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TEACHING ON ZOOM IN THE EYES OF THE LECTURER: AN EYE TRACKING STUDY

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Abstract

The shift to “Zoom” online learning in higher education, has aroused questions regarding the professional vision of lecturers- which is the core of this study. Since teaching on “Zoom” is screen based, it was possible to use an eye-tracking device to study lecturers’ vision gazes during teaching. The study describes ten lecturers vision behaviours by fixations and lecturer’s personal perception of vision. Main results revealed that sidelong variability between lecturers’ eye gazes, lecturers mainly focused on their presentations. They felt high vision interaction with participated students yet, more than fixations revealed. These results and more discussed in the study, emphasis the importance of understanding lecturers’ professional vision on “Zoom”, for improving the quality of teaching on this rather new method of teaching.

Keywords:

Eye tracking, professional vision, online learning

Introduction

The awakening of technologies in the current decade enabled pedagogical staffs to overcome barriers such as the need to teach only by attending physically the traditional classroom. In fact, since the Covid-19 pandemic and its aftermath, many higher educational institutions around the world, including Holon Institute of Technology in Israel, have shifted many of their studies to online synchronous classes. Using the “Zoom” videoconference software, both lecturers and students participate in virtual classes together, utilizing features such as screen sharing of visual content (e.g. presentations), open web cameras and microphones for communication. Conducting classes via the “Zoom” with open cameras “face to face” indeed amplify opportunities for interaction between the lecturer and students. However, these interactions are different in nature, to those in the traditional classes. First, using the “Zoom” software does not demand opening cameras or microphones of all participants. This means that the lecturer does not necessarily see face-to face all the students attending, but rather sees closed camera screens. Never the less, the lecturer cannot control opening students’ cameras (for obvious legal and privacy reasons). Second, the limited visual range offered by web cameras can often make it challenging to

observe participants’ body gestures and eye gaze, affecting the interpersonal interactions. Additionally, teaching on “Zoom” cannot reveal all participants cameras at once, and therefore the lecturer can only look towards a specific group of students, rather than the full class. And last, the self-awareness generated by observing oneself through the camera display on the “Zoom”, also known as ‘mirror observation’ (Bailenson, 2021), may shift the lecturer’s focus and impact their teaching.

The effect of opening cameras while participating in an online video conference was presented during the beginning of this century. Several studies discussed the interaction effect of opening cameras on self-awareness in different interpersonal communication situations (non-academic), such as during a conversation in an introductory meeting or a discussion of several participants. There findings were not conclusive however, they emphasize that opening web cameras and being watched, increased participants attention and self-awareness, resulting in a positive impact on overall behaviour during meetings (Joinson, 2001; Miller, Dechant & Mandryk, 2021; Miller, Mandryk, Birk, Depping & Patel, 2017; Nielsen, 2017). Other studies of that time, dealt with the use of video conferencing interfaces for distance learning purposes, focusing on the effectiveness and/or students’ degree of satisfaction learning with such an interface (Candarli & Yuksel, 2012; Knipe & Lee, 2002). Beside presenting difficulties, advantages and disadvantages of general distance learning, they emphasized the importance of opening the web camera during online classes for enhancing communication and establishing

stronger relationships with the lecturer and classmates, as well as promoting student engagement and commitment to learning (Yamada & Akahori, 2009).

A significant increase in studies regarding online learning interfaces occurred during the Covid-19. Yet, at that period of “Ad-Hock” actions, they focused either on the technological aspects of using video conference tools (Dias, Lopes & Teles, 2020; Orhan, & Beyhan, 2020); or students’ feelings and perspective using online learning (Aguilera-Hermida, 2020; Atmojo, Muhtarom, & Lukitoaji, 2020; Serhan, 2020). They mostly overlooked the lecturer or methodological aspects regarding teaching with online tools leaving these matters unattended.

