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A POINT CONTINGENCY INCREASED WEBCAM USAGE IN A UNIVERSITY CLASSROOM[1]

UNA CONTINGENCIA DE PUNTOS AUMENTÓ EL USO DE LA CÁMARA WEB EN UN AULA UNIVERSITARIA

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Abstract

The use of online instruction has increased substantially in the last few years. An important aspect of remote instruction that has received some attention via survey-based research is student webcam usage. There are few empirical strategies to increase students' webcam usage. In the present study, we replicated a prior study by providing students with points contingent on webcam usage during remote college instruction. An alternating treatments design was used to assess the influence of the contingent point delivery on webcam usage. Twenty-four undergraduate students in a psychology course participated. The contingency enhanced webcam usage and the points served as effective reinforcers. A simple reinforcement contingency can improve webcam usage in a college classroom, but outcomes can likely be enhanced by including additional antecedent operations.

Keywords: reinforcement, webcam, learning, online instruction, antecedent operations

Resumen

El uso de la enseñanza en línea ha aumentado sustancialmente en los últimos años. Un aspecto importante de la instrucción remota que ha recibido cierta

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atención a través de investigaciones basadas en encuestas es el uso de la cámara web por parte de los estudiantes. Existen pocas estrategias empíricas para aumentar el uso de la cámara web por parte de los estudiantes. En el presente estudio, replicamos un estudio anterior proporcionando a los estudiantes puntos dependiendo del uso de la cámara web durante la instrucción universitaria remota. Se utilizó un diseño de tratamientos alternos para evaluar la influencia de la entrega de puntos contingentes en el uso de la cámara web. Participaron veinticuatro estudiantes de pregrado de la carrera de psicología. La contingencia mejoró el uso de la cámara web y los puntos sirvieron como refuerzos eficaces. Una simple contingencia de reforzamiento puede mejorar el uso de la cámara web en un aula universitaria, pero los resultados probablemente puedan mejorarse al incluir operaciones antecedentes adicionales.

Palabras clave: reforzamiento, cámara web, aprendizaje, instrucción en línea, operaciones antecedentes

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Online instruction has been a part of higher education for several years and of necessity became ubiquitous during the recent COVID-19 pandemic. Since stay-at-home orders have been lifted, remote instruction has persisted at a high level in many schools and overall has remained commonplace (Payares-Montoya, 2022). There are several modes of remote instruction. In synchronous remote instruction, teaching takes place in real time over a video conferencing platform, which allows for interactions among students and instructors in the moment.

Videoconferencing platforms provide students and instructors with the option of using their webcams (and microphones), observing, and listening to each other in real-time, which generally benefits students. Using webcams can facilitate non-verbal interactions between those in attendance and help to build interpersonal relationships and increase student comfort (Develotte et al., 2010; Gherheș et al., 2021). In addition, in some cases there is a positive correlation between the level of webcam usage by students and scores on examinations (Giesbers et al., 2013), and between the level of webcam usage and success in collaborative problem-solving (Baker, 2002). Another benefit of students using webcams during remote instruction is that doing so reduces the likelihood of their switching between academic and non-academic activities, which can interfere with learning (Kuznekoff et al., 2015; Redner et al., 2020; Rosen et al., 2011). Finally, if webcams are

used, professors can respond to students' non-verbal cues, such as a quizzical look, or "light-bulb" moments, and make important judgments about whether to continue discussing a topic (Angelo & Cross, 1993).

The benefits of students keeping their webcams on extend to instructors. A recent review of the literature (Lee, 2022) found that between 2020 and 2022, a lack of student webcam usage negatively impacted teachers' perceptions of self-efficacy, engagement, and well-being. Instructors rate themselves as more effective when they can observe students' body language (Mottet, 2000). Some instructors have also noted that they feel like they are talking to themselves or talking in a void when student webcams are off (Castelli & Sarvary, 2021). Unsurprisingly, most instructors prefer that students have their webcams on throughout class (Belt & Lowenthal, 2022).

