. As regards the structure of the layout design, 90 percent of the students strongly agreed with the statement that the layout design was well structured while 70 percent strongly agreed that the layout design was appealing to them. Finally, it can be concluded from the results, that the majority of the participants expressed their positive perceptions about the layout design used in the Prezi presentation.

In Table VII, 80 percent of the participants strongly agreed that the presentation was easy to follow; contents presented in the slides helped them to recall important information and the ideas were connected with smooth and effective transitions

while 20 percent participants agreed with items 1, 3, and 5. Forty percent of the participants strongly agreed while 60% agreed that the presentation reflected excellent use of font (item 2). In addition, the majority of the participants (90%) strongly agreed while 10% agreed that the information presented enhanced their understanding and the Prezi presentation helped them to capture their attention during the presentation (items 4 and 7). Furthermore, 50 percent of the participants agreed and 50% strongly agreed that the contents were well organized in the slides. The results reveal that all the participants responded positively regarding the overall presentation of Prezi. They were found to either agree or strongly agree to all the statements stated in the table. Therefore, it can be concluded that the presentation delivered by using Prezi was well organized that helped the students to enhance their learning.

TABLE VII
STUDENTS OVERALL PERCEPTION ON THE PREZI PRESENTATION

No.	Item	SD (%)	D (%)	N (%)	A (%)	SA (%)
1	The presentation is easy to follow.	0	0	0	20	80
2	The presentation reflects excellent use of font.	0	0	0	60	40
3	Contents presented in the slides helps me to recall important information.	0	0	0	20	80
4	Information presented in slides enhances the audiences' understanding.	0	0	0	10	90
5	The ideas are connected with smooth and effective transitions.	0	0	0	20	80
6	The contents are well organized in the slides.	0	0	0	50	50
7	The Prezi presentation helps me to capture my attention during the presentation.	0	0	0	10	90

The descriptive statistics including mean, standard deviation, minimum and maximum values of the five different variables, text, slide design, images, layout, and overall presentation of the Prezi shows that the majority of the participants agreed with the overall presentation (mean, 4.73) followed by layout (mean, 4.56), images (mean, 4.28), text (mean, 4.25) and slide design (mean 4.23) of Prezi. It indicates that the Prezi presentation is beneficial for the students to enhance their understanding and knowledge.

VII. DISCUSSION

In reference to research question 1, the allocation of students' visual attention during a Prezi presentation, indicates that participants focused more towards text followed by images, captions, subheading, white space, slide title and the heading. The majority of the participants concentrated more on text as compared to the other segments of the visual presentation which was affirmed by the eye tracking results.

The majority of the participants responded that the overall use of the text in the Prezi presentation was readable, appropriate, and comprehensible to them for understanding. Furthermore, participants' number of fixation or area of

interest was greater in textual materials as compared to other dimensions of the visual presentation. In addition, it can be concluded from the results that most of the participants preferred the combination of text and visual images to be used in the slides of Prezi presentation.

Most of the participants preferred plain white background for presentation to assist them to accelerate their speed of reading and increase understanding, learning, and comprehension. In connection with the study done by [33], the researcher used bulleted list in some of the slides such as slide 5-11, 16 and 18. In addition, the researcher also used a concise sentence headline instead of phrase headline in slide 2 and 3. Therefore, the bullets and concise sentence headlines helped the students understand the material easily.

The layout design of the Prezi presentation was another variable in the study that was measured through ten items. Based on the results of the study, it can be concluded that the students believed that layout design could help them for better understanding of significant points about the subject. It also helps to focus on the important pieces of information and recall them after the class is over. A study conducted [34] revealed that certain layout (e.g. canonical) enhances the students' learning process. In addition, [35] also emphasized the importance of visual layouts with additional semantic information about the design as they assist in comprehending the images. In this respect, Mayer's spatial contiguity principle supports the idea that students learn in a better way when words and pictures are presented together instead of far from each other on the slides of the presentation. Therefore, in view of the above discussion, it can be concluded that an appropriate layout of the Prezi presentation influences the students' learning and understanding.

As regards the satisfaction level of the respondents regarding the overall presentation style of Prezi, most of the students were of the view that information presented in slides improved their understanding and learning. Almost all the students responded that the overall style of the Prezi presentation captured their attention during the presentation. The majority of the students proclaimed that attractive layout design and visual presentation maximizes the students' level of interest in the classroom.

