

# Webcams In Virtual Teams: Perceptions Of Impact On Interactions And Effectiveness

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## ABSTRACT

*Virtual teams have proliferated as businesses realized benefits in coordinating across geographic and departmental boundaries. With the increase in quality and availability of video over the Internet, there are opportunities to improve effectiveness of virtual teams by integrating videoconferencing into synchronous meetings. The purpose of this qualitative study is to evaluate the impact of video on team interactions and effectiveness. Results showed a relationship between the added richness and authenticity brought about by video and increased effectiveness, while also showing a relationship between the increased stress of learning new technology and decreased effectiveness. These relationships provided the basis for a proposed theoretical model that describes the impact of webcam utilization on virtual teams as a function of time along five key dimensions: authenticity, focus, stress, learning technology, and effectiveness.*

**Keywords:** Virtual Teams; Team Effectiveness; Communication; Technology; Video; Webcams

## 1. INTRODUCTION

The popularity of teams to accomplish tasks once done by individuals or departments arose in the second half of the twentieth century with the Quality movement (Deming, 1986). With the advent of the Internet and personal computers, communication technology provided a tool for bringing dispersed teams together more frequently and at lower cost compared to the more common face-to-face meeting (Kimble, 2011). Because of the obvious benefits to the bottom line, there has been growing interest and use of geographically dispersed virtual interactions to accomplish what face-to-face meetings did in the past. Geographic separation, time differences, and leanness of communication media can add to the friction within the team environment (Daim, et al, 2011). The purpose of this study is to examine the use of web-based video in a virtual team and identify the key dimensions of impact.

## 2.0 LITERATURE REVIEW

This section contains a brief review of the literature related to the characteristics of virtual teams, communication and technology issues, trust, and effectiveness.

### 2.2 Virtual teams

A review of virtual teams research summarized the characteristics of virtual teams as: “small, temporary groups of geographically, organizationally, and/or time-dispersed knowledge workers who coordinate their work predominantly with electronic information and communication technologies in order to accomplish one or more organizational tasks” (Ebrahim, Ahmed & Taba, 2009, p. 2655). A typology proposed by Bell and Kozslowski (2002) identifies two key differences between conventional teams and virtual teams: dispersed locations and technology-aided communication. Despite the cost and time advantages offered by virtual teams, many teams fail to live up to their potential (Greenberg, Greenberg, Antonucci, 2007). Three categories of issues can reduce

effectiveness: communication issues, technology issues, and trust issues.

### **2.2.1 Communication issues**

Mehrabian's (1981) studies in the late 1960s identified a now-classic breakdown of verbal, tone, and non-verbal communication. He stated that people determine what they liked or disliked based on 7% verbal communication (i.e., words), 35% vocal tone, and 55% body language. In virtual teams, with technology stripping off layers of the richness of face-to-face communication, virtual communication can easily lead to misunderstandings (Ebrahim, et al., 2009). "Technology-enabled communication does not convey the same richness of emotion and reaction that face-to-face communication enables" (Greenberg, et al., 2007, p. 327). Adding richness to the communication channel through the use of video might permit team leaders to notice the combination of verbal and nonverbal behaviors, allowing them to diagnose potential problems more rapidly (Jones & LeBaron, 2002). Team leaders can also use the context of individual work settings to facilitate communication. Jones and LeBaron suggest that further research is needed in the "interface of verbal and nonverbal behaviors and technological means of communication." (2002, p. 512)

### **2.2.2 Technology issues**

There is an expectation that the more communication technology that is available, the better the team experience will be; however, when new technical capabilities are used within virtual teams, it has been noted that there is a significant initial drop in effectiveness (Ebrahim et al., 2009). Technology adds a new dimension to "free riding" (Greenberg, et al, 2007) because distance removes team members from having to physically face each other. Multitasking is another issue that has arisen as a result of the improvement in technology (Bannister and Reminyi, 2009). Given the technological ability to work with multiple computer programs or monitors, and the physical rate of normal speech of 125 words/minute while the mind works at about 400 words/minute (Nichols, 1960), multitasking has proliferated in virtual communication (Benbunan-Fich & Truman, 2009).