Despite the possible benefits of their using webcams during remote instruction, many students do not use theirs during synchronous sessions (Gherheș et al., 2021). Castelli and Sarvary (2021) found that 90% of students did not turn on webcams during online instruction and Gherheș et al. reported that more than half of students preferred that their webcams were off.

Given the potential benefits of students using their webcams regularly, there is a need for simple, reliable procedures to increase webcam use in higher education. Lotfizadeh and Acosta (2022) developed such a procedure, based on the behavioral principle of positive reinforcement. In the reinforcement condition, students could earn 9.5 of 10 points by taking a quiz at the beginning of the session and the remaining 0.5 point by having their camera on during the lecture that followed. They were informed on the quiz, and by two slides presented during the lecture, that 0.5 points were available for keeping their cameras on. Two control (no-reinforcement) conditions, one with a 10-point quiz at the beginning of the session and one without a quiz, were arranged. On average across meetings, 18.3% and 10.5% of students, kept their cameras on under these respective control conditions. In marked contrast, 83.4% of students kept their cameras on in the reinforcement condition. By mistake, on one occasion the quiz did not mention the available 0.5 point for webcam use. On that occasion, only 34% of students activated their cameras. These results suggest that the quiz instructions used by Lotfizadeh and Acosta, not simply the opportunity to earn points for camera activation, may have been crucial to the success of their reinforcement arrangement.

Lotfizadeh and Acosta (2022) did not attempt to evaluate the function of these instructions and provided data indicating they may have an effect, only because of a lapse in procedural fidelity. One

possibility is that they served as an establishing operation (EO) (Michael, 1982). Rules can serve as EOs, which are environmental variables that increase the reinforcing value of designated stimuli (e.g., points) and the likelihood of occurrence of responses appropriate to the circumstance that produces such stimuli (e.g., webcam use) (Lotfizadeh et al., 2014; Poling et al., 2020). It is possible that describing on the quiz that 0.5 of 10 possible points could be earned via webcam use increased the reinforcing value of the half-point that was available for webcam use and evoked webcam usage. The EO was absent in the errant session, and this resulted in the reduced webcam usage. A problem with this analysis, however, is that essentially the same rule was provided after the quiz was taken, and it is unclear why it did not serve as an EO.

An alternative possibility is that the instructions may have functioned as a discriminative stimulus (S^D), which is a stimulus that evokes a particular kind of responding because historically that kind of responding has been more successful in producing reinforcement in the presence of that stimulus than in its absence (Cooper et al., 2020, p. 790). Participants in the Lotfizadeh and Acosta (2022) study had earned points for webcam usage only in sessions preceded by a statement on the quiz indicating that points were available, which may have established the statement as a verbal S^D. That S^D was absent during the errant session, and webcam use fell.

A third possibility, which we discuss later, is that the information provided by Lotfizadeh and Acosta (2022) on pre-lecture quizzes had both S^D and EO functions, which jointly increased webcam use. Regardless of why the procedure used by Lotfizadeh and Acosta was effective, if a simple contingent point delivery intervention is to be widely useful for increasing webcam usage, then that strategy must be effective across a range of pedagogical arrangements, not just in those that arrange pre-lecture quizzes containing information about the subsequent availability of points for webcam use. According to McDaniel et al. (2011), both pre- and post-lecture quizzes enhance learning and exam performance, however, the point contingency has not been examined in the absence of such antecedent stimuli when post-lecture quizzes are implemented. The purpose of the present study was to assess whether contingent point delivery for webcam use increased usage when such information was not provided. To do so we replicated the Lotfizadeh and Acosta (2022) study, with the exception that quizzes were administered after lectures rather than before to remove the contingency rule statement on the quiz and eliminate any EO effects it might have.

