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A Review of the Effects of Virtual Communication on Performance and Satisfaction across the Last Ten Years of Research Published in the Journal of Organizational Behavior Management and the Journal of Applied Behavior Analysis

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Work and school settings have seen an overall increase in the use of virtual communication technology over the last decade (Kiers, 2020). This use of virtual communication technologies has seen an unprecedented growth in the year 2020 owing to the shelter-in-place and lockdown measures put in place due to the COVID-19 global pandemic (World Health Organization, 2020). Despite this increase in the use of virtual communication technologies, limited research has been conducted on the effects of delivering behavioral interventions through different virtual communication technologies on performance and satisfaction. The purpose of this literature review is to analyze the research conducted on virtual communication in two applied behavior analytic journals in the last decade (2011-2020) and compare the effects of the various virtual delivery mechanisms of behavioral interventions on performance and satisfaction in work and school settings.

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by

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The U.S. government and public health institutions set social distancing and personal hygiene guidelines in order to battle the COVID-19 pandemic in March of 2020 (World Health Organization, 2020). Each state went into lockdown through the state mandated shutdowns of offices, businesses, and schools (Wu et al., 2020). This caused many organizations and institutions to move to virtual instruction and working-from-home. With that, the opportunities to meet in person, talk face-to-face, and work together greatly diminished for both employees and students (Nguyen, 2020).

Though remote work was already on an upward trend before the pandemic (Kiers, 2020), the prevalence of remote work has increased significantly as a result of the state mandated shutdown. Until 2019, only 7% of civilian workers in the U.S. worked, at least in part, remotely. In April of 2020, 62% of Americans had worked online, figures that Pew states are double that of mid-March (Kiers, 2020; Pew Research Center, 2020).

Remote work in organizations uses virtual communication technology to exchange messages between two or more people. For this review, virtual communication is defined as any communication that is delivered via computer, smartphone, or other automated device. Computer-mediated communication (CMC) is any kind of human communication that takes place through networked computers, and includes communication delivered by a person in real-time (e.g., videoconferencing) and through recorded videos and modules (e.g., computer-based instruction/training) (Lee & Oh, 2015). CMC involves the exchange of text, audio and/or video messages on a one-to-one, one-to-many and many-to-many formats (Lee & Oh, 2015). Thus,

virtual communication can be defined, as Berry (2011) does, as: “the process of transferring information, meaning, and understanding between two or more parties”. For this study, virtual communication will be defined as people using the previously described technology to transfer this information, when they are not face-to-face.

Non-Behavioral Research on Virtual Communication

Researchers in other fields have completed comprehensive literature reviews on the research on virtual communication. Abarca et al. (2020) conducted a review of the journals available in the “Web of Science (WoS)” and “Scopus” databases. This review was published in the online engineering journal, *IEEE Access*. The two databases were reviewed to identify studies that: (a) described and dealt with any aspect of the communication, collaboration and coordination of virtual teams; (b) considered a virtual team as a relationship for communication, collaboration, and coordination between its members; (c) provided a clear link or contribution to the different aspects of communication, collaboration, and coordination in virtual teams; and (d) had main objectives that were clearly and sufficiently described and explained, and the methodology proposed appropriate steps to address the research problems and answer the research questions.

The authors conducted a systematic literature review (SLR) and a bibliometric analysis of research conducted between 2015 and 2019 on virtual teams working on programming projects. They used the search terms and keywords which included and were related to “*virtual team(s)*” and “*virtual collaboration*”. The review focused on three main themes: (a) the main areas and topics of current research in virtual teams, (b) the main constructs that had been investigated in current research on virtual teams, and (c) the gaps in existing research and possible areas for future research.

The review found that the main topics of current research in virtual teams were those which used the keywords: “virtual reality”, “management”, and “project management”, while the term “leadership” appeared the least. The constructs investigated were: the technology used for remote relationships (the delivery mechanism), trust (between members of a team), communication technologies used (e.g., Skype, WebEx), equipment needed for virtual communication (e.g., computers, tablets), leadership (how effective leaders were in inspiring the team), and education (about the importance of collaboration in virtual teams). The gaps in existing literature were: a lack of understanding of the new organization style of virtual teams owing to new technologies being developed for collaboration, and a lack of research concerning emotions and their influence on performance.

While this review provided insight along the three main themes, one limitation of the review was that it did not provide sufficient information about how this review could help guide future research. The authors aimed to prove that using a systematic literature review with a bibliometric review was effective in finding relevant articles for their study, but the review did not mention how the relevant articles found could help further research or be applied in real-world settings. Abarca et al. (2020) also did not provide any recommendations to virtual teams about how they could improve their communication via virtual delivery mechanisms, using the results of the review.