Based on the results of the current study, it can be concluded that the students paid their attention not only on text but also on the images.

In addition, the findings from the questionnaire indicated that the participants found the Prezi useful, effective and valuable for learning process. Therefore, it can be concluded that a Prezi presentation can be included in their lecturers courses; however, educators need to design and develop the slides of the presentation using appropriate message design taking into consideration of the layout, text, and images. The educators should also be cognizant of Mayer's Cognitive Theory of Multimedia Learning and CRAP Model in order to make the proper and effective use of a Prezi presentation as a means of communication and a delivery mode to impart and share information.

The results of the study also revealed that the Prezi presentation has enormous benefits towards reaching educational objectives. According to the Dual Coding Theory, students prefer and learn more with a combination of images and verbal information being conveyed through presentation [36]. In connection with the Dual Coding Theory, the Prezi Presentation contributes a lot in transmitting useful verbal and visual information. Dual Coding Theory helps to transmit information to short-term memory from the sensory register of memory. Then the information goes to long-term memory. In this way, an individual is able to retrieve or recall information from long-term memory. According to this theory, visually presented information captures more attention of viewers than words. Therefore, the concepts and words the educator intends to convey to the students should be presented through images in order to increase the clarity and attractiveness of the information.

APPENDIX





Slide 19

Slide 20

Slide 21: Ending

Fig. 4 Prezi slides

REFERENCES

- [1] S. Kahraman, C. Çevik, and H. Kodan, "Investigation of university students' attitude toward the use of PowerPoint according to some variables," *Procedia-Computer Science Journal*, vol. 3, pp. 1341-1347, 2011.
- [2] M. J. M. Ferreira, "Intelligent classrooms and smart software: Teaching and learning in today's university," *Education and Information Technologies*, vol. 17, no. 1, pp. 3-25, 2012.
- [3] S. Arifalo, K. Ajisola, A. Adesanmi, and E. Tola, "PowerPoint as an ICT tool for teaching and learning in the schools focusing on secondary and tertiary institutions in Nigeria," *International Journal of Engineering Research and Technology*, vol. 2, no. 8, pp. 2519-2522, 2013.
- [4] Anderson, I., "Approaches to signal flow pedagogy: A black box model and scalable, interactive studio modeling using Prezi presentation software." In *Audio Engineering Society Conference: 50th International Conference: Audio Education*. Audio Engineering Society, July 2013.
- [5] M. M. Ladores, *Instant Prezi Starter*. Packt Publishing Ltd., 2013.
- [6] S. Stokes, "Visual literacy in teaching and learning: A literature perspective." *Electronic Journal for the Integration of technology in Education*, vol. 1, no. 1, pp. 10-19, 2002.
- [7] J. Holzl, "Twelve tips for effective PowerPoint presentations for the technologically challenged." *Medical Teacher*, vol. 19, no. 3, pp. 175-179, 1997.
- [8] L. P. Rieber, *Computers, Graphics & Learning*. Madison, WI: Brown & Benchmark, 1994.
- [9] R. E. Wileman, *Visual Communicating*. Englewood. Cliffs, N.J.: Educational Technology Publications, 1993.
- [10] M. A. Seaman, "Developing visual displays for lecture-based courses." *Teaching of Psychology*, vol. 25, no. 2, pp. 141-145, 1998.
- [11] A. Arntson, *Graphic Design Basics*. Cengage Learning, USA, 2007.
- [12] B. C. Green, N. Murray, and S. Warner, "Understanding website useability: An eye-tracking study of the Vancouver 2010 Olympic Games website." *International Journal of Sport Management and Marketing*, vol. 10, no. 3, pp. 257-271, 2011.
- [13] A. Glöckner, and A. K. Herbold, "An eye-tracking study on information processing in risky decisions: Evidence for compensatory strategies based on automatic processes." *Journal of Behavioral Decision Making*, vol. 24, no. 1, pp. 71-98, 2011.
