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The Effects of Video Self-Evaluation on Skill Acquisition with Yoga Postures

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The Effects of Video Self-Evaluation on Skill Acquisition with Yoga Postures

by

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A thesis submitted in partial fulfillment
of the requirements for the degree of
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Department of Child and Family Studies
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Abstract

This study evaluated the use of video self-evaluation and video feedback procedures to enhance the accuracy of yoga poses. In the self-evaluation intervention participants watched their behaviors via video and scored task analyses for feedback for each pose. In the video feedback intervention, the participants and the researcher together scored the task analyses for the behaviors along with practice during video recordings. The interventions were assessed in a multiple baseline across behaviors design. Results showed that both video self-evaluation increased the accuracy of all poses and video feedback further increased the accuracy on one pose for one participant.

Chapter One: Introduction

Recently there has been much hype in the western media concerning injuries related to yoga (e.g., Alvarez, 2010; Fishman, Saltonstall, & Genis, 2009). Yoga is an ancient practice dating back thousands of years in the eastern hemisphere, and recently the art has weaved its way into the western culture (Alvarez, 2010). There are many different areas of practice with yoga. One of the most popular forms in the western culture is hatha yoga which is generally comprised of breathing exercises, various postures, and meditation (Tran, Holly, Lashbrook, & Amsterdam, 2001). Generally yoga classes involve an instructor that acts as a model and presents verbal feedback while students practice various positions. Classes may involve a group of people or individualized instruction.

Numerous health benefits for persons practicing yoga are identified not only by the media, but by empirical literature as well (e.g., Fishman et al., 2009; Tran et al., 2001). Ross and Thomas (2010) conducted a literature review of various studies regarding yoga's effects on health. The studies assessed the effects of yoga versus other forms of exercise (e.g., stationary cycling, walking, and jogging) on several health outcomes. When they compared the different studies, they found yoga to be more effective than the other forms of exercise measured in 22 out of 32 health components including menopausal symptoms, kidney function, sleep disturbance, cholesterol levels, and fatigue. Nearly 70% of the literature assessed found yoga to be more beneficial than other exercises with the various health conditions. These results show that yoga may have a more positive effect on health conditions when practiced regularly than other forms of exercise. The famous New York Times article, "When Yoga Hurts," discussed the potential

harmful effects of practicing yoga (Alvarez, 2010). The article discussed that many people get hurt in yoga classes because they may not warm up or stretch before engaging in the activities. The article makes the point because American yoga classes are so large it is often difficult to get feedback on various poses. One can use an online search engine to search “yoga injuries” and find millions of related websites and blogs. Researchers conducted an international survey and from the results they found that one of the four most reported causes of injury with yoga was “inadequate or improper instructions being given to students” (Fishman et al., 2009, p. 51). The western culture is beginning to have the same viewpoint as the media: practicing yoga can cause injuries just like any other sport or fitness activity (Alvarez, 2010). With the growing number of people looking to yoga as a form of exercise, it is important for behavior analysts to evaluate procedures to improve yoga practice and thus prevent injuries from happening.

Various procedures have been evaluated to promote skill acquisition and productivity in sports and fitness (e.g., Allison & Ayllon, 1980; Hume & Crossman, 1992; Osborne, Rudrud, & Zezoney, 1990). Some interventions have included coaching packages (e.g., Allison & Ayllon, 1980; Komaki & Barnett, 1977), the introduction of visual cues (Osborne et al., 1990), contingent musical reinforcement (Hume & Crossman, 1992), attentional shift training (Ziegler, 1994), goal setting and public goal posting (e.g., Smith & Ward, 2006; Ward & Carnes, 2002), TAGteach training (e.g., Fogel, Weil, & Burriss, 2010; Stokes, Luiselli, Reed, & Fleming, 2010), and video modeling and feedback (e.g., Boyer, Miltenberger, Batsche, & Fogel, 2009; Guadagnoli, Holcomb, & Davis, 2002; Rikli & Smith, 1980).

One procedure that has been proven to be effective for skill acquisition in a variety of areas is the use of video (Dowrick, 1991). The use of video could increase the amount of instructor or self-monitored feedback. Procedures used to increase feedback are important

because limited feedback is a major problem as class sizes for yoga training continue to grow (Alvarez, 2010). Procedures used to increase feedback could also increase skill acquisition while decreasing the number of injuries associated with practicing yoga. An efficient and cost effective method of giving feedback on performance is using video (Dowrick, 1991). The use of video has been assessed in various areas of research including, but not limited to: sports (e.g., Benitez-santiago & Miltenberger, 2012; Rikli & Smith, 1980; Stokes et al., 2010), peer interactions (e.g., Dunlap et al., 1992; Maione & Mirenda, 2006), and preventing injury in workstations (e.g., Nielsen, Sigurdsson, & Austin, 2009; Sigurdsson & Austin, 2008).

Video modeling has been used in combination with video feedback and has been shown to have a significant effect on behavior measured in various studies (e.g., Boyer et al., 2009; Nielsen et al., 2009; Zetou, Tzetzis, Vernadakies, & Kioumourtzoglou, 2002). Zetou et al. (2002) assessed video procedures on acquisition and retention of the form of set and serve volleyball skills in a group design. One group used video modeling with verbal cues from instructors and the second group received verbal feedback while watching the videos of their own behaviors. The results showed higher skill acquisition with the expert modeling than with the self-modeling group. Boyer et al. (2009) examined the effectiveness of a video treatment package including modeling and feedback on the acquisition of three gymnastic skills in a multiple baseline across behaviors design. There was a clear increase in skill set acquisition with the introduction of the video treatment package. Nielsen et al. (2009) evaluated a procedure in which the participants scored the video models and were given feedback on the scores. The study evaluated the effectiveness of video modeling and feedback procedures for increasing safe and correct patient lifting transfers by staff in a multiple baseline across participants design. With the introduction of video modeling the percentage of correct lifting by all participants

except for one increased, and for the two participants that were given the feedback phase, the percentage correct increased to even higher levels.