### **2.2.3 Trust in virtual teams**

Trust can be more challenging in virtual teams than traditional teams because of the lack of direct social pressure that comes from personal contact (Cascio, 2000; Handy, 1995). Jarvenpaa, et al. (2004, p. 251) said that "trust has direct positive effects on cooperation and performance" and Ebrahim, et al (2009), identified trust as a key element in successful virtual teams. Trust may become the primary determinant as to whether or not team members believe the project will be successful (Peters & Karren, 2011). Although, even if trust is high in a team, it is not a reliable predictor of team effectiveness as research has shown no correlation between trust and team success (Jarvenpaa, et al., 2004). Others have found that trust in virtual teams is built through performance (e.g., timely responses) rather than social interactions and emotional attachment, which are common when building trust in traditional teams (Peters & Karren, 2011).

## **2.3 Effectiveness of virtual teams**

Traditional methods of monitoring team effectiveness by evaluating the inputs, processes, and outputs of the team may not be adequate for virtual teams (Bosch-Sijtsema, et al., 2011). If team effectiveness is defined (Kahai & Cooper, 2003) in terms of decision quality, time required for decision-making, and consensus, then increasing media richness through the use of video conferencing should help in four ways: (1) adding multiple cues with the use of body language, (2) providing rapid feedback and clarification of meaning, (3) adding personal feelings and tailoring the communication to the needs of the recipient, and (4) language variety resulting from a wide range of symbols that can be used to convey meaning. This suggests that richer media, such as videoconferencing, should be more useful for tasks that are ill-defined and complex. Results of Kahai and Cooper's study, however, would indicate that richer media is not always relevant. Simpler media may be better when team members are not familiar with the task, as adding complex technology can add frustration. Richer media may be useful when the team leader is concerned with free riding because it "enables multiple cues and immediate feedback [that] will result in greater total socio-emotional communication. Greater total (positive and negative) socio-emotional communication lends to increased task-oriented communication" (Kahai & Cooper, 2003, p. 268).

### **3.0 METHOD**

The study is exploratory in nature, using the Constant Comparative Method (CCM) based on grounded theory (Glaser and Strauss, 1967; Strauss, 1987; Glaser, 1992) to study in depth a specific autoethnographic case study (Ellis, Adams, and Bochner, 2011). It was conducted in a larger analysis context that applied mixed qualitative methods to address the issues of validity, reliability, and solidification. For this case study, all data was collected from the subjects over a seven week period before analysis was conducted. Consequently the CCM was applied retrospectively, examining the data in time-order established by the subjects.

#### **3.1 Research objective**

Virtual teams are a significant development in the way organizations accomplish their work. Recent technological developments and their impact on the work of virtual teams is not fully understood. One such technological development is the increasing use of video webcams. This study sought to examine how the addition of webcams influenced the work, interactions, and effectiveness of a virtual team.

#### **3.2 Subjects**

The subjects in the study were a virtual team consisting of six business faculty collaboratively working on research projects. The team consisted of five men and one woman operating in geographically separated locations in the United States. Prior to the start of the study, the team had met for approximately one hour weekly using a web conference tool that allowed the leader of the team to share video of himself via webcam and also provided a chat tool. All subjects interacted by phone and only the leader could be seen via video.

#### **3.3 Data collection**

The virtual team met for one hour each week to discuss and develop projects. Each subject created an audio log following the virtual team meetings to capture their reactions to the use of webcams in the meetings. The logs were structured around four topics:

1. What impact did video have on your team experience? Why?
2. What impact did video have on the development of trust in your virtual team? Why?
3. What impact did video have on your own effectiveness? The effectiveness of your team? Why?
4. Other comments.

Seven sets of logs were created for seven meetings, including an initial baseline before the virtual team began using webcams for all subjects and six weekly logs after the webcams were in use. The audio logs were independently transcribed and the CCM researchers provided with the transcripts.