Layng (2016) analyzed studies published in business and management journals between the years 2000 and 2015 with a goal to help employers improve their virtual skills, and to correct communication breakdowns within virtual teams. The author included studies that: (a) set clear rules or expectations when using certain types of technology, (b) defined effective work completion, (c) laid out general team norms and expectations, (d) included timelines and

specified team member outcomes, and (e) used documentation systems. He found that team performance improved when the use of CMC was followed by face-to-face interactions between team members, but not when CMC was used alone. The author attributed this to the limited virtual communication media available at the turn of the 21st century. Layng (2016) observed from the articles that communication between team members was effective in improving performance only when face-to-face interactions preceded virtual communication. The author noted an increase in the effectiveness of virtual teams alone without face-to-face interactions as virtual communication technology advanced and became more sophisticated.

The review found that studies published in this time period predicted that businesses' and organizations' future success would depend on their ability to effectively use the ever-evolving virtual communication media to guide team performance. The review also concluded that most of the virtual communication that took place in organizations between 2000 and 2015 was text-based (e.g., emails, direct messages). Furthermore, it was found that video and audio communication became more common after video-conferencing software became more mainstream in the later years of the review (from 2010 to 2015). The author further argued that the challenges to virtual communication were trust, time conflict (when team members were working from different time zones), cultural differences (among teams with members from different countries/ethnicities), and the need for a "robust collaborative workspace" (the need for members of the team to actively engage in team meetings and collaborate among themselves without the need for manager intervention) .

Behavioral Research on Virtual Communication

Since the beginning of the 21st century, there have been 30 literature reviews conducted in the *Journal of Organizational Behavior Management (JOBM)* and 49 literature reviews

conducted in the *Journal of Applied Behavior Analysis (JABA).* Of these, two reviews—one in JOBM (Johnson and Rubin, 2011) and one in JABA (Siravaman and Fahmie, 2020)—were related to virtual communication. Johnson and Rubin (2011) analyzed virtual communication in terms of computer-based instruction (CBI)—a CMC training package which involves videos and online modules. Siravaman and Fahmie analyzed virtual communication in terms of providing ABA-based telehealth services—which used videoconferencing to deliver behavioral interventions.

Johnson and Rubin (2011) searched the PsycINFO database for articles related to CBI published between the years 1995 and 2007. These articles were filtered and studies which compared interactive computer-based instruction with another form of instruction were included for further investigation. These included: (a) alternative interactive CBI methods, (b) non-interactive CBI, or (c) non-computer-based instruction, were included for further investigation. Studies were also only added if the participants of the studies were employees or employee analogs.

Based on the inclusion criteria, 79 studies were finalized for review. Of the 79 studies analyzed in the review, 42 compared interactive CBI with other instructional formats. Of these, 27 applications showed that participant performance improved through the use of interactive CBI (64.3%), 13 applications found no differences in performance between interactive CBI and other instructional formats or mixed results (31%), while two applications found that another instructional format improved performance over interactive CBI (4.8%). Hence, interactive CBI was found to be a better option than the comparative instructional alternatives (i.e., alternative interactive CBI methods, noninteractive CBI, or non-computer-based instruction) 95.2% of the time.

Sivaraman and Fahmie (2020) systematically reviewed cultural adaptations in the global application of ABA-based telehealth services outside of the United States. Their framework used for organization had three main themes: (a) community outreach, (b) changes in the structure and process of service delivery, and (c) adaptation of content. The inclusion criteria for the review was: participants were families living outside of the United States, measures of child or parent behavior were reported, and the treatment was behavior analytic and delivered via telehealth. The authors deemed 36 articles eligible. Nine of these studies were finalized for the review. The information extracted from the studies was: participant characteristics, procedural aspects of the study, barriers to telehealth/barriers to direct services reported, and results. These adaptations were coded into three broad categories, which were: community involvement, changes in the structure and process of delivery, and adaptations made to the content.

Overall, the results of the review showed that the most popular forms of adaptation were changes to the structure and process of service delivery, and the involvement of members from the community in the development or implementation of the training. The results further showed that eight out of nine studies involved members of the community in the development and implementation of the trainings. All nine studies featured changes in some aspect of the structure and process of service delivery while also matching the training language to that of the client. Two studies provided details about adaptation of content such as level of personal specificity and inclusion of cultural content. All nine studies reported the unavailability of ABA services and trained behavior analysts as a barrier to direct services. Seven out of nine studies reported problems related to poor internet connectivity. All nine studies reported parent/intervention fidelity measures while seven studies reported child behavior measure. Six out of nine studies conducted social validity data (each study scored the training favorably).