Another element frequently used in combination with video feedback is instructional feedback (e.g., Guadagnoli et al., 2002; Rikli & Smith, 1980; Stokes et al., 2010). Guadagnoli et al. (2002) evaluated the effectiveness of video feedback, verbal feedback, and self-guided feedback for a golf swing in a pretest-posttest randomized group design. The self-guided group participants were instructed to practice on their own. The verbal feedback group participants were trained with an expert and given verbal feedback on their swings. The video feedback group was paired with an expert that provided verbal feedback and video feedback throughout the training sessions. The results indicated that the introduction of video feedback had the greatest effect on the distance and accuracy of the golf swing of participants. Stokes et al. (2010) evaluated the effectiveness of verbal feedback and video plus verbal feedback for increasing football blocking skills in a multiple baseline across participants design. With descriptive feedback alone, the correct number of steps in the task analysis did not increase. With the introduction of the video feedback procedure, the percentage of correct steps increased substantially. In another recent study, Benitez-santiago and Miltenberger (2012) evaluated two video feedback procedures for improving skills related to capoeira, a performance style of martial arts. In the video feedback phase, participants watched their performance on the video as the researcher provided feedback, and during the video feedback plus practice phase participants practiced the movements two to five times before being videotaped and given live feedback from the instructor. Their results showed that the video feedback condition improved skills to greater percentages quicker than typical practice for all three movements measured, and skills increased to higher percentages with the introduction of practice sessions between videotaping.

Several video feedback interventions involve a self-evaluation element (e.g., Boyer et al., 2009; Guadagnoli et al., 2002). Self-evaluation procedures have been shown to have considerable effects on behaviors (Dunlap et al., 1992; Sigurdsson & Austin, 2008). Self-evaluation procedures can be valuable for instructors with larger class sizes who might not have time to provide feedback to all the students. Dunlap et al. (1992) evaluated the effects of an intervention that included a video self-evaluation procedure for increasing desirable peer interactions in children with severe emotional and behavioral disabilities. Students watched themselves on video, identified desirable behaviors, and received reinforcers for correct self-evaluation and desirable behaviors. With the introduction of the intervention, desirable behavior increased for all participants. Sigurdsson and Austin (2008) assessed the effectiveness of a real-time video feedback procedure combined with a self-monitoring procedure for increasing safe postures for participants working at desks. In the video plus self-monitoring phase, participants observed their own postures on video and scored them as safe or unsafe while attending to a typing task. The results showed an increase in correct posturing for the participants.

Because of the national concern with yoga injuries in the media and the general public (e.g., Alvarez, 2010), it is important for behavior analysts to evaluate procedures for enhancing skill acquisition and reducing injuries. The implementation of a video feedback procedure may increase these skill sets more rapidly and to a greater extent than the traditional style of instruction, and the use of self-evaluation may increase the utility of the procedure. There were two purposes to the study. Firstly, the study assessed a video self-evaluation (VSE) procedure to enhance the skills involved in practicing yoga. Secondly, if the VSE procedure was not effective the study evaluated the use of a standard video feedback procedure, much like the one used by Benitez-santiago and Miltenberger (2012).

Chapter Two: Method

Participants and Setting

The study included two participants, ages 21 (Bill) and 24 (Ted) who responded to a flyer describing the study. The participants were interested in learning yoga poses, did not have experience in yoga, and did not have any injuries. Both participants were students of a university and attended classes on the university campus. The experimental procedure was conducted in a fitness lab at the physical education department on the university campus.

Bill attended the university as a student of computer engineering, and was interested in the study because he wanted to begin a fitness program. Bill had little experience with fitness overall, and stated that since he had experience with meditation, yoga would be a good fitness exercise for him. Bill also stated that he did not exercise or practice yoga outside of the sessions. Ted attended the university as a anthropology major, and was interested in the study because he wanted to attend yoga classes with more knowledge on the basic poses. Ted showed interest in several poses, and stated that he would like to include the intervention with the other poses. While in the study, Ted played various sports and was active outside of the sessions.

Recruitment and Consent

The researcher posted flyers on the university campus and the adults interested in the study were given information via email. All adults interested in the study received handouts regarding the intervention and were asked if they wanted to participate. The adults who agreed to participate met with the researcher and signed consent forms.

Materials

The materials included one Canon T3i digital single-lens video camera, a tripod, an Acer laptop, itunes video playing software for direct immediate feedback, and yoga mats for the participants' use. A memory card from the camera was inserted into the laptop computer to decrease the latency of feedback after the target behaviors were exhibited. The video camera recorded the participants' flow of poses. The tripod held the camera in place and decreased any shaking or human error while recording the participants. The laptop and video playing software were utilized for assessment, video self-evaluation and video feedback. The participants were encouraged to use the yoga mats for exhibiting the poses.

Target Behaviors

Target behaviors were comprised of task analyses of three common yoga poses (see Appendices A-C for the three yoga poses). The poses were chosen based on the low probability that the acquisition of one pose would influence the acquisition of another pose. The poses were also chosen because they are generally introduced in a typical beginning yoga class (Cleveland Clinic, n.d.). The three yoga instructors working with the researchers agreed that the poses chosen for measurement were appropriate for beginner level yoga students and for healthy individuals.

The poses included the vrikshasana (tree pose), the virabhadrasana II (warrior pose two), and the svanasana (downward facing dog pose). The vrikshasana is a balancing pose in yoga where one stands on one leg with arms raised. The virabhadrasana II is a stretch pose where one stands with legs and arms spread apart. The svanasana is a stretch pose where one stands on the hands and feet. The task analyses developed by the researcher were reviewed by a certified yoga instructor who judged the task analyses to accurately depict the steps involved in each pose.

Data Collection

For each phase the participants' behaviors were recorded via video camera and scored by the researchers using the task analyses. To ensure the best scoring and the best feedback, the participants were recorded at different angles depending upon the pose being assessed.

Vriksasana and virabhadrasana II were recorded from the front of the participants. Svanasana was recorded from the side of the participants. Behaviors in the task analyses for each pose were coded by the researcher as either correct or incorrect during assessment sessions. The percentage correct was calculated by dividing the number of correct steps by the number of steps in the task analysis multiplied by 100%.