#### **3.4 Data analysis**

ATLAS.ti software was used to manage the qualitative analysis of the transcripts. Consistent with the CCM approach, the transcripts were organized by subject by week so that codes were developed in time-order relevant to the transcripts. CCM was applied by thematically coding the logs in time order, refining and adding themes between each week of logs. For each set of logs, the following essential steps were used (Boeije, 2002):

1. Each researcher independently developed and applied thematic codes.
2. Researchers exchanged their code books and collaborated on differences, creating a unified codebook.
3. Each researcher re-applied the unified codebook to the logs.
4. Inter-coder reliability (ICR) was examined using Fleiss' Kappa as calculated by the Coding Analysis Toolkit ("CAT," 2010). ICR was used as a collaboration tool for discussing coding differences, not as a means for quantitatively assessing solidification (Marques & McCall, 2005).
5. Researchers collaborated on improvements to the unified codebook in preparation for thematically coding the logs for the next week.

All seven sets of logs were analyzed in this manner, creating a final unified codebook, which was then reapplied to all logs in time-order by each researcher.

Thematic coding of the subjects' logs resulted in the unified code book with a total 47 themes. During the coding process, the researchers found the trend of themes to be particularly interesting and focused the analysis of the themes with the most variability as a function of time. This consisted of 18 themes, shown in Figure 1. Subjects were increasing, decreasing, or otherwise changing their focus regarding the impact webcams had on virtual team interactions over the seven weeks they logged their perceptions. For example, technical issues were encountered by most subjects as they initially used the webcam capabilities of the web conference system.

To identify such trends, the coding pattern of each theme was analyzed as a function of time by summing the quantity of instances a code was applied per log and then normalizing the quantity across all seven sets of time-ordered logs. This resulted in patterns of themes not weighted by quantity of coding instances – the pattern is meaningful, not the number of instances of a code. To construct this analysis, the coding table was exported from ATLAS.ti to Excel the patterns visually constructed, shown in Figure 1. The small bar chart for each theme indicates the normalized instances of the theme occurring in each log progressing from the Baseline on the left through Week 6 on the right. Note that the first bar in the pattern is for the baseline logs before webcams were used by the entire team; only the leader of the virtual team was sharing video. All members of the virtual team used webcams during the team meetings starting in Week 1.