Studies regarding the lecturers behaviour on “Zoom” underlined, once more, the degree of confidence in the tool as a pedagogical key factor (for example, Joia & Lorenzo ,2021). Yet, Bailenson (2021) suggests that the utilization of web cameras in lecturers resulted in an increased cognitive load (due to the various stimuli present), which differ from those encountered in traditional classroom settings. He assumed that lecturers may endure similar negative emotions as those reported by students in similar web-based learning environments (Castelli & Sarvary, 2020; Gherheş, Simon & Para, 2021), both at the level of internal effects (such as: anxiety, preoccupation with self-awareness) and at the level of external effects (such as: awareness of the lecturer environment). Following these assumptions, it is possible to assume that lecturers’ degree of online teaching experience, using web cameras, influences their teaching and lecturer-student interactions, as shown in studies regarding "Teachers' Professional Vision".

"Teachers' Professional Vision"

The term “Teacher Professional Vision-TPV” (Goodwin, 1994), defines teachers' ability to perceive and interpret relevant classroom situations during teaching. It is considered a main component of teaching, alongside components of knowledge and belief, and its goal is to improve professional teaching and teacher-student interactions (Muhonen, Pakarinen, & Lerkkanen, 2020; Meschede, Fiebranz, Möller, & Steffensky, 2017). The working model of TPV uses observations (mostly video recordings) of teachers while teaching in a classroom (Kleinknecht & Schneider 2013; Van Es & Sherin, 2008). The model includes two layers of analyse: (a) noticing significant events and situations that occurred during a lesson, (b) knowledge-based interpretation, explanation and reasoning of those situations by the teachers (Grub, Biermann, & Brünken, 2020).

Using this model enables studying teachers’ attention allocation and interactions in their ecological environment-the classroom (as opposed to a lab setting). It is mainly used as a pedagogical tool. Yet, it has also been included in recent academic studies (Grub, Biermann, & Brünken, 2020), such as studies using eye-tracking method (Beach, & McConnel,2019).

Eye- Tracking studies

Eye tracking studies are based upon data collection and analyse of participants’ eye position and eye movements while conducting a study (Carter & Luke, 2020). Eye tracking technologies (e.g., “Tobii Pro-Lab”, see physical setting of device Fig.1) are non-invasive, and consist of a hardware (e.g., immobile or mobile device) and a software. Eye tracking is used for human behaviour studies in various fields such as: psychology, education, human-computer interaction, educational technology, design, advertising, and in various fields of medical sciences. Its main purpose is to collect voluntary and involuntary participant eye positions and movements in the visual field due to the study stimuli. The information collected enables the understanding of visual gaze positions and visual patterns of gaze for better understanding of the human behaviour.

Following this, there are two main output measurements collected in the eye-tracking device: "fixations"- representing when the eyes “stops” (for milliseconds) at a certain point in the visual space, at which the brain receives the visual information; and "saccades"- representing the eye movements, between the starting point and the next target point gaze focus. These measures can be presented as raw data (for statistical analyses), and as visualization outputs such as “gaze plots” (presenting the order of fixations and saccade patterns, see Fig 3-4). Collecting this data enables knowing where a participant looked at, for how long, towards where the eye continued? etc.

Eye- tracking has been used in TPV studies to better understanding authentic teachers’ actions during class. For example, using eye- tracking glasses, it was found that experience teachers tend to turn their gaze more towards struggling students and/or distractions during lessons and refer to them. On the contrary, less experienced

teachers tend to turn their gaze mainly to the material being taught (Cortina, Miller, McKenzie, & Epstein, 2015; Jarodzka, Skuballa, & Gruber, 2021; Wyss, Rosenberger, & Bühner, 2021). These findings are obviously important in the pedagogical aspects of teaching. To the best of our knowledge, there are no published studies regarding lecturer's eye gaze during online teaching and/or video conference teaching in higher education.

In light of this, using an eye-tracking device, the purpose of the current study was to examine lecturer eye gaze on the "Zoom" while teaching students in higher education. To reveal where do the lecturers mostly look at while teaching, and where do they look at when a lecturer-student interaction occurs?

The presented study is considered a pioneering study. It has both a theoretical and an applied contribution. At the theoretical level, its findings will shade new light in the field of "professional vision" which up to today focused on teaching in a classroom rather also on the web platforms. At the applied level, findings regarding lecturer's eye gaze patterns and preferences, most possible, will refine recommendations for teaching on "Zoom".