Inter-observer Agreement

Thirty-three percent of video recording sessions were observed by two independent observers. A total inter-observer agreement (IOA) method was calculated across each phase for every behavior. Each observer independently watched and scored the videos of the participants during sessions. Agreement was defined as both of the observers scoring correct or incorrect (+ or -) for the same step within the task analyses. The percentage of agreement for each task analysis was calculated by dividing the number agreements by the number of agreements plus disagreements (steps in the task analysis) multiplied by 100%.

The mean IOA for both participants was 95.9% (range = 86%-100%). For Bill, the mean IOA across behaviors for the baseline phase was 95.9% with a mean of 93% for vriksasana, a mean of 98.3% for svanasana, and a mean of 95.9% for virabhadrasana II. The mean IOA across behaviors for the treatment phase was 94.5% with a mean of 96.5% for vriksasana, a mean of 95% for svanasana, and a mean of 93.3% for virabhadrasana II. For Ted, the mean IOA across behaviors for the baseline phase was 96.4% with a mean of 100% for vriksasana, a mean of

100% for svanasana, and a mean of 93.3% for virabhadrasana II. The mean IOA across behaviors for the treatment phase was 96.7% with a mean of 95.6% for vrikshasana, a mean of 97.1% for svanasana, and a mean of 97.8% for virabhadrasana II.

Social Validity

Three questionnaires assessed the social validity of the target behaviors for the intervention and the outcome of the experiment. A certified yoga instructor approved the task analyses of the three poses to socially validate the behaviors measured. The instructor gave open-ended feedback on the task analyses, and the researchers edited the task analyses based on the feedback given. The instructor followed up on the final edit of the task analyses by rating them on a 5-point Likert-type scale (see Appendix D). Participants received one of two questionnaires in the form of a rating scale (see Appendix E) regarding the ease of participation and acceptability of the intervention. All participants were asked to fill out a 5-point Likert-type scale to assess the social validity of the intervention. The participant exposed to the video feedback phase of the intervention received the questionnaires for both the video-feedback and self-evaluation interventions, whereas the participant only exposed to the VSE intervention received the questionnaire only relating to the self-evaluation intervention.

Another aspect of social validity included the assessment of the outcome of each phase by observers blind to each experimental condition, similar to that of the Boyer et al. (2009) study. Two certified yoga instructors scored a sample of the videos in random order of phases. The observers were asked to score the videos on a 5-point Likert-type scale (see Appendix F).

Treatment Integrity

To assess treatment integrity, a percentage of agreement was scored between the researcher and participant on the task analyses as the participant conducted the video self-

evaluation. The percentage was calculated by dividing the number agreements by the number of agreements plus disagreements multiplied by 100%. The percentage of agreement between the researcher and participant assessed the skill acquisition and procedural integrity of each participant during both experimental phases of the intervention.

Treatment integrity data were collected for at least 50% of sessions for Bill, and at least 40% of sessions for Ted. When treatment integrity fell below 80%, the researcher retrained the participants to utilize the task analysis while watching the videos. Treatment integrity fell below 80% once with Bill, and twice with Ted. The mean treatment integrity across sessions for Bill was 89%, with a range of 67%-100%. The mean treatment integrity across sessions for Ted was 91%, with a range of 66%-100%.

Procedures

A multiple baseline across behaviors research design was used to assess the intervention effects with each participant's yoga poses. Data were collected on the participants' poses throughout baseline, VSE, and maintenance phases. A video feedback condition was implemented for one pose. One to three assessment sessions were conducted in each meeting of the researchers and participants, and at least one meeting per week was conducted throughout the experiment.

Baseline. Data for participants' poses were collected while the participants used standard procedures for yoga. The researcher acted as a model throughout the first two sessions of the baseline phase, much like that of standard yoga instruction. The participants were told to continue using the standard procedures for practicing yoga throughout baseline. The participants attempted each pose two to three times during each assessment session.

Video self-evaluation (VSE). In this phase, the participants viewed their pose on video immediately after participating in the pose and evaluated the pose by using the task analysis to score each of the steps in the pose. The intervention was first applied to one pose until increases were observed in that pose and then applied to the other two poses in sequence. The first two sessions of the VSE phase for each pose involved the researcher showing the participants how to evaluate each video by using the task analyses. The researcher viewed the video with the participants, scored the behaviors with the participants via the task analysis data sheet, and discussed the scoring of correct or incorrect steps observed. Each subsequent session in this phase consisted of the participants scoring each video without assistance or feedback. During this phase the participants practiced each pose individually, and subsequently watched the video recording of the practice. While watching the recording, the participants scored themselves as correct or incorrect on the various steps that constructed each pose. The researcher was not present in the room during the self-evaluation of the videos. The researchers separately scored the video and calculated the percentage of agreement to assess treatment integrity of each participant.

Video feedback. The video feedback phase was implemented if a high level of skill acquisition did not occur throughout the VSE phase. The video feedback phase was implemented with one pose during the intervention condition. During the video feedback intervention phase the researcher video recorded the participant practicing the pose. The participant then watched the practice video as the researcher provided feedback on each step in the task analysis. The participant practiced the pose again and immediately watched the video as the researcher provided verbal feedback.

Maintenance. To assess maintenance of the procedures, participants were video recorded at 2 weeks (Ted) and 5 weeks (Bill) following the removal of the intervention. The researchers then scored the videos of the participants' poses with the task analyses.

Chapter Three: Results

The introduction of VSE resulted in an immediate increase in the percentage correct for all six asanas across two participants. Results are shown in Figures 1 and 2. For one asana that did not increase to high levels for Ted, VSE and video feedback procedures resulted in a substantial increase in the asana. The experimental procedures were introduced following the introduction to the standard yoga instruction procedures, and as expected, some skill acquisition occurred in the longer baseline phases.

Because there were increasing trends in some of the baseline phases, the researchers measured two baseline means much like that of Boyer et al. (2009). The researchers measured whole baseline and end of baseline means. The end of baseline mean was calculated on the portion of the data that was stable at the end of the baseline phase. The means for the interventions were also calculated on the portion of the data that was stable and the end of the intervention phases.

