Adults in Distance Education: A Multimodal Approach to Understanding Learner Engagement

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Introduction

In this paper, we propose a novel research methodology which used recorded study sessions with screencast, webcam video, and audio recording of adult students in their home environments as they participated in their online classes to understand the experience of adult learners in distance education. We will describe how we used screencast analysis to deconstruct study sessions to understand embodied actions distance students take during learning activities and the impact of their environment on their learning. This paper includes links to copies of the coding tool developed and sample video clips for analysis. A discussion of limitations and other applications of this research method are included.

The State of Screen Recording Analysis

Video analysis has a long history in the behavioral and education sciences (Erickson, 2011), but the analysis of screen recordings has yet to become widely used. Screen recording analysis has been used to study user interaction with technological devices (e.g., Kim et al., 2020), user experience in educational software (e.g., Lahav et al., 2020), and language learning or translation (e.g., Mueller-Spitzer et al., 2018; Orrego-Carmona et al., 2018). In a recent meta-analysis of multimodal research studies, only four of the 207 articles used screen recordings as a data source (Noroozi et al., 2020). Many of the studies that use screen recording techniques to capture data use quantitative approaches to data analysis and very few are done outside of controlled settings. Our method used an embodied discourse approach to data analysis in ecologically valid settings of students' homes. Most research on adult learners relies on self-report which can be problematic as student perceptions and recollections may not accurately reflect what happens during the learning process. By combining subjective data from student reports and objective data through screen recordings, we were able to corroborate findings.

Why Screen Recording Analysis is Important

Using a multimodal approach to data collection afforded us the opportunity to watch participant facial expressions and gaze while simultaneously observing actions on their computer screen. While participants were recording their study sessions in the comfort of their home we could also hear the sources for distraction. We witnessed if a noise actually distracted their work or if they were able to work through the din. Observing mouse movements, eye movements, and hearing students speak to themselves out loud are artifacts we would not have been able to observe concurrently using other data collection methods.

Methods

Participants

Participants in our collective case study (Merriam & Merriam, 1998) were six academically high-achieving working mothers with prior experience in distance education. The students were studying at both the undergraduate and graduate levels. All participants were juggling multiple roles, employed outside of the home and had school-aged children. Initially, when we sought out participants, we were recruiting any adults currently in distance education. However, due to the small number of respondents, we were left with six participants who coincidentally were all high-achieving working mothers.

Data Collection

Our data collection methods included interviews with faculty of the targeted courses, interviews with student participants, recorded study sessions, debriefs with participants on these sessions, and student reactions to selected clips of study sessions. Interviews were conducted with each faculty member. These interviews were recorded, transcribed, and coded for common themes relating to instructor perceptions, interactions between students and the instructor, instructional design, and growing into the role of an online instructor.

Interviews were also conducted with each participant at the start of the study. Students were read a statement about the goals of the study, were asked for recording permission, and whether they agreed to participate. Upon agreement, initial interviews were recorded. Questions relating to students' assets and challenges, time and place, and learning strategies were asked. All of the participant interviews were recorded, transcribed, and coded. Upon completion of the initial interviews, students were provided with instructions for video screencast recordings.

Participants were asked to record at least 30 minutes of study sessions over the next three weeks at a rate of about one per week. Each participant had their own individual Zoom link that would automatically upload the recording to our private, secure Kaltura account. These accounts are through our University, are password protected, and are FERPA compliant. Students were prompted to share their screen and ensure their audio was on. Students were asked to also record these sessions even if they were not actively using their computer for the study session. For example, one student was reading from a text and taking notes but we were still able to capture her study session because we were recording with her camera.

After each study session was recorded, a 15-minute debrief was conducted with each participant. We questioned students about what the recording was capturing, what went well for them during the week academically, and what posed a challenge for them. We also asked what tasks they completed for coursework during the week that were not recorded in the screencast.

Throughout analysis of the screen recordings, we found that questions arose about what was happening in the recordings: *What were students doing and why? How did that distraction impact their ability to complete a task? How did they work through that distraction?* To gain more insight into the recordings, we compiled a few short video clips from study sessions for each participant. We then met with the participant to show them the short clips, get their reaction, and ask questions regarding the clips.