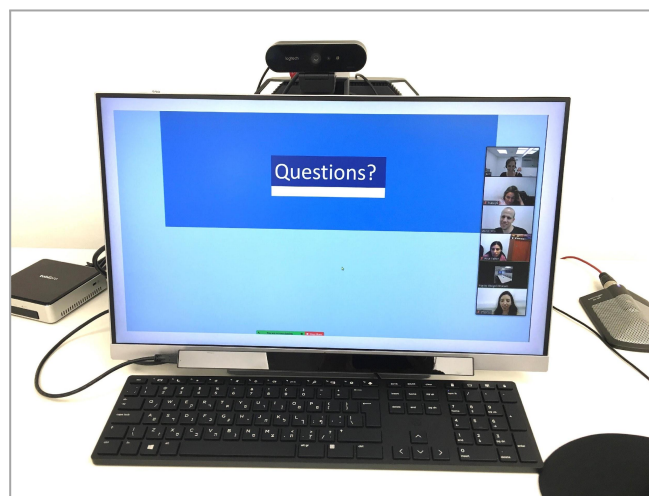


Fig 1. study setting with Eye tracker Tobii Pro-Lab.

Method

Participants and procedure

Using the "Tobii Pro-Lab 1200hz", ten participants (five females, five males), lectured on the "Zoom" at the "[User Experience Lab](#)", at HIT. Various subjects were taught as a "Pitch" (Komulainen, Siivonen, Kasanen, & Rätty, 2020), using open cameras by lecturers. All lecturers had experienced previous "Pitch" lectures. The students attending these "Pitches" were paid viewers. Each student had a specific role and opened the camera upon prior request (not known to the lecturer). Each "Pitch" was accompanied by a Power Point presentation (PPT), which included five fixed template slides: an opening slide, personal introduction (about me-the lecturer), main subject presentation slide, questions slide (for a more specific lecturer- student interaction) and an ending thank you slide. See Fig 1 as an example of the setting while teaching the "Pitch". Following each "Pitch", a short semi-structure interview (5-6 questions) was conducted with each lecturer to understand their perspective of the "Pitch" (for example: What did you feel during teaching? what did you mostly look at during the "Pitch"? etc).

Data analysis

This is a descriptive study, using raw data collected by the eye-tracker and narrative information collected via 5-6 questions in a semi- structure interview.

Lecturers' eye tracking gaze were measured by fixations. Each lecturers "Pitch" was divided into five "Time Of Interest" (TIO) frames in according with the five PPT slides accompanying each "Pitch". Each TIO was than divided in to five "Areas of interest" (AOI) of the "Zoom" screen: The PPT presentation page AOI, the lecturers' open camera AOI (mirror of himself), and three student AOIs, according to their role in the study (the listening and participating students AOI, the non-listening students AOI with open cameras, and students with closed cameras).

Due to differences in “Pitch” durations (Mean= 7.38 minutes, SD=2.06) and differences in AOI sizes (e.g., AOI of page size bigger than AOI “Zoom” participants camera boxes), number of fixations in each AOI were converted to percentage of fixations per AOI and slide. Data analysis included averages and standard deviations of fixations.

Results

Overall lecturers gaze

Data examination of lecturers’ overall percentage of fixations for each AOI during the “Pitch”, revealed variability between subjects and each lecturer divided his gaze differently in his lecture (see Fig 2, 3-4). Additionally, there were no gender differences between gaze patterns. Despite this, the highest observation fixation percentage for most lecturers was towards the PPT pages accompanied their lecture (AOI Mean= 52, SD=20). After which, most lecturers’ fixations focused on the students that were listening and participating (AOI Mean=29, SD=12), also seen in Fig 2. High lecture gaze variability was found within the AOI of the students which were not listening, but had their cameras open (AOI Mean= 9, SD= 7), and within the AOI of the lecturer’s camera (AOI Mean= 7, SD=13). The AOI of students closed cameras had received little gaze, if at all (AOI Mean=3, SD=3).