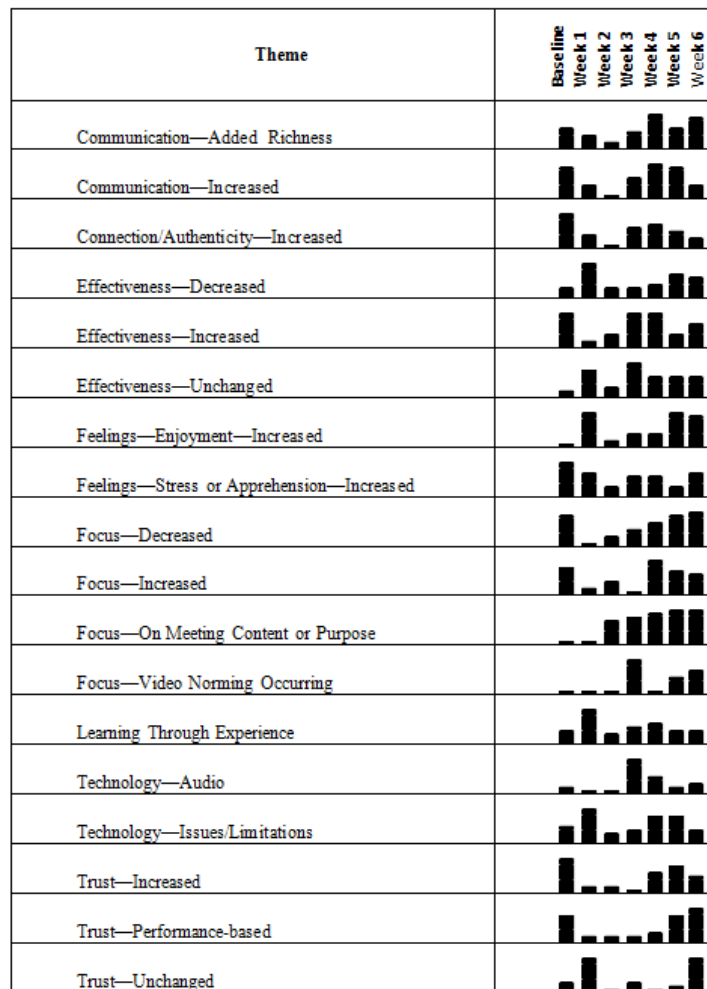


Figure 1. Patterns of themes based on normalized coding instances as a function of time.

## 4.0 DISCUSSION

The following is a discussion of each theme shown in Figure 1. These themes were chosen due to the subjects' change in perceptions of each over the duration of the study timeframe.

### 4.1 Communication

*Added Richness* conveyed the subjects' ability to use the video as an additional means to express themselves, allowing for more or different forms of creativity, added use of humor, and incorporation of body language. Video provided new ways to interact. The coding results for *Added Richness* showed that incorporating webcams was initially recognized by the virtual team as a benefit and remained a strong theme throughout all seven weeks. One subject summarized the value and potential of this added richness in week 7: "Again, the understanding of focus and are they really listening and did they understand that has some benefit, but I believe it could be improved dramatically if one were to include hand motions more than what we are in the team process."

*Increased Communication* captured the subjects' perception that webcams increased communication effectiveness between team members. It provided a way to check for engagement and participation; to see if others look alert. Subjects shared: "... I found the video to be more important than I expected it to be. I think the primary impact of the video is on trust and not so much effectiveness" and "I was also surprised at how much people tell me. I think it's related to the video, because you can see people."

*Connection/Authenticity* was expressed by subjects as gaining a better sense about each other via the webcam video. They could see each other, where they worked, what they were wearing, and what their surroundings revealed about them. It created a degree of transparency and authenticity. One subject summarized this as, "So, I felt more connected to [Names] by seeing them - seeing their facial expressions, seeing their contexts, so I did feel more connected with them."

### 4.2 Effectiveness

Subjects shared their perceptions on individual and team *Effectiveness* with webcams integrated into virtual team meetings compared with their prior experience of not using webcams. Themes emerged from the subjects' transcripts to support *Effectiveness Increasing*, *Decreasing*, and remaining *Unchanged*. The trend patterns in Figure 1 show an expectation for team Effectiveness to increase, indicated by the Baseline bar. However, this drops considerably in Week 1 when webcams were first used by all members of the virtual team and Effectiveness decreased or remained unchanged. Subjects shared their experience in which using the unfamiliar webcam technology increased stress and decreased the team's prior effectiveness. For example, "I think I was so focused on understanding and using the technology that I was overwhelmed with an overwhelming amount of information and options and things to learn that I was focusing on learning the technology as opposed to capitalizing on working with the visual features, as well." The technology became the focus instead of the purpose of the meeting. This subsided in Week 2 with net effectiveness increasing as the technology became more familiar.

By Week 4 all three dimensions of *Effectiveness*, *Increasing*, *Decreasing*, and *Unchanged* were again high, indicating very mixed perceptions. Some of this was due to subjects being self-reflective on their journey with webcams as they had become more comfortable with using them: "One conclusion to draw from this experience is technology, in the beginning stages, will hurt team effectiveness." Another element that surfaced was that, as the team became comfortable with the webcam technology in Weeks 1, 2, and 3, they began incorporating other capabilities of the web conference tool in Week 4, such as desktop sharing. Introducing these additional unfamiliar capabilities impacted effectiveness.