Data Analysis

Macro-Level Review. We utilized a whole-to-part inductive approach (Erickson, 2006) to screen recording analysis, watching all of the recorded sessions to identify a construct for further analysis. Each researcher watched at least two recorded study sessions in whole from each participant, noting observations and questions for further analysis. For example, some questions that arose while we were watching the videos included: *Does the amount of content on the screen impact how efficient the learner is with locating the information they need? Is on-screen behavior different when the student is familiar with the resource? How long does it take students to read text on the screen? What factors impact this reading speed? LOTS of distractions here. Are they different from the distractions of other students?*After watching the videos and discussing our observations, we were all struck by the overwhelming amount of distraction that these students experienced during their study sessions in their homes. Distraction became the construct on which we focused on our analysis.

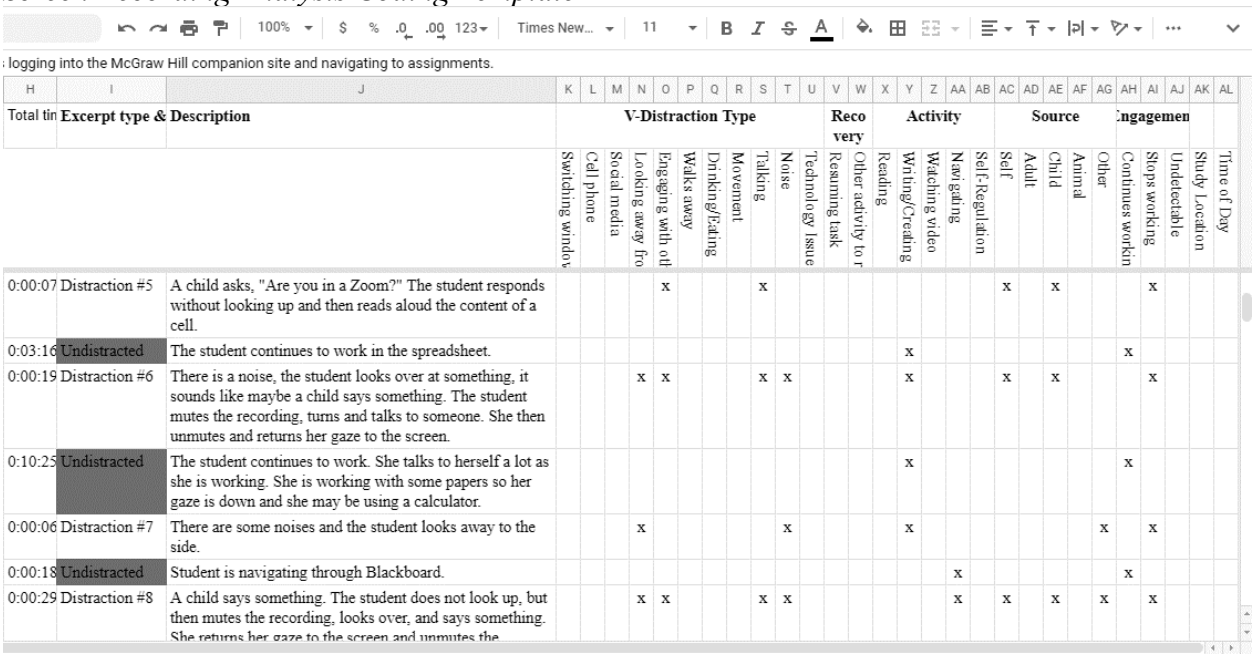
Video Annotation. Our next step in data analysis was to begin annotating each study session video. We played, paused, and rewound video segments frequently to capture the actions we saw on the screen and in the environment, as well as the audio, noting start and stop times. A discourse analysis approach helped us to describe the actions we observed visually and auditorily, while embedded within the natural context that provides meaning to the actions (Hardy et al., 2004). A new excerpt was created in the annotation every time the action changed on the screen or there was a new interruption, which determined our units of study. Each excerpt was labeled as "un-distracted" or "distracted" to identify whether a distractor was present, whether or not the student appeared distracted by it. We used evidence in our observations to justify any inferences we made. For example, while we may not have seen a cell phone in the video window, hearing an alert tone followed by the student looking down for several moments led us to conclude that the student was looking at a message on their phone. Our initial annotations were created in tables in Microsoft Word. Each researcher watched some of the same study sessions and annotated them so that we could come to agreement on what we were seeing and calibrate our strategy for documentation. During the annotation process, we began to note that there were different types of distractions and different sources.