As shown in Figure 1, VSE was effective for Bill's three poses. For the vrikshasana pose, the whole baseline mean was 17%, and the mean of the last six data points of the VSE intervention was 96%. For the svanasana pose, the end of baseline mean of 37%, and the mean for the last six data points of VSE was 73%. For the virabhadrasana II pose, the end of baseline mean was 48%, and the VSE intervention mean was 87%. During the maintenance assessment for Bill, the percentage correct for each pose decreased to 57% for the vrikshasana pose, 55% for the svanasana pose, and 60% for the virabhadrasana II pose.

As shown in Figure 2, VSE was effective for two of Ted's poses and VSE and video feedback were effective for a third pose. For the svanasana pose, the whole baseline mean was 13%, the VSE phase mean was 48%, and the video feedback phase mean was 95%. For the vrikasana pose, the whole baseline mean was 29%, and mean of for the last seven data points of VSE was 98%. For the virabhadrasana II pose, the end of baseline mean was 55%, and the mean for VSE was 86%. During the maintenance assessment, the percentage correct for each pose was 84% for the vrikasana pose, 90% for the svanasana pose, and 80% for the virabhadrasana II pose.

Social validity data for the participants' acceptance of the interventions are shown on Tables 1 and 2. Table 1 shows the social validity results for the VSE procedure, and Table 2 shows the results for the video feedback procedure. Bill felt comfortable practicing the vrikasana and virabhadrasana II poses, but was not comfortable practicing the svanasana pose. Even though Bill stated that the accuracy of his poses increased after VSE, he stated that he did not like the procedure. Ted stated that he felt comfortable practicing each pose and he enjoyed both the VSE and video feedback procedures. Ted stated that he felt the accuracy of his poses increased after being introduced to the procedures.

A yoga instructor rated the task analyses that were used to measure the behaviors with high scores, suggesting that the task analyses were a valid depiction of the yoga poses. Instructor social validity data from blind ratings of performance in baseline and intervention phases showed that the instructors agreed that the VSE and video-feedback procedures produced noticeable changes in the yoga poses. Overall, the yoga instructors rated the poses higher in the intervention phases than in baseline (Tables 3-8). For Bill, the average rating from the instructors for baseline and intervention was 2.5 and 3.5 for the svanasana pose, 1.8 and 3.8 for

the vrikasana pose, and 2.4 and 4.0 for the virabhadrasana II pose. For Ted, the average rating from the instructors for baseline and intervention was 3.0 and 3.8 for the svanasana pose, 3.3 and 3.9 for the vrikasana pose, and 3.0 and 3.8 for the virabhadrasana II pose..

Table 1. Mean Social Validity Ratings of Video Self-evaluation for Bill and Ted

		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1.	I am comfortable performing the Virabhadrasana II (Warrior II pose).				2	
2.	I am comfortable performing the Vrikasana (Tree pose).				1	1
3.	I am comfortable performing the Svanasana (Downward Facing Dog pose).	1				1
4.	I liked using video feedback and the task analyses to self-manage my poses.	1				1
5.	I think my poses got better after using video feedback.				1	1
6.	The video feedback took the same amount of time that I expected.		1	1		

Table 2. Social Validity Rating of Video Feedback for Ted

		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1.	I am comfortable performing the Virabhadrasana II (Warrior II pose).				1	
2.	I am comfortable performing the Vrikasana (Tree pose).					1
3.	I am comfortable performing the Svanasana (Downward Facing Dog pose).					1
4.	I liked using video feedback.				1	
5.	I think my poses got better after using video feedback.					1
6.	The video feedback took the same amount of time that I expected.			1		

Table 3. Mean Instructor Ratings for the Svanasana Pose for Bill

		Baseline	VSE
1.	The participant performed the Svanasana (Downward Facing Dog pose) with high accuracy.	1.5	3.25
2.	The participant looked like an expert when performing the Svanasana (Downward Facing Dog pose).	1.75	3.25

Table 3 (Continued)

		Baseline	VSE
3.	The participant seemed to understand the flow of the Svanasana (Downward Facing Dog pose).	2	3.25
4.	The participant's body parts were in the correct places during the flow of the Svanasana (Downward Facing Dog pose).	2.25	3.5
5.	The participant began the pose in the correct position.	2.75	3.75
6.	The participant ended the pose in the correct position.	2	3.75

Table 4. Mean Instructor Ratings for the Vrikshasana Pose for Bill

		Baseline	VSE
1.	The participant performed the Vrikshasana (Tree pose) with high accuracy.	1.75	3.5
2.	The participant looked like an expert when performing the Vrikshasana (Tree pose).	1.5	3.5
3.	The participant seemed to understand the flow of the Vrikshasana (Tree pose).	1.5	4.25
4.	The participant's body parts were in the correct places during the flow of the Vrikshasana (Tree pose).	1.75	4
5.	The participant began the pose in the correct position.	2.5	3.75
6.	The participant ended the pose in the correct position.	2.75	4

Table 5. Mean Instructor Ratings for the Virabhadrasana Pose for Bill

		Baseline	VSE
1.	The participant performed the Virabhadrasana II (Warrior II pose) with high accuracy.	2.25	4
2.	The participant looked like an expert when performing the Virabhadrasana II (Warrior II pose).	2	3.5
3.	The participant seemed to understand the flow of the Virabhadrasana II (Warrior II pose).	2.5	4
4.	The participant's body parts were in the correct places during the flow of the Virabhadrasana II (Warrior II pose).	2.5	4.5
5.	The participant began the pose in the correct position.	2.75	3.75
6.	The participant ended the pose in the correct position.	2.5	4

Table 6. Mean Instructor Ratings for the Svanasana Pose for Ted

		Baseline	VSE
1.	The participant performed the Svanasana (Downward Facing Dog pose) with high accuracy.	2	3.75
2.	The participant looked like an expert when performing the Svanasana (Downward Facing Dog pose).	1.75	3.25
3.	The participant seemed to understand the flow of the Svanasana (Downward Facing Dog pose).	2.75	4
4.	The participant's body parts were in the correct places during the flow of the Svanasana (Downward Facing Dog pose).	2	3.75
5.	The participant began the pose in the correct position.	3.75	4.25
6.	The participant ended the pose in the correct position.	3	4