Sivaraman and Fahmie (2020) concluded that a lack of trained ABA practitioners in the clients' regions was a major barrier to direct services. All reviewed studies reported improvements in the fidelity of implementations for the adult participants. Two of the studies observed changes in child performance and the results reported desired behavior change in child participants for both studies. The authors of the review addressed the limitation of their review stating that though cultural adaptations in the reviewed studies were identified, data was not taken to evaluate which cultural adaptations were effective, how the adaptations worked together, and what impact the adaptations have on participant behavior. In terms of the delivery mechanism, the review asserted that delivering behavioral interventions via telehealth using delivery mechanisms such as videoconferencing showed high satisfaction among the adult recipients of the ABA-based training and services, while improving the performance of the child participants in the studies receiving ABA services. These results suggest that delivering behavioral interventions through virtual mechanisms improves performance and satisfaction.

Both JOBM and JABA have published various empirical studies that have analyzed virtual communication technology. For example, JOBM has published articles that assessed the effectiveness of using CBI (Chae et al., 2020: Day-Watkins et al., 2018; Fagerstrom, 2010; Jamison et al., 2014; Mailey et al., 2020; Pandey et al., 2016), and automated devices (Gravina et al., 2013; Goomas, 2012; Yu et al., 2013) to deliver behavioral interventions to improve performance. Similarly, JABA published studies that evaluated the effectiveness of using CBI (Brodhead et al., 2019; Clark et al., 2015; Critchfield, 2014; Curiel & Poling, 2019; ; Dallery et al., 2013; Downs et al., 2015; Dupere et al., 2013; Geiger et al., 2018; Higbee et al., 2016; Jarvis & Dallery, 2017; Koffarnus et al., 2013; Kurti & Dallery, 2013; Retzlaff et al., 2020; Rosales et al., 2015; Scheithauer et al., 2013; Schnell et al., 2018; Scott et al., 2018; Townsend, 2020;

Vladescu et al., 2012), smartphones (Dallery et al., 2021; Raiff et al., 2016), and automated devices (Stedman-Falls & Dallery, 2020) to deliver behavioral interventions to improve performance.

Despite the considerable research published in JOBM and JABA assessing virtual communication, there have been no literature reviews which compare the effects of the virtual communication medium used—for the delivery of behavioral interventions—on performance and satisfaction.. Hence, this review will add to the literature in applied behavior analysis (ABA) by systematically analyzing the aspects of virtual communication and its delivery mechanism which are able to affect performance and satisfaction.

The Current Study

The purpose of the current study will be to examine the effects of virtual communication media on the performance and satisfaction of people who work or study remotely. This review will add to the literature available on virtual communication in applied behavior analysis by providing an assessment of the effect that each medium of virtual communication has on participant performance and on satisfaction in remote work or remote learning settings. Understanding the effects of these different approaches may help produce better work performance and learning outcomes as virtual communication becomes more common.

Method

The experimenter will review the PsycINFO database for all empirical studies published in JOBM and JABA over the past ten years (2011-2020). The results of the search will then be further filtered, and articles will be excluded if they meet any of the following conditions: (a) implemented in an analog or laboratory setting, (b) do not report empirical data, (c) book reviews, (d) discussion articles, or (e) conceptual papers. The resulting articles will be

downloaded and individually reviewed using the following search terms: *virtual, remote, virtual communication, video-based, video-modeling, audio-based, computer-based (or CBI), smartphone, text-based, telehealth, email, eLearning, internet-based, web-based, online, technology-based.* After this manual inspection of the filtered documents, the empirical studies which match any of the search terms will be reviewed.

Coding Categories and Reasoning

The articles will be analyzed in terms of evaluation parameters referred to as coding categories in this section. The use of these coding categories will form a basis for the critical comparison and analysis of the reviewed studies. Each study will be categorized based on its effects on participant performance and satisfaction. Researchers will code each article using the following on the basis of: (a) delivery mechanism, (b) independent variables (IV), (c) dependent variables (DV), (d) setting, (e) intervention source, (f) participant, (g) results, and (h) social satisfaction.

Delivery Mechanism

The virtual communication media used to deliver interventions may affect the discriminative effect of the antecedents and/or the reinforcing or punishing value of the consequences delivered. It is important for behavior analysis research to evaluate the delivery modalities used in virtual communication, and to assess their differential effectiveness in delivering antecedents and consequences. The delivery mechanism used for the interventions in each study of virtual communication will be further categorized into one of three broad categories of delivery mechanisms, which are: (a) computer-based, (b) phone-based, and (c) other element.

