

# Improving Learning Performance Using Gaze Pattern to Detect Distraction and Regain User Attention

# ABSTRACT

Distraction reduces learning performance when watching educational video lectures. Monitoring and tracking trainee's eyes can help us detect distraction in near real time. We can then employ strategies to gain back the trainee's attention and improve learnability. In this project, we use an eye tracker to monitor users' attention and detect distraction. We use nonverbal cues, i.e. automatic video play & pause triggered by detection of user distraction, to regain their attention. We experimented three different conditions: 1) The participant is not given any non-verbal cue. 2) The video paused when the participant looked away from the video for more than 3 seconds and played when she looked back. 3) The video paused for 3 seconds after a random interval and played again. We found that participants that were given nonverbal cues remembered more details from the video. Our proposed method, detecting user distraction and re-gaining their attention (cond 2.), improved performance more than no cue (cond. 1) and randomly pausing and playing the video (cond. 3). Furthermore, in these conditions female participants performed better than male participants, which may suggest that these cues were more effective for females than males. We hope that results from these experiments will give insight into future research in this area.

# Our goal

- Design a computer based educational system which helps students keep focused using non-verbal cue.
- Using our method, improve student's delayed retention
- Design a monitor that can efficiently collect data during the video lecture

# **Related works**

Online lecture shapes university community, in a lot of education literature, research illustrate that difference between the online and lecture students. They found online students were less likely to complete the course (John Dutton 2002), and they were more easier to get distracted than the traditional lecture students (Julie Foertsch 2013).

Other result shows that learning performance is much better when the lecture contains organizational cues and note-taking. delayed retention is also better when students view lectures containing organizational cues and immediate behaviors (Titsworth 2009). Arousal-attention theory argues that the use of immediacy. There are two major theories as to how immediacy can be used by an instructor to positively impact student cognitive and affective learning. Increases student arousal thus increasing student attention and engagement leading to a greater recall ability [40]. Second, motivational theory suggests that immediacy can increase student ambition by sparking curiosity and driving them to increased inquiry and involvement.

#### Method and device



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Calibration and mapping from eye ball location to world

 $f^* = \arg\min_{f \in \mathcal{F}} \|(x_w, y_w) - f(x_e, y_e)\|_2^2$ 



**Figure 1.** Video players and markers to detect the target surface.

Estimation of level of focus (running average)

 $F_t = (1 - \alpha) * F_{t-1} + \alpha * W_t$  $W_t \in \{0, 1\}$ , Gaze is on the target surface  $F_t \in [0,1] \subset \mathbb{R}$ , Level of focus  $\alpha \in [0, 1]$ , Sensitivity parameter



Figure 2. Not done.



Figure 3. Not done.

## DISCUSSION

We conducted a two-way analysis of variance (ANOVA) to test whether presence of non-verbal cues or gender affected participants' learning of the story details. The analysis showed a significant difference in learning of female participants F(2,6) = 7.267, p = .024between different levels. Specifically, they significantly learned better under level 2 (p = 0.009), and slightly better under level 3 (p = 0.06). This is despite the fact that under level 1, where no cue was given, both female and male participants had similar learning performance. We did not find

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## CONCLUSIONS

The results show that our proposed method of detecting participant distraction, pausing the video, and replaying when attention is regained significantly improved female participants' learning.