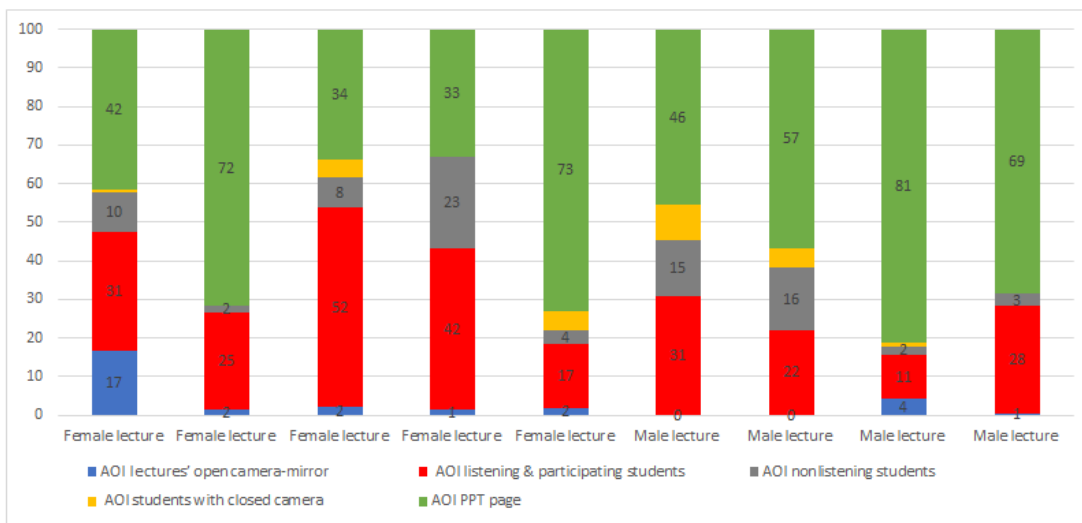


Fig 2. Percent of lecturer fixations by AOI.



Fig 3-4. Examples of results of two lecturers' "Gaze Plot" on "Zoom". Circles represent fixations, number indicates their order of appearance.

Lecturers gaze during lecturer-student interactions

The "questions" slide of each "Pitch" represented a lecturer-student interaction, in which a student asked a question regarding the "Pitch's" subject and received an answer by lecturer. As seen in Fig 5, not all of the lecturer- interaction time was allocated to looking at the student. On average, only 54% of fixations of all 10 lecturers were divided to looking at the students that asked the questions. The other 46% of eye attention of the lecturers while answering, focused mainly on the PPT page (although the slide had no information on it, only the word "Questions?"). The rest of lecturers' fixations were divided between looking at the non-listening students, mirror looking and/or looking at closed cameras.