Method

Participants

Twenty-five undergraduate students enrolled in an upper-division psychology course at a public university in California participated in the study. One student was excluded from data analysis because for that student we provided supplemental resources and additional time during quizzes. This resulted in 24 participants being enrolled in the study (16 females and 8 males). We did not have access to demographic data for the participants in this study. The closest estimate is based on the most recent university demographic data. That survey revealed that most students were Hispanic/Latinx (72.1%), followed by Asian (11.3%), White (4.1%), Black or African American (3.3%), unknown (1.9%), two or more races (1.3%), Native Hawaiian or Pacific Islander (0.1%), and American Indian or Alaska Native (0.1%) (The Common Data Set, 2020). This study was submitted to and reviewed by the university Human Subjects Institutional Review Board (HSIRB) as an exempt study. The study evaluated typical classroom procedures using de-identified archival classroom data disseminated for the group (i.e., individual participant data are not presented).

Settings and Materials

All lectures were conducted remotely on the ZOOM™ (Version 5.3.1.) video conferencing platform. Zoom™ meets HIPAA compliance standards (Zoom, 2021). All students had access to the videoconferencing platform prior to the first lecture.

The study was conducted from August to November 2021 during the 16-week Fall semester. The students attended classes remotely from a location outside of the university or from a computer on campus. There were two lectures per week, each lasting 75 minutes. The students used personal computers, laptops, tablets, or phones to watch and listen to lectures. Based on verbal reports, all students had access to a videoconferencing device with a camera and had the skills required to turn on their webcams. All lectures were conducted synchronously.

Measurement and Analysis

The dependent variable was the percentage of students in attendance who had their cameras on during a pre-determined time in each lecture. This measure was selected because it was the same as that used by Lotfizadeh and Acosta (2022). The instructor took a screenshot of the meeting during the 30–45-min block of the lecture so that students who joined late were included. The instructor took the screenshot when there

was a transition in the lecture topic with a 5-10 s pause during the 30-45 min block. The instructor tallied the number of students who had their webcams on in the screenshot and tallied the total number of students in attendance on the screenshot. Webcam usage was defined as a student having their webcam on with any part of their head (above the neck) visible on the screenshot. The instructor gathered data during sessions that had a quiz. At the end of the lectures, the instructor divided the number of students who had their webcams on during the screenshot by the total number of students in attendance on the screenshot and multiplied the result by 100 to yield a percentage. The instructor did not inform the students when in lecture they would take the screenshot and gather webcam data. Visual analysis was used to analyze the data. In addition, we conducted a paired-samples *t*-test to compare the mean difference across the conditions ($\alpha = 0.05$).

Inter-Observer Agreement

The instructor served as the primary data collector. Another researcher served as the secondary observer. Both observers reviewed the screenshots and independently tallied the number of students with webcams on and the number of students present in each lecture. Each observer independently calculated the percentage of students in attendance who had their webcams on. Total count inter-observer agreement (IOA) was calculated by dividing the smaller percentage score by the larger score and multiplying the result by 100%. IOA was calculated for all sessions separately and was 100% for each of them.

Design and Procedures

An alternating treatments design was used to assess the effects of the intervention on webcam usage. During the reinforcement condition, a student would earn one point (10% of the daily quiz score) if their webcam was on during the lecture. During the no-reinforcement condition, points were not awarded for having their webcams on. The reinforcement and no-reinforcement conditions alternated semi-randomly, with each condition presented in no more than two consecutive sessions. Each session began with a lecture that was followed by a quiz. There were 13 sessions, six with reinforcement and seven without it. In the reinforcement condition, a total of nine points could have been obtained from answering the questions on the quiz and one point earned by webcam usage. During sessions without the reinforcement contingency, 10 points could have been obtained from answering the questions on the quiz.

Each quiz was dedicated to a particular book chapter, and it was administered after the lecture. There were seven chapters that required two lectures to cover the entire topic. When two lectures were required for a topic, the quiz was administered at the end of the first of two lectures and webcam usage data from only the first lecture was included in the study. During the mid-term and final exams, the students had the opportunity to earn an equivalent number of extra credit points as what could have been obtained from using their webcams by answering extra questions on the exams. This opportunity was provided to students in case various obstacles prevented them from using their webcams and was also available to students in Lotfizadeh and Acosta (2022).