Table 7. Mean Instructor Ratings for the Virksasana Pose for Ted

		Baseline	VSE
1.	The participant performed the Vriksasana (Tree pose) with high accuracy.	2.75	3.75
2.	The participant looked like an expert when performing the Vriksasana (Tree pose).	2.5	3.75
3.	The participant seemed to understand the flow of the Vriksasana (Tree pose).	3.25	4
4.	The participant's body parts were in the correct places during the flow of the Vriksasana (Tree pose).	3	3.75
5.	The participant began the pose in the correct position.	3.5	4.25
6.	The participant ended the pose in the correct position.	3	3.75

Table 8. Mean Instructor Ratings for the Virabhadrasana Pose for Ted

		Baseline	VSE
1.	The participant performed the Virabhadrasana II (Warrior II pose) with high accuracy.	1.75	4
2.	The participant looked like an expert when performing the Virabhadrasana II (Warrior II pose).	1.75	3.25
3.	The participant seemed to understand the flow of the Virabhadrasana II (Warrior II pose).	1.75	4
4.	The participant's body parts were in the correct places during the flow of the Virabhadrasana II (Warrior II pose).	2.25	4
5.	The participant began the pose in the correct position.	2.5	4.25
6.	The participant ended the pose in the correct position.	2	3.5

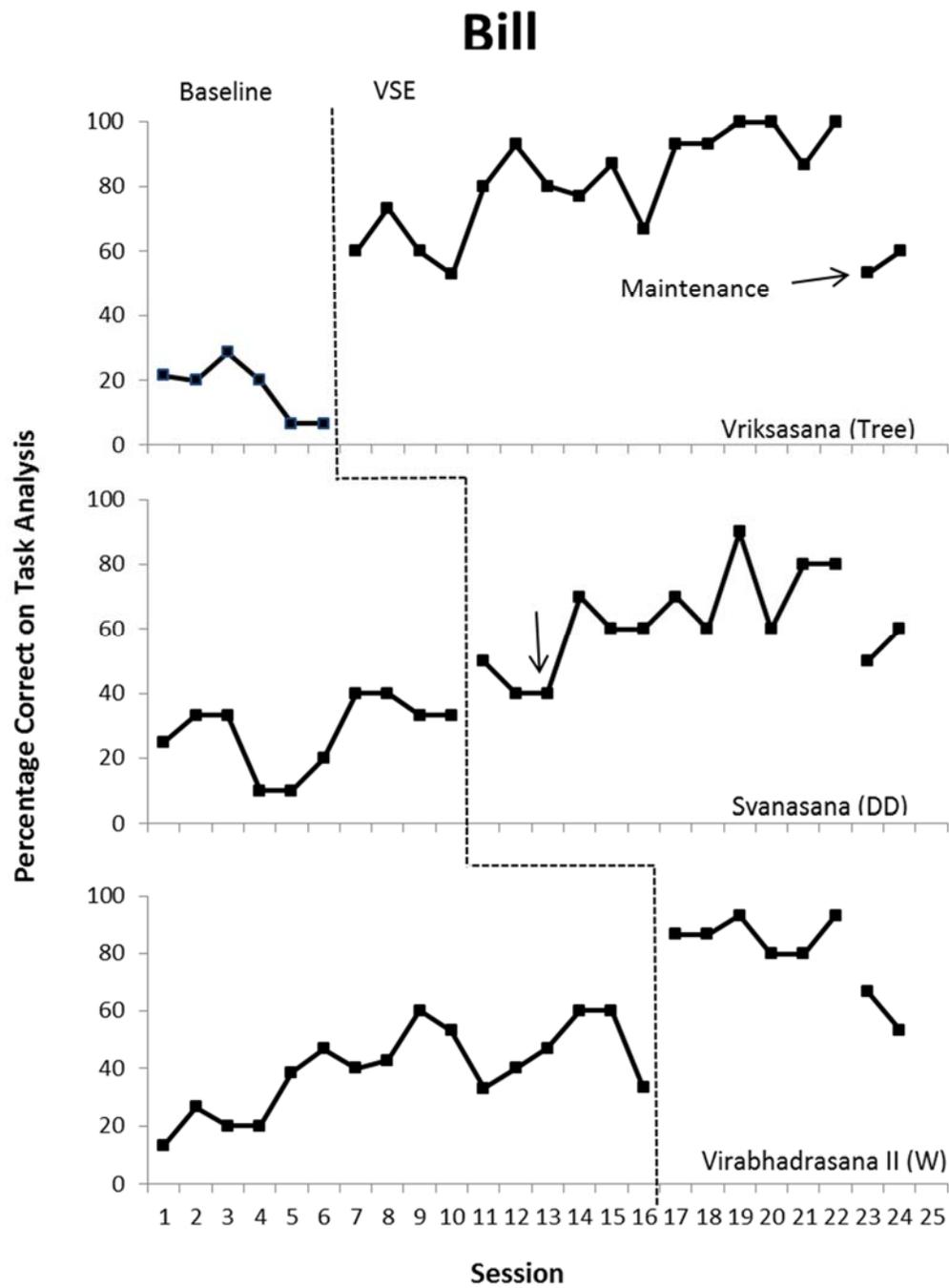


Figure 1. Percentage Correct on Task Analyses Across Sessions for Bill. The above graph shows the percentage correct of Bill's vrikasana, svanasana, and virabhadrasana II poses. The unmarked arrow represents the session where retraining occurred.

