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Seating Location and Attention on the Multimedia Environment and Tools

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Abstract: This study analyzes whether students in large classrooms featuring multimedia environment and tools engage equally in academic activities and pay attention to lectures. It also analyzes whether animations and video clips in lecture materials attract student's attention in class using a computer vision experimental setup. This study may be useful for universities and academic institutions to design modern student centric multimedia classrooms.

Key words: Academic performance, seating position, multimedia, class achievements, class performance, spatial distribution of student, content knowledge

INTRODUCTION

Many universities employ multimedia tools and multimedia system because of the assumption that multimedia information helps students learn quickly that improves academic achievements. A popular but unsubstantiated, belief among the academicians is that students prefer the use of a variety of artistic or communicative media. One widely cited and completely unsupported assertion by Treichler (1967) states 'people generally remember 10% of what they read, 20% of what they hear, 30% of what they see and 50% of what they see and hear'. To find out whether there is empirical support for these assumptions, this research analyzes the student's seating location and their attention on the multimedia lecture materials that include short videos and animations. In fact, learning can be enhanced by instructional materials that includes illustrations and narration. This phenomenon is called the modality effect and it be explained by cognitive load theory (Van Gog and Scheiter, 2010). According to this theory, information presentation in one modality overloads the limited capacity of working memory. When the available capacity is exceeded learning is impaired. presenting learning materials in visual and auditory modalities can increase the amount of information that can be stored and processed in working memory (Ozcelik *et al*., 2010).

To analyze the influence of multimedia on student's attention in small (N = 27) multimedia class, the experimental setup was performed using a non-intrusive camera that captured classroom video during multimedia session. MATLAB (Thompson and Shure, 1995) is used to analyze the captured video and calculate the student's eyes status (close or open) and head movements.

Several studies are reported in the literature that use eye tracking to analyze multimedia learning process (Van Gog and Scheiter, 2010). Review studies from a variety of fields show that multimedia use may help people learn information more quickly compared to traditional classroom lectures (Lindner *et al*., 2017, 2018).

MATERIALS AND METHODS

Experimental setup and analysis: This research conducted at the large university in Asia in an undergraduate class. The observation spans for one semester. The dropout students are excluded from the evaluation. There are four multimedia screens, two at the front podium and two at the middle as shown in Fig. 1.

The experiment analyzes the correlation of seating position and cognitive engagement or distraction of students during lectures is evaluated using 15 min multimedia clips (movie and animations). A 15 min multimedia clips (total 9 clips) were used for evaluation. The Viola-Jones object detection framework (Viola and Jones, 2004) that utilizes Haar-like (Lienhart and Maydt, 2002) features is used.

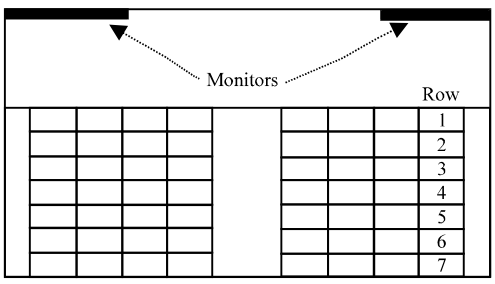

Fig. 1: Seat arrangements

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Fig. 2: Eye-lid movement (closed or open) detection converting image to grayscale and binary: a) Greyscale image and b) Binary image with 50-pixel value threshold

Figure 2 shows the greyscale image of the eyes after cropping and images after converting to a binary image. The first frame is used as an ideal frame. The number of black pixels in binary images decreases significantly when the eyes are closed. Eyes closed for 5 sec or more considered the student is not paying attention to the multimedia clip and increased the distraction counter. Similarly, lowered heads pixels number is considerably lower than the facing to the screen. Head lowered for 15 sec or more is considered the distraction and increased the counter. A guard time of 5 sec is placed between two readings.

The correlation between the template and the image window used as a measure of similarity in template matching. The cross correlation function (3) proposed by Hotz (1991 and Fua (1993) is used:

$$\text{Resulting correlation Score (S)} = \frac{\sum_{i=0}^{N-1}\sum_{j=0}^{m-1}(T(i,j)W(i,j))}{1-\sqrt{\sum_{i=0}^{N-1}\sum_{j=0}^{M-1}T^2(i,j)}\sqrt{\sum_{i=0}^{N-1}\sum_{j=0}^{M-1}W^2(i,j)}}$$

where, T is the template of size M×N and W is the window of size M×N. Figure 3 shows the mean number of times students closed their eyes during 15 min clips. The results in the chart are average of 8100 sec measurements. As shown in Fig. 3, students who sat in the front row, i.e., closed to the multimedia screen closed their eyes in the class less than those who sat in the middle rows on average. However, the number of eyes closed at the last row are less than the students in other rows. The number of eyes closed in GL is much higher than in MM.

Figure 4 shows the mean number of times students distracted (down or not pointed towards screen) their

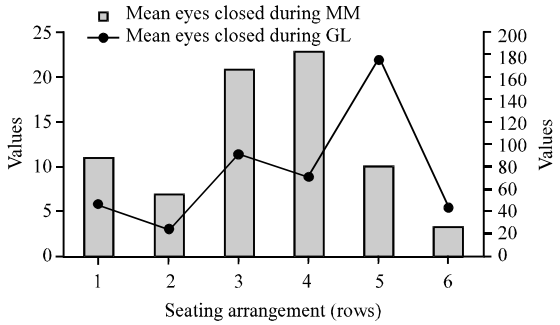

Fig. 3: Eye closed during playing Multimedia lecture (MM) clips and General Lecture (GL)

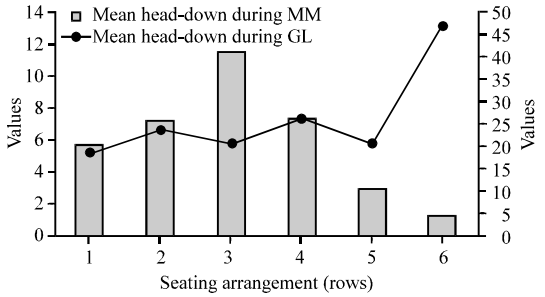

Fig. 4: Head down during playing Multimedia lecture (MM) clips and General Lecture (GL)

head from the multimedia screen. In average, a student who sat in row 3 had a greater number of head-down than student that sat in other rows during MM. The trend in the GL is quite different in the GL.

RESULTS AND DISCUSSION

These results show that students in the middle rows from the multimedia screen are more distracted during watching multimedia lecture clips. Students in the front and last rows showed greater attention to the multimedia and students in the middle show less attention. Also, students pay more attention on multimedia lecture materials in the classroom than normal lectures.

CONCLUSION

The use of a variety of artistic or communicative media helps engage young learner's interest and enhances their understanding. The experimental results show that students pay greater attention to multimedia materials in class than general lectures. Students in the middle row distract more than the students in the first and last rows.

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