Video Coding. After we had completed annotating several videos, we began to develop a coding scheme to analyze each study session moment-by-moment. Initially, we categorized the type of distraction the learner experienced, the type of activity interrupted, and source of the distraction. This was done by moving the tables from Microsoft Word to Microsoft Excel and adding columns for each distraction type (switching windows/scrolling, cell phone, social media, looking away from screen, engaging with other person, walks away, drinking/eating, movement, talking, noise, technology issue), the type of activity the student was engaged in (reading, writing/creating, watching video, navigating, self-regulation), and the source of the distraction (self, adult, child, animal, other). An x was placed in the corresponding column to mark each of these three categories for each excerpt (see Figure 1). In order to facilitate collaboration on these files, we moved the files to Google Sheets. One of the videos was coded by each researcher using this template to determine inter-rater reliability and calibrate our interpretations of the codes (Miles et al., 2020). As new codes were added, such as *technology issue* or *self-regulation*, we went back to re-code the completed videos to include these new codes. During this phase, we

began to realize that some distractors did not seem to affect the students and they remained engaged in their work. Our constant comparative approach and the iterative nature of our coding led us to notice what we initially overlooked (Glaser, 1965). We then added a new category of engagement (continues working, stops working, undetectable) and went back to recode each excerpt. View the data analyzed in this study here: https://tinyurl.com/3m2ycek8.

Figure 1

Screen Recording Analysis Coding Template



logging into the McGraw Hill companion site and navigating to assignments.

			V-Distraction Type											Recovery		Activity				Source				Engagemen				
Total tin	Excerpt type & Description		Switching windov	Cell phone	Social media	Looking away fro	Engaging with ot	Walks away	Drinking/Eating	Movement	Talking	Noise	Technology Issue	Resuming task	Other activity to r	Reading	Writing/Creating	Watching video	Navigating	Self-Regulation	Self	Adult	Child	Animal	Other	Continues workin	Stops working	Undetectable	Study Location	Time of Day
0:00:07	Distraction #5	A child asks, "Are you in a Zoom?" The student responds without looking up and then reads aloud the content of a cell.					x				x										x		x			x			
0:03:16	Undistracted	The student continues to work in the spreadsheet.															x									x			
0:00:19	Distraction #6	There is a noise, the student looks over at something, it sounds like maybe a child says something. The student mutes the recording, turns and talks to someone. She then unmutes and returns her gaze to the screen.				x	x				x	x					x				x		x				x			
0:10:25	Undistracted	The student continues to work. She talks to herself a lot as she is working. She is working with some papers so her gaze is down and she may be using a calculator.															x									x			
0:00:06	Distraction #7	There are some noises and the student looks away to the side.				x						x					x								x		x			
0:00:18	Undistracted	Student is navigating through Blackboard.																	x							x			
0:00:29	Distraction #8	A child says something. The student does not look up, but then mutes the recording, looks over, and says something. She returns her gaze to the screen and unmutes the				x	x				x	x							x		x		x		x		x			