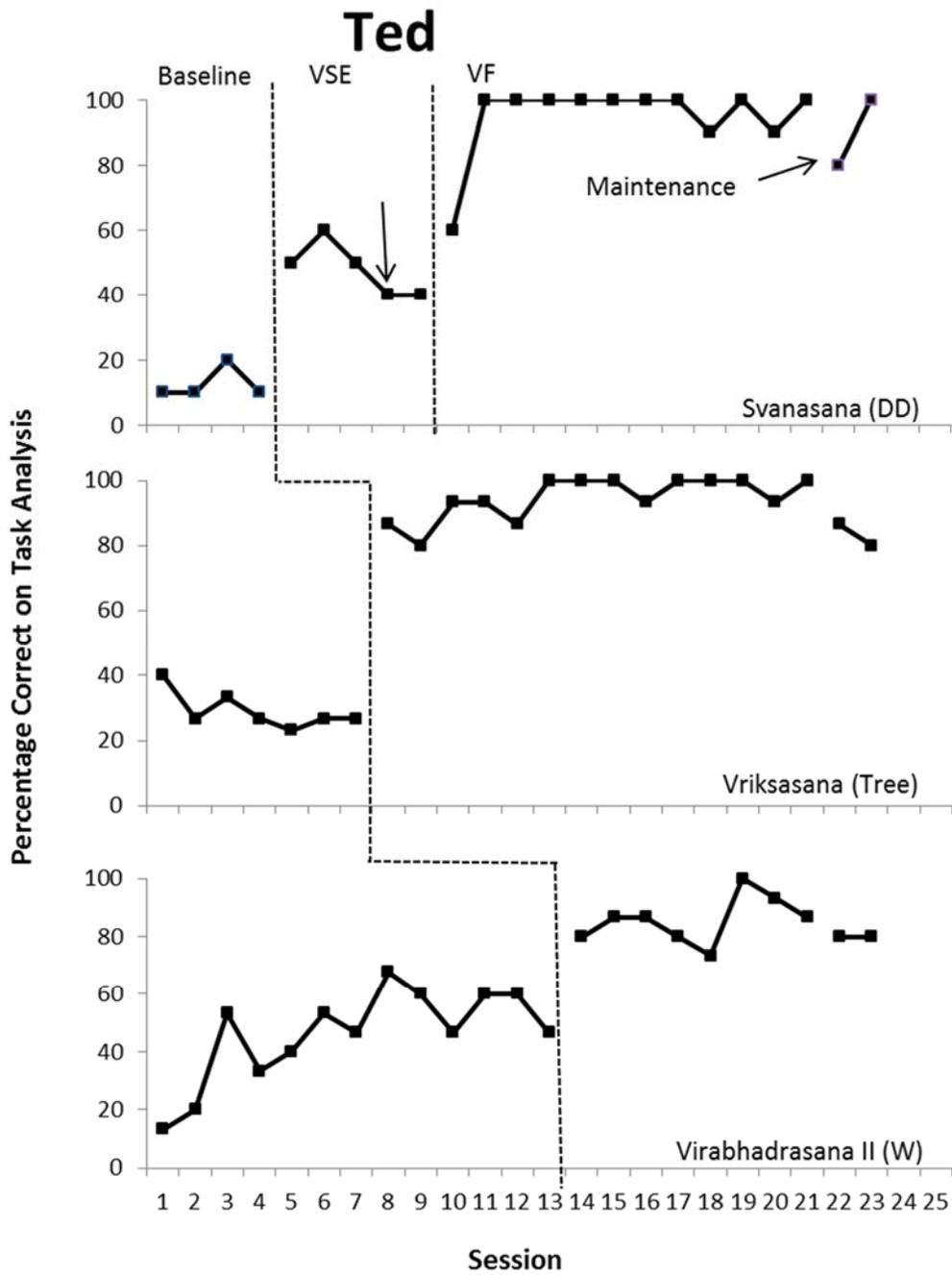


Figure 2. Percentage Correct on Task Analyses Across Sessions for Ted. The graph above shows the percentage correct of Ted’s svanasana, vriksasana, virabhadrasana II poses. The unmarked arrow represents the session where retraining occurred.

Chapter Four: Discussion

The study assessed the effectiveness of a video self-evaluation (VSE) procedure with three yoga poses for two participants, and video-feedback was evaluated with one pose. The VSE procedure increased the percentage correct with all of the poses, and the video-feedback procedure increased performance of one pose for one participant even further. VSE can be utilized for persons who are not receiving the amount of feedback from an instructor necessary to increase correct performance and prevent injury. With the VSE procedure, a yoga practitioner in a class could videorecord him or herself practicing a pose and then immediately review the recording for self evaluation. The findings in this study suggest that such an approach can lead to substantial increases in performance regardless of fitness level. One participant in the study did not engage in fitness activities while the other was active in athletic activities, and both showed acquisition for the poses measured with the introduction of the intervention.

Furthermore, such a procedure could be conducted with little disruption to the class. The results of this study are comparable to those of studies evaluating similar procedures including self-monitoring and self-evaluation from video (Dunlap et al., 1992) and video feedback with self-evaluation (Sigurdsson & Austin, 2008). This study provides more evidence that individuals can evaluate their own performance via video to increase performance. Furthermore, the increases in performance in the current study are comparable to results obtained in studies using video feedback from the researchers (Benitez-santiago & Miltenberger, 2013; Boyer et al., 2009) suggesting that VSE might be a viable alternative to traditional video feedback that requires a

coach or other expert to review the video with an athlete and provide feedback as the video recording is being reviewed. Although these results were positive, more research is needed to substantiate the findings.

Personal preference for the intervention, reflected in the social validity questionnaires completed by the participants, varied between participants. Bill stated that he did not like the procedure; however Ted stated that he enjoyed it. During the baseline phase for both participants, there was a low level of performance for each of the three skills. For Bill, VSE greatly increased his performance of both the vrikasana and virabhadrasana II poses. For his svanasana pose, there was increased performance although not as elevated as the other poses. For Ted, VSE increased his performance of all three poses; however his performance of the svanasana pose was not as high as anticipated. Video-feedback increased his execution of the svanasana pose to a greater extent than did the VSE procedure.

Although the data indicated that VSE can be an effective procedure for increasing yoga, some limitations were also noted. Finding beginner level volunteers proved more problematic than anticipated and, because the participants were unfamiliar with yoga, they appeared challenged with the notion of failure to perform with fidelity. Bill expressed dissatisfaction with his performance during the procedure until he showed higher performance of the skill. Another limitation to the study involves the maintenance data with Bill. He did not practice the poses outside of the sessions, and the maintenance data were collected 5 weeks following the end of the intervention. Lastly, both participants were retrained for self-evaluation because of low treatment integrity. The fact that the participants needed retraining on a skill suggests that video self-evaluation may not always be successful and may require a coach or researcher to evaluate the quality of the self-evaluation and provide retraining if needed. It is not clear how effective

VSE would be without the initial training or the booster training when used by other athletes for yoga or other sports. More research should evaluate the necessary amount of preliminary training required for success and the factors that may contribute to the need for booster training.