### 4.3 Feeling

The first aspect of feelings was *Enjoyment Increased*, which captures the theme that feelings of enjoyment, comfortableness, satisfaction, wellness and the like increased as a result of using webcams. An increase in enjoyment occurred when the webcams were initially introduced but less enjoyment was expressed the next week as

technology and learning issues dominated perceptions. However, as experience with the webcams increased, the consensus was that they improved the enjoyment associated with virtual team meetings. Example expressions of this include: “I’m enjoying seeing the folks on the team” and “So, instead of the team meetings being dreaded or to be avoided, I find them to be more attractive and anticipated.”

Another frequently shared feeling was an increase in *Stress or Apprehension*. This was conveyed as increased stress from unfamiliar or problematic technology or trying something new and not knowing the potential impacts. As might be expected, stress was initially high as seen in the Baseline bar in Figure 1 in anticipation of using webcams and remained high during their initial use in Week 1. Comments such as, “I was supposed to lead the meeting and I was a novice with the technology” and “...it’s gonna be a learning curve for us to move forward but once I think we overcome and accomplish week one, get through this stage fright of this new technology, I think we’ll be okay” reflect this concern. As they became more comfortable with the technology, stress related to the technology element of using the webcams had become a non-issue for all subjects by Week 5 and remained that way in Week 6.

#### **4.4 Focus**

One of the more frequently shared themes was an increase in *Focus* or a decrease in multitasking as a result of using webcams. Attentiveness and engagement were also perceived as improving. In previous virtual team meetings that did not use webcams, subjects shared that they were more likely to have multitasked and be working on other things when meeting by phone. The addition of webcams made team members self-conscious about being perceived as being engaged in the meeting. *Focus--Decreased* in Figure 1 does show a rise in the frequency of subjects addressing decreased focus in weeks 2 through 6, but this was attributed to self-reflection in the subjects’ logs regarding the ability of video to reduce multitasking and create more focus. For example, a subject shared: “If it was just the audio, then I would be multitasking and doing something else and not be connected to what the speaker was saying.”

A new theme clearly emerged during Week 2 and grew in its use that was not previously seen. This is a *Focus On Meeting Content or Purpose*, defined as the subjects addressing the purpose of the meeting or content related to the meeting and not the phenomenon under study. This may be an indication that the use of video had become expected and natural and subjects were more focused on their purpose for meeting. Along with this was the introduction of the *Video Norming Occurring* theme that was first observed in Week 3. As the team members became comfortable with the webcam technology and its use, it appeared to be taking a back seat to the purpose of the meetings. It was discussed less in the logs, being replaced with information about the meeting topics.

#### **4.5 Learning through experience**

The use of unfamiliar technology and its associated capabilities presented initial obstacles to the virtual team. Subjects improved in their use of the technology as their experience with it increased. For the most part, learning through experience followed the path of the power law of learning with subjects reporting rapid improvements in their use of technology (Palmieri, 1999). Initially, subjects felt effectiveness was diminished, but by Week 3 most team members felt the learning curve had been overcome. While most team members reported significant gains in learning through experience, it was not universally consistent. One member stated: “I think using the technology once a week doesn’t facilitate comprehension or utilization. For myself, I would need to use the tool more often or more frequently in order to be more effective and efficient in capitalizing on the opportunity of [the web conferencing tool].”

#### **4.6 Technology**

The importance of *Audio* was expressed in contrast to the video by being the most important communication media. Video adds an element of communication richness, but the audio is vital. As an example, a subject shared, “First prize is audio plus video, but it is not as much better as audio over text.” However, the use of webcams was seen as a means of enhancing communication for the previously phone-based virtual team meetings: “I don’t hear as good though when I don’t have the visual feedback.”

*Technology Issues/Limitations* included issues such as poor lighting, background noise, not knowing the user interface well, and encountering technology problems. All of these issues were viewed as diminishing the team experience. Additional training could have minimized the occurrence of these issues. Learning to effectively use the technology was a large aspect of the first meeting that utilized webcams, as seen in the spike in Figure 1 for *Issues/Limitations* during Week 1. One subject said, “I was not disappointed in the first session, but felt that technology had not been fully utilized yet, and that is to be expected with limited preparation and no special equipment.” While many subjects were more comfortable with the technology by Week 3, some were not, such as the subject who shared, “So, I don’t think the video had much of an impact on effectiveness. If anything, it might’ve been distracting in effectiveness because I’m still learning how to use the video function.” However, comfort with the webcam technology did greatly increase from Week 1 to Week 3. There were new *Issues/Limitations* encountered in Weeks 4, 5, and 6 related to desktop sharing and other factors, not predominantly from the webcams.