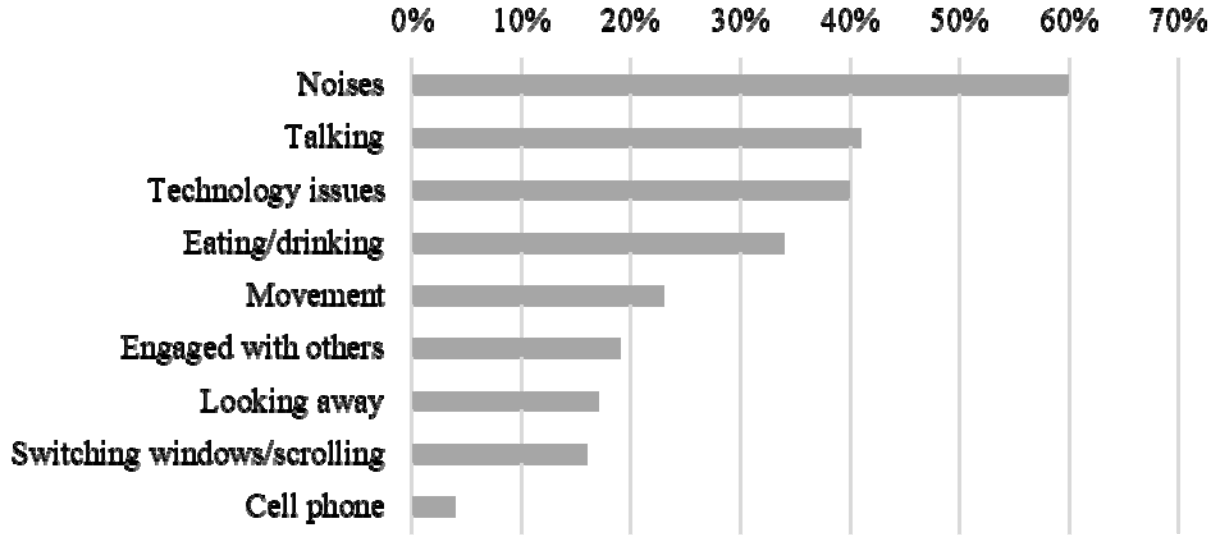
Quantitative Analysis. Adding codes and timestamps allowed us to conduct quantitative analysis on individual study sessions and then collectively to determine the frequency and source of distractions and to determine which activities were most engaging. We developed a list of questions to ask using the data we collected. Those questions and the results are listed here.

1. *What was the ratio of time that students endured distraction during study sessions versus being distraction free?* On average, distractions were observed during 34% of the recorded study sessions.
2. *How did students spend their time on the different types of learning activities?* Students spent the majority of the recorded study time writing/creating (53%) or reading (36%), with the remaining time spent watching videos (22%), navigating (22%), or self-regulating their learning (6%). Sometimes students work engaged in more than one activity at the same time, so these values do not total to 100%.
3. *How often did students stop working and for how long?* Students stopped working for 21% of the recorded study time, remained engaged in work for 72% of the time, with the remaining 6% undetectable. Students stopped working an average of every three minutes and thirty-eight seconds.
4. *Which distraction types were associated with students stopping (or continuing) working?* Levels of engagement during distraction varied by distraction type (see Figure 2). Students continued to work during 60% of the time where there were extraneous noises, 41% of the time when there was talking, 40% of the time during technology issues, 34% of the time while eating/drinking, 23% of the time when there was movement observed, 19% of the time

while they were simultaneously engaged with others, 17% of the time while they were looking away from the screen, 16% of the time while they were switching windows, and 4% of the time while they were using a cell phone. They disengaged from their work completely when they were using social media or walked away from their computer.

Figure 2

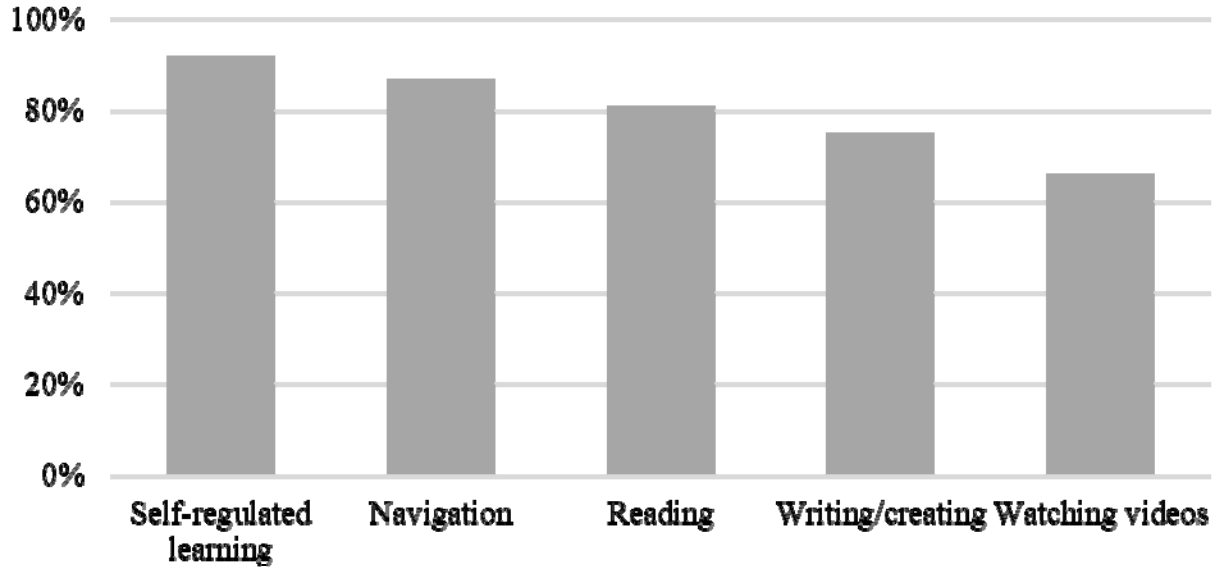
Percent of Time Engaged During Distraction by Type