The study was the first to assess a video self-evaluation procedure with yoga. The self-evaluation component of the procedure can increase the utility of video feedback for yoga students by limiting the amount of trainer time necessary for success. Because this study was conducted with two participants, future research should replicate the VSE procedure with other novice yoga practitioners and other yoga poses. In addition, it would be advantageous to evaluate this procedure with advanced yoga students to see if the VSE procedure can elevate performance even higher. Furthermore, future research should evaluate the effectiveness of VSE for enhancing performance in other sports. If a sport requires skilled performance and the performance can be captured on video, VSE has the potential to enhance performance. Finally, due to the findings that the video-feedback intervention was needed for one pose, future research should continue to evaluate video-feedback with yoga poses and compare its effects to the effects of VSE with yoga and other sports performance.

One variable this study did not evaluate or manipulate is motivation. Video feedback or VSE can be effective procedures if increases in performance function as reinforcers for the individual using the procedures. In this case ‘motivation’ might be defined as being present when improvements in performance function as reinforcers. The assumption behind video feedback and VSE in particular, is that improvements with the use of the procedure will be reinforcing, thus leading to continued high levels of performance and continued use of the procedures that produce better performance. Using the task analysis to mark the steps that were performed correctly during VSE and video feedback allowed the participant to more easily

observe improvements in performance (i. e., to see more steps checked as correct). This immediate feedback is a key element of VSE, one that will only contribute to its success if improvements function as reinforcers (the athlete using it is “motivated”). Future research should evaluate the influence of motivation on the effectiveness of VSE, video feedback, and other behavioral procedures to enhance sports performance.

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Appendices

Appendix A: Task Analysis for the Virabhadrasana II

Virabhadrasana II (warrior pose II)	(+ if correct (-) if incorrect				
Session #					
1. Stand at front of mat (shorter side) with big toes 2-3 inches apart and arms relaxed at sides.					
2. Move right (or left) leg back behind hips with a 2-3 foot separation of feet.					
3. Move right (or left) foot such that both feet make a 90 degree angle, keeping the front foot at the front of the mat.					
4. Bend front knee towards the front of the mat.					
5. Reach out left arm ahead towards the front on the mat, and right arm towards the back of the mat while keeping back straight and aligned.					
6. Keep shoulders down and in line with arms with palms facing down towards the floor and head facing towards the front of the mat.					
7. Stay in pose for at least 30 seconds.					
8. After 30 seconds has passed, bring arms down and back leg forward to once again stand at the front of the mat.					
9. Move left (or right) leg back behind hips with a 2-3 foot separation of feet.					
10. Move left (or right) foot such that both feet make a 90 degree angle, keeping the front foot at the front of the mat.					
11. Bend front knee towards the front of the mat.					
12. Reach out right arm ahead towards the front on the mat, and left arm towards the back of the mat while keeping back straight and aligned.					
13. Keep shoulders down and in line with arms with palms facing down towards the floor and head facing towards the front of the mat.					
14. Stay in pose for at least 30 seconds.					
15. After 30 seconds has passed, bring arms down and back leg forward to once again stand at the front of the mat.					

Appendix B: Task Analysis for the Svanasana

Svanasana (Downward Facing Dog)	(+ if correct (-) if incorrect				
Session #					
1. Start position sitting on mat with legs under hips, with calves on floor parallel to the longer part of the mat.					
2. Put hands on mat palm side down with top of fingers parallel to the shortest part of the mat with fingers spread apart and wrists parallel to shorter side of mat.					
3. Exhale and lift knees so that thighs are perpendicular to the floor and under the hips, with back parallel to floor. Keep fingers separated, with palms shoulder width apart and slightly in front of shoulders.					
4. Lift feet and tuck toes under on mat such that feet are perpendicular to the floor with knees still on mat.					
5. Position pelvis towards feet keeping palms face down on the mat, stretching arms.					
6. Gently lift pelvis in the air, stretching hamstrings and keeping palms and toes placed on the mat. Do not lock knees.					
7. Straighten back first, while keeping knees bent.					
8. Once back is straight, straighten legs while keeping head in line with back. Keep shoulders apart.					
9. Keep position for at least 1 minute.					
10. Once 1 minute has passed, bring knees down to mat and exhale.					

Appendix C: Task Analysis for the Vriksasana

Vriksasana (tree pose)	(+ if correct (-) if incorrect				
	Session #				
1. Begin by standing on mat (or stand on floor without mat for more grip) with big toes 2-3 inches apart, keeping legs close together.					
2. Grab ankle while bringing right (or left) leg up, bringing bottom of foot into the navel area.					
3. Release leg with hand and bring hands to grip hips.					
4. Press right foot into thigh while balancing on the left foot					
5. Put arms down to sides to straighten them, and pull them up above head.					
6. Keep arms above head with palms facing parallel to each other. Look up towards ceiling or face wall.					
7. Hold position for at least 30 seconds.					
8. After 30 seconds has passed, bring hands down and foot down to previous placement on floor.					
9. Grab ankle while bringing left (or right) leg up, bringing bottom of foot into the navel area.					
10. Release leg with hand and bring hands to grip hips.					
11. Press left foot into thigh while balancing on the right foot.					
12. Put arms down to sides to straighten them, and pull them up above head.					
13. Keep arms above head with palms facing parallel to each other. Look up towards ceiling or face wall.					
14. Hold position for at least 30 seconds.					
15. After 30 seconds has passed, bring hands down and foot down to previous placement on floor.					

Appendix D: Instructor Rating Scale

Instructor Task Analyses Rating

Please carefully read and answer the five questions. Please make an **X** mark on the line that best indicates your opinion to the question.

1. The task analysis of the Virabhadrasana II (Warrior II) is indicative of the original pose.

_____	_____	_____	_____	_____
strongly	disagree	neutral	agree	strongly
disagree				agree

2. The task analysis of the Svanasana (Downward Facing Dog pose) is indicative of the original pose.

_____	_____	_____	_____	_____
strongly	disagree	neutral	agree	strongly
disagree				agree

3. The task analysis of the Vrikshasana (Tree pose) is indicative of the original pose.

_____	_____	_____	_____	_____
strongly	disagree	neutral	agree	strongly
disagree				agree

4. I believe the task analyses are easy to understand.

_____	_____	_____	_____	_____
strongly	disagree	neutral	agree	strongly
disagree				agree

5. I believe the task analyses are capable of testing the true form of a pose.

_____	_____	_____	_____	_____
strongly	disagree	neutral	agree	strongly
disagree				agree

Appendix E: Participant Social Validity Rating Scales

Participant Rating Scale 1

Participant # _____

Please carefully read and answer the six questions independently. Please make an **X** mark on the line that best indicates your opinion to the question.