#### **4.7 Trust**

*Trust Increased* represents the theme that trust between team members increased as a result of incorporating the video in team interactions. An example mentioned by one team member was the ability to look someone in the eye via the webcams. Subjects shared in their Baseline logs an expectation for the webcams to positively contribute to trust. This was not initially realized as technology issues and learning to use the webcams became a hindrance. Subjects instead indicated that the addition of webcams during Week 1 had little impact on trust, such as, “I didn’t sense that the presence of increased video diminished or increased that sense of trust.” In Weeks 4, 5, and 6, after gaining some experience with using webcams, their impact on trust was seen as more positive. One subject shared, “In terms of trust, I think it very well could actually help to nurture trust because the body language communicates different messages that I don’t see otherwise.” However, there was also strong recognition that the webcams themselves do not create trust. Rather, trust is built when team members follow through on commitments and do the work that is expected (“I think the greatest factor for trust was follow-through”). To the extent that video increases *Connection/Authenticity*, it can increase the responsibility and pressure felt by team members to fulfill their commitments.

### **5.0 FINDINGS AND RELATIONSHIPS IN THEMES**

The data analysis also showed relationships between variables. The first two discussed below are in relationship to the added richness of the communications enabled by using webcams and includes increases in authenticity, effectiveness, and focus. The third is the relationship between technology issues, stress, and effectiveness.

#### **5.1 Communication and connection/authenticity**

*Communication—Added Richness* and *Connection/Authenticity-Increased* were frequently expressed in relationship to each other by the subjects. The addition of webcams to the virtual meetings added richness to the communication channel, in part due to body language and seeing people in their environment, which increased the connection subjects felt with each other (Greenberg, et al., 2007). Subjects shared: “...the inclusion of body language causes me to see everyone in a different way,” and “I think the video helped to increase that sense of intimacy because I could see people.”

#### **5.2 Communication, effectiveness, and focus**

A dependency between *Communication-Added Richness*, *Effectiveness-Increased*, and *Focus-Increased* was well supported in the data. Co-occurrence analysis was first performed to examine the relationship between the added communication richness enabled by using webcams and individual and team effectiveness (Jones & LeBaron, 2002). However, the dominant reason provided for an increase in effectiveness was the accountability video added for subjects to be engaged in the meeting and not multitask (Benbunan-Fich & Truman, 2009). This was expressed in several ways by subjects, including: “... it did have an impact on my effectiveness just by being able to see others...,” “And also effectiveness because I think we’re getting through questions and brainstorming a little bit more easily by being able to see reactions to statements on video,” and “... it did create a higher level of

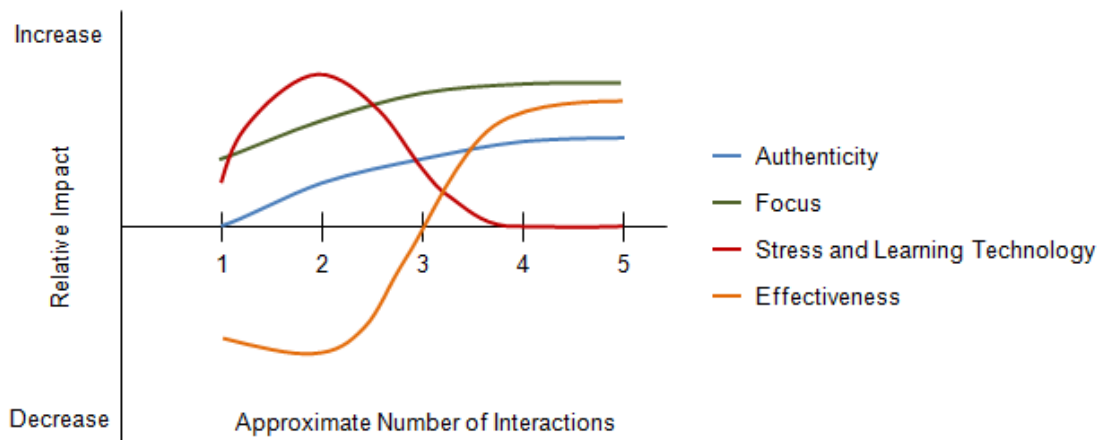
effectiveness at least on my part as far as the teamwork was concerned because I did not feel that I could type without people noticing me type.”