5. *Which learning activities were associated with students continuing (or stopping) working?* Students appeared to remain engaged during distraction at different rates depending on the type of activity they were engaged in (see Figure 3). During self-regulated learning activities, students persisted through distraction and remained engaged 92% of the time, 87% of the time during navigation, 81% of the time while reading, 75% of the time while writing/creating, and 66% of the time while watching videos.

Figure 3

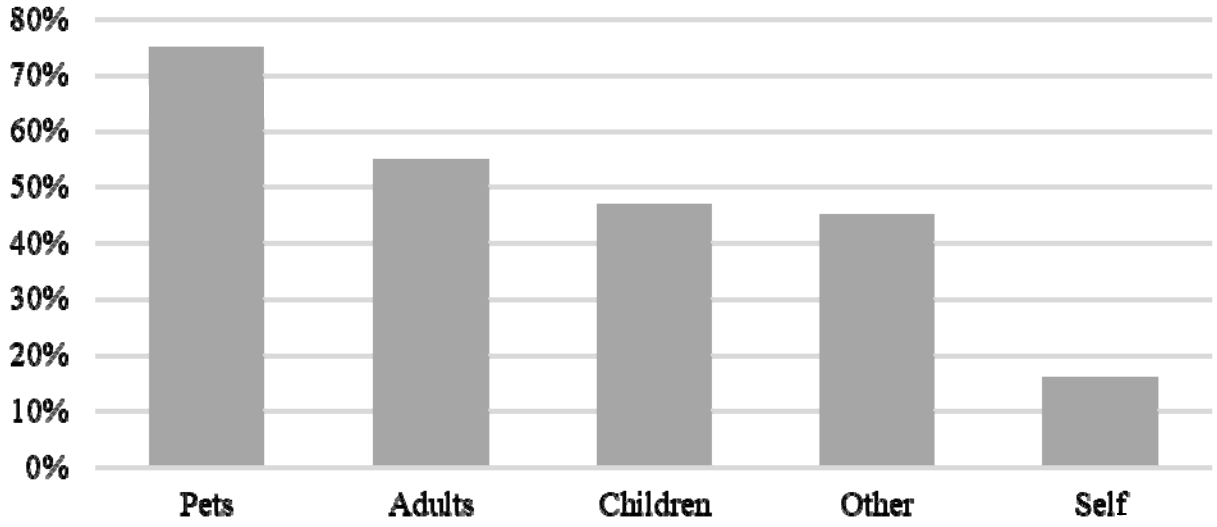
Percent of Time Engaged through Distraction by Learning Activity



6. *Who/what was the greatest source of distraction?* Students were their own greatest source of distraction, either by engaging in a different task other than the learning activities or choosing to respond to a distractor such as a child or message alert. Students were the source of distraction for 24% of the total recorded study time, with distractions from children accounting for 17% of the recorded study time, 9% by other sources, 8% by other adults in the environment, and 1% from pets.
7. *Was the source of the distraction related to whether they continued working?* The source of the distraction appeared to be related to whether the student continued to remain engaged (see Figure 4). Students were able to remain engaged during 75% of distractions from pets, 55% of distractions from other adults, 47% of distractions from children, 45% of distractions from other sources, and only 16% of distractions where they were the source of the distraction.