Instructions for Intervention

When the reinforcement condition was in effect there was a statement on the lecture slides that specified that nine points could be earned on the quiz and one point by webcam use. The statement was presented twice (before data collection), once on the first lecture slide and once after the tenth slide so that tardy students could contact it. The statement was presented in red bolded font on the lecture presentation slide. In addition, the instructor read this statement to students:

> *If your webcam is on and you are visible throughout lecture today, you will obtain the final 1 point on today's quiz*.

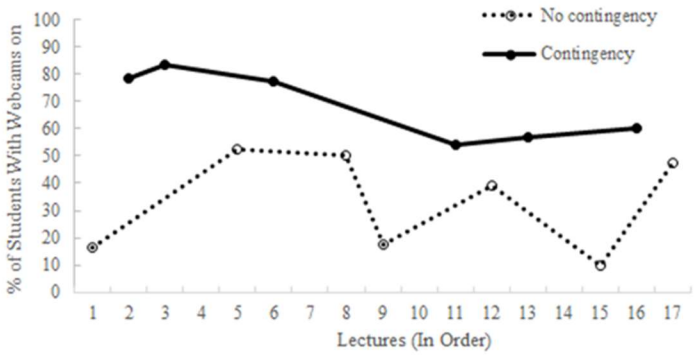
Results

Webcam Usage

There were on average 23.5 (*SD* = 1.4) students in attendance during lectures. The webcam usage data are depicted in Figure 1. When the reinforcement condition was in effect, a higher percentage of students used their webcams compared to the no-reinforcement condition. There was a slight descending trend in the data across time, but the data were not highly variable. The data for the no-reinforcement condition showed some variability with no apparent trend. The data points for the reinforcement and no-reinforcement conditions did not overlap. In the reinforcement condition, the data ranged across sessions from 54.2% to 83.3% of students with webcams on, with a mean of 68.4% (*SD* = 12.6). In the no-reinforcement condition, the data ranged from 10.0% to 52.2% of students used their webcams, with a mean of 33.3% (*SD* = 18.0). The results of the paired-samples t-test indicated that the reinforcement condition (*M* = 68.4; *SD* = 12.6) resulted in statistically significantly more students using their webcams than the no-reinforcement condition (*M* = 30.9; *SD* = 18.5), $t(5) = -5.775$, $p = 0.002$.

Figure 1

Percentage of Students in Attendance With Webcams on



Note. Lectures with a quiz only.

Discussion

Research findings suggest that students who keep their cameras on during synchronous sessions are likely to benefit from the practice (Baker, 2002; Develotte et al., 2010; Gherheș et al., 2021; Giesbers et al., 2013). Nonetheless, many students keep their cameras off during such sessions (Castelli & Sarvary, 2021; Gherheș et al., 2021). Given that webcam usage is valuable but far from high, there appears to be clear value in having an easy and effective strategy for increasing students' webcam usage in higher education. The reinforcement strategy used by Lotfizadeh and Acosta (2022) seems to be such a strategy. However, they arranged a quiz at the beginning of meetings, followed by a lecture, a format that would not suit all courses and instructors. The purpose of the present study was to systematically replicate and extend the research by Lotfizadeh and Acosta to another common pedagogical arrangement with different antecedent stimuli, one in which a lecture was followed by a quiz.

In the present study, allowing students to earn a point per session by having their webcams on, rather than answering a quiz question, increased the percentage of university undergraduates who used their webcams during online instruction to an average across sessions of 68.4%, compared to 33.3% in the no-reinforcement conditions. There was no overlap of the cross-session data paths for the two conditions. These findings demonstrate that simply making points available dependent upon webcam use substantially increases webcam use. The

procedure was simple and easy to use as well as effective and could be easily adapted to a broad range of higher education classes.