- [14] T. Van Gog, and K. Scheiter, "Eye tracking as a tool to study and enhance multimedia learning." *Learning and Instruction*, vol. 20, no. 2, pp. 95-99, 2010.
- [15] S. Djamasbi, M. Siegel, and T. Tullis, "Generation Y, web design, and eye tracking." *International Journal of Human-Computer Studies*, vol. 68, no. 5, pp. 307-323, 2010.
- [16] F. Y. Yang, C. Y. Chang, W. R. Chien, Y. T. Chien, and Y. H. Tseng, "Tracking learners' visual attention during a multimedia presentation in a real classroom." *Computers & Education*, 62, 208-220, 2013.
- [17] B. Perron, and A. Stearns, "A review of a presentation technology: Prezi." *Research on Social Work Practice*, vol. 1-2, DOI: 10.1177/1049731510390700, 2010.
- [18] C. Conboy, S. Fletcher, K. Russell, and M. Wilson, "An evaluation of the potential use and impact of Prezi, the zooming editor software, as a tool to facilitate learning in higher education." *Innovative in Practice*, vol. 7, pp. 31-45, 2012.
- [19] J. Bort, "Presentation Maker Prezi Added New Features to Lure Business Users Away From PowerPoint." Retrieved from <http://www.businessinsider.com/prezi-reaches-30-million-users-2013-11?IR=T&>, 2013.
- [20] R. Atkinson and R. Shiffrin, "Human memory: A proposed system and its control processes." In K. Spence & J. Spence (Eds), *The Psychology of Learning and Motivation: Advances in Research and Theory: Vol. 2*. New York: Academic Press, 1968.
- [21] A. Paivio, *Mental Representations: A Dual Coding Approach*. Oxford, England: Oxford University Press, 1986.
- [22] J. Sweller, "Cognitive load during problem solving: Effects on learning." *Cognitive Science*, vol. 12, no. 2, pp. 257-285, 1988.
- [23] R. E. Mayer, *Multimedia Learning*. New York: Cambridge University Press, 2001.
- [24] R. E. Mayer, "Cognitive theory of multimedia learning". *The Cambridge Handbook of Multimedia Learning*, pp. 31-48, 2005.
- [25] R. E. Mayer, "Applying the science of learning: evidence-based principles for the design of multimedia instruction." *American Psychologist*, vol. 6, no. 8, 760, 2008.
- [26] R. Williams, *The Non-designer's Design Book*. Peachpit Press, 2008.
- [27] D. Lauer, and S. Pentak, *Design Basics*. Cengage Learning, 2008.
- [28] J. M. Apperson, E. L. Laws and J. A. Scepansky, "An assessment of student preferences for PowerPoint presentation structure in undergraduate courses." *Computers and Education*, vol. 50, pp. 148-153, 2008.
- [29] Uz, C., Orhan, F., & Bilgic, G. Prospective teachers' opinion on the value of PowerPoint presentations in lecturing. *Procedia - Social and Behavioral Sciences*, vol. 2, pp. 2051-2059, 2010.
- [30] D. George, and M. Mallery, *Using SPSS for Windows step by step: a simple guide and reference*. Boston, MA: Allyn & Bacon, 2003.
- [31] P. Kline, *The Handbook of Psychological Testing*. (2nd ed.). London: Routledge, 2000, p. 13.
- [32] R. J. Jacob, and K. S. Karn, "Eye tracking in human-computer interaction and usability research: Ready to deliver the promises." *Mind*, vol. 2, no. 3, pp. 574-605, 2003.
- [33] M. Alley, and K. A. Neeley, Rethinking the design of presentation slides: A case for sentence headlines and visual evidence. *Technical Communication*, vol. 52, no. 4, pp. 417-426, 2005.
- [34] B. Sharif, and J. I. Maletic, "An eye tracking study on the effects of layout in understanding the role of design patterns." In *Software Maintenance (ICSM), 2010 IEEE International Conference on Software Maintenance*, pp. 1-10, IEEE, September, 2010.
- [35] S. Yusuf, H. Kagdi, & J. I. Maletic, "Assessing the comprehension of UML class diagrams via eye tracking." In *Program Comprehension, 2007. ICPC'07. 15th IEEE International Conference on* pp. 113-122, IEEE, June, 2007.
- [36] D. G. Levasseur, and J. K. Sawyer, "Pedagogy meets PowerPoint: A research review of the effects of computer-generated slides in the classroom." *The Review of Communication*, vol. 6, no. 1-2, pp. 101-123, 2006.