Computer-based. For the purpose of our review, a computer could be either a desktop computer, a laptop, or a tablet (iPad or android). Anticipated computer-based delivery mechanisms are: online modules, wireless scanners, software, video modules, web conferencing (through apps such as Zoom, WebEx), video modeling (with embedded instructions/ with voiceover instructions), and other (which will capture any computer-based delivery mechanisms not adequately captured by the aforementioned categories).

Phone-based. A phone-based delivery mechanism would deliver interventions using phone calls, instant messages, direct messages, downloaded applications, or text messages through smartphones (Android, Apple, Windows).

Other Element. An intervention delivered through a mechanism which is not computer-based or phone-based will be added to this category (e.g., a hand-held scanner).

Independent Variables (IVs)

By categorizing the independent variables (IVs) used in each study, future researchers will be provided with an overview identifying which behavioral interventions have been delivered via virtual communication technology in previous studies, how many times each intervention has been studied, and how effective each intervention is in changing behavior (improving performance). This may help future researchers decide whether it would be appropriate to choose interventions for their studies that have been assessed multiple times in the past. Furthermore, it may also identify opportunities for future researchers to replicate studies that may not have been researched sufficiently. Subsequently, this will help to find gaps in literature for interventions that have not yet been analyzed using virtual delivery methods. For example, if the review shows that feedback, as an IV, has been delivered virtually in a variety of studies and each study shows a constant effect of feedback on performance, this could mean that

there is little need for researchers to replicate a similar study as the effect would probably be the same. The anticipated interventions in these studies will be: training, feedback, prompts, authority relations, instructions, monetary incentives, functional analysis, task analysis, preference assessment et cetera.

Dependent Variables (DVs)

Similar to the IVs, it is important to categorize the dependent variable used in each reviewed study in order to discern the effect of the intervention, delivered virtually, on participants' performance. Doing so could help future researchers analyze whether changes in the DV being used in a study effectively translates to changes occurring in performance. This may guide future researchers to replicate a study using a different measurement of the DV which more accurately reflects changes in performance. For example, if studies that use "time between responses" as the DV consistently show mixed or no effects for various combinations of the other categories (i.e., various delivery mechanisms and settings), this can guide future researchers to investigate whether "time between responses" is an appropriate DV to measure for those interventions, or if future research should look at the interventions using other DVs. The anticipated dependent variables that will be identified in the current review are: scores on tests, percentage of steps implemented correctly, time elapsed to complete task, percentage of time spent on-task, resources consumed or saved, number of correct responses, percentage of correct responses, accuracy of implementation of steps, levels of dependent variable, number of times desired performance was reached et cetera.

Length of Study

Whether a study is effective in changing behavior or not can also be influenced by the length of time the study was conducted for. This means how long baseline data was taken for,

how long the intervention was, and how long data was taken for. For example, if baseline data for a study is taken for only a few days, the results obtained by experimenters from this data may be inaccurate due to confounding variables. This could result in either a Type-1 error or a "false positive" or a Type-2 error or a "false negative". Analyzing the length of each study reviewed can help guide research by ensuring that future studies record data for an adequate amount of time. The length of a study can be measured in: hours, days, weeks, months et cetera.

Follow-up Data

After an intervention used in a study in successfully implemented in a real-world setting, researchers may choose to return to the site of the intervention and take follow-up data. Follow-up data helps confirm or deny whether the intervention was able to persist in the real world for an extended period of time after the experimenters concluded the study. This may help guide future research by assessing the longevity of the intervention used in a study. There can be various reasons why a follow-up study could reveal that an intervention did not persist in the real-world setting. This can be due to increasing cost issues, employee dissatisfaction, issues with motivation et cetera.

Setting

It is important to distinguish the effects of the setting of a study on its effectiveness on performance and satisfaction. Different settings mean that different environmental factors may come into play and affect performance. For example, a video modeling intervention might be more effective in changing the behavior of a child with autism spectrum disorder (ASD) when it is delivered at their school than it would be if it were delivered in the child's home. This may be because the discriminative stimuli that occasion the child's behavior could be different in the school than they are at home. Hence, the work or school setting used in each study will be coded.

Each setting would be classified as either a school (i.e., K-12 schools and special education schools), a university, a home (i.e., client home, employee home), a healthcare clinic (e.g., autism center, disability center, old-age home, nursing home, hospital), community (for studies which recruited participants from the community via flyers or adds), an office (i.e., any setting with desk-related jobs), a manufacturing plants et cetera.