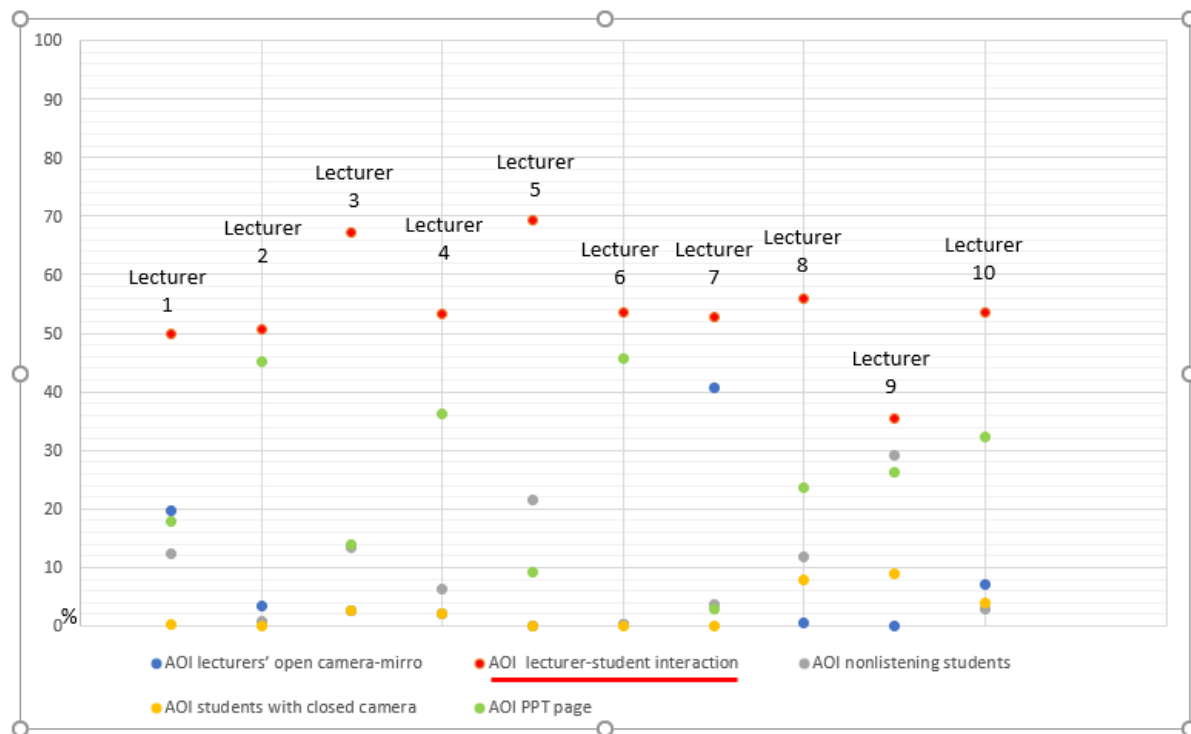


Fig 5. lecturers' gaze references (percent of fixations) while answering students' question.

Lecturers main interview reports

Lecturers narratives were divided to three themes:

1. Lecturers' self-confidence during the "Pitch". All participants described high levels of stress at the first moments of their lecture, mainly due to the notion that they were teaching within an eye-tracking study. Yet, all described that this feeling passed quickly and changed to feelings of relaxation and confidence.
2. Noticing visual attention. Lecturers reported mainly looking at the PPT and alternately at listening and participating students. They emphasised looking at the student whom had asked a question while answering it, although understanding that he cannot see that.

3. Reasoning-All lecturers explained they had the mental need to look at their presentation pages either to “catch” main terms or “lay” their eyes while thinking. Three (one female and two male), were aware of their open camera. One deliberately noted he made sure not to look at himself, the others mentioned that it was important to mirror look in order to verify that they were seen properly on the “Zoom”. All lecturers noticed that there were closed cameras, and chose not to refer to them.

Conclusions and Discussion

The purpose of this study was to examine lecturer eye gaze on the “Zoom” while teaching students in higher education. All though fixation results revealed variability between lecturers’ gaze, most lecturers’ fixations focused on their presentation slide and only then at their students. Within the later, lecturers mainly looked at participating students, neglecting those which had open cameras but did not participate or closed cameras. Lecturers interviews revealed they were aware of their gaze behaviours, yet in a much wider feeling than noted by the eye-tracker. A strong emphasize to this was noted during lecturers’ gaze while answering a student’s question- which showed rather low fixations on the student cube (only 54% average gaze), and rather a broader gaze towards other various component on the screen. This can be explained by the lecturers reports of being aware that the students cannot see they are looking directly at him. Surprisingly, they were less mirror looking by the lecturers than expected, perhaps due to high confidence of the lecturers using the “Zoom”.

The “Zoom” platform for teaching is based on verbal, vision and upper body communication. Our findings focused on one of these main components. Findings reflect a rather narrow vision behaviour of lecturers on the “Zoom”, leaving many other vision variables neglected. Additionally, it appears that it is not enough to use a professional presentation, and/or feel confident during teaching on “Zoom” to communicate with students. Instead, a set of recommendations are needed to increase lecturer’s visual communication. Even if students do not see precisely towards where a lecturer is looking, he is in control of his lesson also in the vision field and this must be emphasized. For example, lecturers’ vision referring to non-listening students, may invite action to change these students’ behaviours during lessons, rather than the lecturer deliberately ignoring them by eye sight. Nevertheless, to do so, there is a need to continue studying this matter, as being done currently at [our lab](#).

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