**5.3 Learning new technology, stress, and effectiveness**

Using the technology associated with the webcams was unfamiliar to most subjects. This had two related consequences. First, subjects expressed increased stress initially when webcams were added to the virtual meetings. The stress was primarily associated with learning (Bosch-Sijtsema, 2007) and properly using the technology. Second, the need to learn the webcam technology caused a decrease in team effectiveness (Kimble, 2011). Time during the virtual team meetings was spent resolving technical issues and subjects helping each other learn to use the tools. Once the subjects had learned the basics of using webcams during their virtual meetings, stress associated with technology issues declined and effectiveness increased (Ebrahim et al., 2009).

**5.4 Proposed Theoretical Model**

A theoretical model is suggested from the analysis of the data (Figure 1) and the key relationships in the themes. Authenticity and experience with technology both contribute to team effectiveness. Authenticity is increased as a result of incorporating video, supporting the development of trust; however, this does not appear to affect team effectiveness as much as expertise with the communication technology used by the team. Initially, a lack of expertise in technology can interfere with team effectiveness and also cause an increase in individual stress. The technology learning curve is generally steep, depending on the complexity of the capabilities. Within a relatively short period of time (approximately three virtual team meetings in our observations) team effectiveness attains a level at which the focus of the team is on the team task. At that point, the team can work effectively and benefits from the increase in focus. As is typical with a qualitative study, these findings cannot be generalized and further study is needed to test the applicability of this model to other virtual teams incorporating video.



**Figure 2: Proposed theoretical model for effect of video on virtual team development.**

**6.0 CONCLUSION**

Incorporating webcams in virtual meetings had beneficial outcomes with few detriments. The added richness of communication provided by seeing the meeting participants had a positive impact. Body language could be interpreted, visual humor used, and other visual cues incorporated (Ebrahim, et al., 2009). Closely associated with this increase in communication depth was the added connection subjects felt with each other and an increase in authenticity. These factors also indicated a positive association with an initial increase in trust. While trust may be improved initially through the addition of webcams, it was not a strong factor in the overall functioning of the team



as the ability to fulfill commitments was viewed as much more important. Participating in virtual team meetings was more enjoyable for subjects, and meetings became something to look forward to. Also, subjects were more focused on the work of the meetings instead of multitasking during the meetings. The increase in focus and communication richness were closely associated with an increase in individual and team effectiveness.

A negative aspect of adding webcams to virtual team meetings was an initial decrease in productivity. Meeting time was expended on helping team members understand how to use the webcam technology. Being unfamiliar with the technology also caused some apprehension by subjects to participate in the meetings initially as well as increased stress. After one to two meetings most subjects were comfortable with the technology, and stress associated with the use of webcams decreased. This suggests that virtual teams choosing to adopt webcams should be purposeful in preparing team members for the experience (Bosch-Sijtsema, 2007). This includes providing the proper technology (e.g., HD webcams, noise cancelling headsets), learning to use the technology's capabilities, considering limitations and likely issues that may arise, and addressing image consciousness concerns (Kimble, 2011). Based on the experience of the subjects in this study, one or two short training sessions focused on these items would more quickly improve the effectiveness of virtual teams adopting webcam technologies.

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