1. I am comfortable performing the Virabhadrasana II (Warrior II pose).

_____	_____	_____	_____	_____
strongly disagree	disagree	neutral	agree	strongly agree

2. I am comfortable performing the Vriksasana (Tree pose).

_____	_____	_____	_____	_____
strongly disagree	disagree	neutral	agree	strongly agree

3. I am comfortable performing the Svanasana (Downward Facing Dog pose).

_____	_____	_____	_____	_____
strongly disagree	disagree	neutral	agree	strongly agree

4. I liked using video feedback and the task analyses to self-manage my poses.

_____	_____	_____	_____	_____
strongly disagree	disagree	neutral	agree	strongly agree

5. I think my poses got better after using video feedback.

_____	_____	_____	_____	_____
strongly disagree	disagree	neutral	agree	strongly agree

6. The video feedback took the same amount of time that I expected.

_____	_____	_____	_____	_____
strongly disagree	disagree	neutral	agree	strongly agree

Please carefully read and answer the six questions independently. Please make an **X** mark on the line that best indicates your opinion to the question.

1. I am comfortable performing the Virabhadrasana II (Warrior II pose).

_____	_____	_____	_____	_____
strongly	disagree	neutral	agree	strongly
disagree				agree

2. I am comfortable performing the Vriksasana (Tree pose).

_____	_____	_____	_____	_____
strongly	disagree	neutral	agree	strongly
disagree				agree

3. I am comfortable performing the Svanasana (Downward Facing Dog pose).

_____	_____	_____	_____	_____
strongly	disagree	neutral	agree	strongly
disagree				agree

4. I liked using video feedback.

_____	_____	_____	_____	_____
strongly	disagree	neutral	agree	strongly
disagree				agree

5. I think my poses got better after using video feedback.

_____	_____	_____	_____	_____
strongly	disagree	neutral	agree	strongly
disagree				agree

6. The video feedback took the same amount of time that I expected.

_____	_____	_____	_____	_____
strongly	disagree	neutral	agree	strongly
disagree				agree

Appendix F: Observer Rating Scales

Rating Scale for Warrior II Pose

Please carefully read and answer the six questions independently while watching the video. Please make an **X** mark on the line that best indicates your opinion to the question.

1. The participant performed the Virabhadrasana II (Warrior II pose) with high accuracy.

_____	_____	_____	_____	_____
strongly disagree	disagree	neutral	agree	strongly agree

2. The participant looked like an expert when performing the Virabhadrasana II (Warrior II pose).

_____	_____	_____	_____	_____
strongly disagree	disagree	neutral	agree	strongly agree

3. The participant seemed to understand the flow of the Virabhadrasana II (Warrior II pose).

_____	_____	_____	_____	_____
strongly disagree	disagree	neutral	agree	strongly agree

4. The participant's body parts were in the correct places during the flow of the Virabhadrasana II (Warrior II pose).

_____	_____	_____	_____	_____
strongly disagree	disagree	neutral	agree	strongly agree

5. The participant began the pose in the correct position.

_____	_____	_____	_____	_____
strongly disagree	disagree	neutral	agree	strongly agree

6. The participant ended the pose in the correct position.

_____	_____	_____	_____	_____
strongly disagree	disagree	neutral	agree	strongly agree

Observer name: _____

Participant number: _____

Video number: _____

Rating Scale for Downward Facing Dog Pose

Please carefully read and answer the six questions independently while watching the video. Please make an **X** mark on the line that best indicates your opinion to the question.

1. The participant performed the Svanasana (Downward Facing Dog pose) with high accuracy.

_____	_____	_____	_____	_____
strongly disagree	disagree	neutral	agree	strongly agree

2. The participant looked like an expert when performing the Svanasana (Downward Facing Dog pose).

_____	_____	_____	_____	_____
strongly disagree	disagree	neutral	agree	strongly agree

3. The participant seemed to understand the flow of the Svanasana (Downward Facing Dog pose).

_____	_____	_____	_____	_____
strongly disagree	disagree	neutral	agree	strongly agree

4. The participant's body parts were in the correct places during the flow of the Svanasana (Downward Facing Dog pose).

_____	_____	_____	_____	_____
strongly disagree	disagree	neutral	agree	strongly agree

5. The participant began the pose in the correct position.

_____	_____	_____	_____	_____
strongly disagree	disagree	neutral	agree	strongly agree

6. The participant ended the pose in the correct position.

_____	_____	_____	_____	_____
strongly disagree	disagree	neutral	agree	strongly agree

Observer name: _____

Participant number: _____

Video number: _____

Rating Scale for Tree Pose

Please carefully read and answer the six questions independently while watching the video. Please make an **X** mark on the line that best indicates your opinion to the question.

1. The participant performed the Vriksasana (Tree pose) with high accuracy.

_____	_____	_____	_____	_____
strongly	disagree	neutral	agree	strongly
disagree				agree

2. The participant looked like an expert when performing the Vriksasana (Tree pose).

_____	_____	_____	_____	_____
strongly	disagree	neutral	agree	strongly
disagree				agree

3. The participant seemed to understand the flow of the Vriksasana (Tree pose).

_____	_____	_____	_____	_____
strongly	disagree	neutral	agree	strongly
disagree				agree

4. The participant's body parts were in the correct places during the flow of the Vriksasana (Tree pose).

_____	_____	_____	_____	_____
strongly	disagree	neutral	agree	strongly
disagree				agree

5. The participant began the pose in the correct position.

_____	_____	_____	_____	_____
strongly	disagree	neutral	agree	strongly
disagree				agree

6. The participant ended the pose in the correct position.

_____	_____	_____	_____	_____
strongly	disagree	neutral	agree	strongly
disagree				agree

Observer name: _____

Participant number: _____

Video number: _____