Although the procedure we evaluated was effective, it did not increase webcam use as much as the procedure arranged by Lotfizadeh and Acosta (2022). This is an interesting result because we used a larger reinforcer (one point) in our study than they did in theirs (0.5 points). Larger reinforcers are typically more effective at changing behavior (e.g., Roll, 2013). It is unclear why the procedure used by Lotfizadeh and Acosta was especially effective. One possibility is that it alerted students to the possibility of earning half a point through webcam use very early in the session, and this message was repeated later, during the lecture. If this were the case, presenting the initial message as part of a quiz was insignificant. However, webcam use fell substantially in the errant session when the initial message was not presented, which suggests that the initial message influenced behavior, probably by acting as an S^D. A second possibility is that seeing the quiz score, which was never higher than 9.5 out of 10, regardless of the answers given, might have functioned as an EO for points and increased the value of the remaining 0.5 points, which they were told could only be earned through webcam use.

In the Lotfizadeh and Acosta (2022) study, the absence of the final 0.5 points after the pre-lecture quiz may have functioned as an EO that increased the evocative strength of relevant S^D and the effectiveness of points as reinforcers. For an EO to evoke a response, an S^D or a stimulus resembling an S^D must be present (see Edwards et al., 2019; Poling et al., 2020). It is likely that if the quiz without all the points (i.e., a maximum of 9.5 out of 10 total points) served as an EO for points, then its effect was partially mediated through the contingency-specifying stimulus (i.e., rule) provided on the quiz. In the absence of such a mediating stimulus, we observed less robust effects than Lotfizadeh and Acosta. Additional studies are warranted to assess the influence of these antecedent events (missing 0.5 points) and stimuli (statements about the contingency on the pre-lecture quiz) on webcam usage by arranging two conditions during pre-lecture quizzes: (a) reinforcement with a statement about the webcam contingency on the quiz and (b) reinforcement with no statement about the webcam contingency on the quiz. Therefore, further research examining how to make reinforcement procedures maximally effective in increasing webcam use while keeping them simple and easy to use, consistent with desired pedagogy, and acceptable to students and instructors, is certainly merited.

There are three limitations of our study that should be mentioned. First, we did not measure learning outcomes to determine if there was an association between webcam use and student learning. Prior studies

have indicated a positive association between grades and webcams (Giesbers et al., 2013), but such an analysis was not possible here because webcam usage was not systematically controlled as an independent variable, it was our dependent variable instead. Future studies should assess learning outcomes and evaluate instructor behaviors that may be influenced by webcam usage. Second, there are likely to be student characteristics that influence students' webcam use, and we made no attempt to delineate differences between students who regularly used their webcams, during either or both conditions we examined. This is a worthwhile target for future research, there may be certain student characteristics that interact with webcam usage to produce better outcomes for some students. Third, although instructors and students have reported perceived benefits to student webcam usage (Castelli & Sarvary, 2021), we did not assess their perceptions as a function of the changes in webcam usage.

In summary, the present study builds on the literature on webcam usage by highlighting how a simple contingency can increase webcam usage for students in a university class. Reinforcement procedures have been used to increase various behaviors in the classroom (LeGray et al., 2010) and in other settings (e.g., Koegel & Frea, 1993), so the effectiveness of such a procedure in the present study and in the prior related study by Lotfizadeh and Acosta (2020) is neither surprising nor interesting from a theoretical perspective. However, its effectiveness should be of practical interest to people interested in the well-being of college students because it offers instructors an easy way to increase a response, webcam use, which is likely to benefit students. That said, it is important to recognize that there are legitimate reasons for a student not to use a webcam, and it is critical that students who have such reasons are not penalized for keeping their cameras off. Fortunately, that is easy to arrange with a reinforcement procedure, where students who do not use webcams can be given the opportunity to earn the same amount of points by performing other responses that are of comparable difficulty.

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