Figure 4

Percent of Time Engaged During Distraction by Source



Triangulation. Results were corroborated with interview data and voiceover reflection by participants of selected clips (Beach et al., 2021; Sezen-Barrie et al., 2014). Interview and weekly debrief transcripts were analyzed to identify qualitative data that supported the observations we made in the recorded video sessions. For example, one student appeared to remain engaged during loud noises her spouse was making while he was playing video games right behind her during one recorded study session. In her weekly debrief, she explained that she also plays video games and was easily able to tune out those noises. Other students explained that their level of engagement during distraction also depended on their interest in the content being studied and how applicable and engaging the assignment was.

After each student had completed recording at least three study sessions, we reviewed these recordings to select clips that we wanted the students to help us understand. We then met with each student again to play back those video clips. The reactions from the participants during this phase of the project included shock and disappointment. For example, in one student video reflection session, a student became upset while watching one of the clips we selected. Her son was very excited and interrupted her studies to tell her something. The student looked up briefly, saying, "Hey, you guys are triplets! Super cool. I love it," then went right back to her work. While watching this clip, the student teared up and said, "That was my, 'I'm really, really trying to engage with you and to give you what you need, but I can't right now.' That was awful." The participant was conflicted with doing her job as a student and doing her job as a mother and it was apparent in her emotional reaction to the clip.

Discussion

Results of our data analysis included high levels of distraction in the home during study sessions from children, spouses, and pets, with distraction experienced during an average of one-third of the total recorded study time. Interest in the content and instructional design were two factors that were related to maintaining engagement during distraction. Students remained more engaged through distraction during self-regulation, reading, and writing/creating activities and

responded more positively to courses that were systematically designed using effective practices in distance education.

The quantitative analysis described here averages all of the study sessions from the six participants, which is a small sample size. There was much variability between the participants on the amount of distraction that they faced from a low of 10% to a high of 60% of a total recorded study session. Therefore, these results cannot be generalized to the whole population. However, the data described here does provide some insight into the experience of adult learners as they participate in distance education.

Potential Concerns Regarding This Method

Potential concerns rest in technological complications such as a participant's camera not being turned on, their sound not working, or the participant not recording the study session. Because of the ecological validity that this method affords, sensitive events or information from the home environment of the participant may be captured in recordings that could cause distress for the participant. The screen recording only captures what we can see on camera. When a student reaches for something, has a conversation with someone off camera, or leaves the view, we do not know what is happening. Assumptions can be made, but at the risk of being inaccurate.

Screen recording analysis is a very labor intensive methodology. Analysis of videos and multiple coding strategies took a lengthy amount of time. Tools that would assist in automating this process or speeding the process up would be beneficial.

Suggestions for Using this Method and for Further Research

The quality of the recorded video and audio will determine the ability to accurately capture events in the screen recordings, so effort should be made to work with participants to optimize equipment. Some troubleshooting may need to be completed with participants before they record their sessions. Management of media and coding files should be considered during study planning. Screen and webcam recording could be combined with other data from tools using Harvard's Multimodal Toolkit (https://mmla.gse.harvard.edu), such as eye tracking or emotion detection; with physiological inputs like heart rate or electrodermal activity; and LMS data from log files to provide a more complete analysis of the learning experience. While our study helped to illuminate the experience of adult learners in distance education, we recommend using this method to study other populations, such as K-12 students in remote learning, traditional-aged college students, or other special populations.

Conclusion

The use of screen recording analysis in authentic environments as a methodology to understand the experience of adult learners in distant education is an innovative approach that proved beneficial in our research, however, we recommend future research in other settings to determine further benefits, feasibility, and limitations. The use of screencast, webcam video and audio recordings provided a modality for the researchers to collect data and analyze the learning techniques and distractions in the learners environment and how it influenced student learning.

This method in natural settings can be combined with traditional techniques, like participant report, to more fully understand the underlying experiences of the learner through screen observations.

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