Intervention source

Intervention source means the person, or the technological device which delivers the antecedents and consequences to the participant(s). The effectiveness of an intervention, delivered virtually, can be affected by the intervention source. This is because one source may not be able to provide the same reinforcers or punishers to the participants that another source can (e.g., the reinforcing effect of attention from a parent might be different than the reinforcing effect of attention from a babysitter). This will aid future researchers in choosing effective intervention sources based on the participants used in future studies. These sources comprise of: (a) experimenters, (b) automated devices, (c) bosses (i.e., managers and supervisors), (e) employees, (f) teachers, et cetera.

Participants

The reinforcing or punishing value of a consequence can be affected by the sample of participants recruited, and hence affect the results of the study. Since every study focuses on one particular category of participants, it can be comprehended in that category and context only. For example, studies that used school children as participants cannot be replicated using participants who are employed adults. Therefore, it is very important to code each study with the relevant category of participants. This will have a two-fold advantage for future researchers. Firstly, they would be able to replicate studies belonging to the same category of participants, on different

data sets. Secondly, they would be able to identify research gaps that show which category needs further exploration and exploitation. Based on the initial inspection of the literature, anticipated participants will contain: students (K-12 and special ed students), employees (office or healthcare), administrative staff, parents (of individuals with autism), teachers (K-12 or special ed teachers), therapists (i.e., behavior analyst and counseling therapists), individuals with developmental disabilities (i.e., children with autism, adults with amnesia et cetera) and others (i-e., community members and participants who do not fall into any of the predetermined categories)

Results

The results section can guide future research by identifying the interventions which have resulted in a change in performance. This change could be an improvement in performance, worsening of performance, or no/mixed effects on performance. Furthermore, changes in performance need to be correlated with the other coded variables identified in the method section. For example, if there is a consistent improvement in performance as analyzed by different researchers, in different settings, for different IVs, and different categories of participants, while only the delivery mechanism (e.g., CBI) remains constant, this research can safely infer that CBI has been established as improving performance in diversified settings and environments. This can also help identify gaps in the literature if the performance does not consistently improve for a variable when other variables are changed. This would mean that researchers should try to explore other avenues in this research domain. This section will be coded as one of three categories: (a) performance improved, (b) performance worsened, or (c) no effect or mixed effects.

Performance improved. The results would be defined as improving performance when the intervention in the study being reviewed results in an increase in the desired performance over baseline for all participants. The desired performance would have to improve over baseline for all participants in the intervention group and not improve over baseline for the control group for the result to be coded as improving performance.

Performance worsened. The results would be defined as deteriorating performance when the intervention in the study being reviewed results in a decrease in the desired performance over baseline for all participants. The desired performance would have to deteriorate over baseline for all participants in the intervention group and either not be affected or improve over baseline for the control group for the result to be coded as deteriorating performance.

No effect or mixed effects. The results would be defined as not affecting performance when the desired performance does not change over baseline for any of the participants. Slight variation in the performance is typical even during baseline, but as long as the change is deemed to be statistically significant by the experimenters, the result will be coded as "not affecting performance".

Social satisfaction

Social Satisfaction measures include efforts to collect participants' opinions about the experiment to assess whether the participants were satisfied with the intervention. These are important as they help to assess the social validity of a study, which predicts the chances of the intervention being implemented in the real-world setting. Studies reporting higher social validity have a better chance of their intervention being implemented and maintaining over time after the conclusion of the experiment. Hence, studies reviewed will be coded by whether the researchers

took social satisfaction data (took steps to collect and analyze social satisfaction data to see whether the effects of the study are seen as satisfying to the participants), or not. For the studies that did take social satisfaction data, the results of the social satisfaction data will be coded as either: (a) satisfied (if every participant in the study reports being satisfied with the intervention and delivery mechanism), (b) dissatisfied (if every participant in the study reports being dissatisfied with the intervention and delivery mechanism), and (c) mixed results (if some participants report being satisfied, while others report being dissatisfied with the intervention and delivery mechanism)

Interobserver Agreement

To ensure accuracy of data and agreement between authors, a research assistant will independently review 40% of the articles. For every category described above, interobserver agreement (IOA) will be conducted using the total agreement method by dividing the number of agreements by the total number of agreements plus disagreements and then multiplying by 100%. If there are any discrepancies between the results of the two reviews, the primary author and the secondary author will discuss and come to a unanimous decision regarding the studies in question.

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