Using a Hero as a Model in Video Instruction to Improve the Academic Performance of a Student With Autism Spectrum Disorder: A Case Study

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Abstract
The present study investigated the impact of a component of video hero modeling (VHM) on the object counting score of an elementary-aged student with autism spectrum disorder (Futoshi). In the VHM, the student’s special interest (Transformer®) exhibited the correct way of counting. The VHM was added to a modified video self-modeling intervention (MVSM), which was provided continuously throughout intervention sessions or withdrawn from the package of MVSM and VHM (MVSM+VHM). An ABCBCB design, with MVSM+VHM in the B phase and MVSM in the C phase, revealed that Futoshi’s object counting score improved every time the component of VHM was added whereas it decreased every time the component was withdrawn. In some MVSM+VHM sessions, the student exhibited verbal or nonverbal behaviors, confirming that he kept the hero’s performance in mind during object counting. MVSM alone was not effective in improving the student’s performance.

Keywords: video hero modeling, autism spectrum disorder, academic skills

Some students with autism spectrum disorders (ASD) may be preoccupied by a character, including but are not limited to, Power Puff Girls®, Pika-chu®, Spiderman®, and Transformer® (Gagnon, 2001). If a preoccupied character or hero served as a model for the student, the student would be highly motivated to imitate the behaviors, which in turn promotes the student’s learning.

The Power Card strategy (PCS) has successfully used a hero as a model in teaching a target behavior to students with ASD. The PCS is defined as a visual instruction in which a written script, accompanied by a picture, describes that a person’s hero faced the same difficulty as the person himself, how the hero overcame the difficulty, and that the hero wants him to use the same strategy as the hero did (Gagnon, 2001). When a target behavior is taught by PCS, the consequence of engaging in the behavior is being like the hero, which is considered highly valuable to the student. Therefore, the behavior is likely to occur in the future when the student faces the situation. This strategy has been demonstrated as effective in improving sportmanship skills (Keelings, Myles, Gagnon, & Simpson, 2003), conversational skills (Davis, Boon, Cihak, & Fore, 2010), and interactivity transition skills (Angell, Nicholson, Watts, & Blum, 2011).

Maximizing the potential of using a hero as a model to improve the performance of students with ASD, Ohtake (2015) has developed a
video intervention technique, called Video Hero Modeling (VHM). The VHM is defined as a type of video instruction in which a student watches a video, before or while engaging in a target behavior, in which an admired character exhibits a correct response in the setting where the student is expected to engage in the behavior. If the target behavior consists of a few steps and lasts for a short period of time (e.g., greeting, requesting), the video is typically presented immediately before going to the place where the student is expected to exhibit the behavior. On the other hand, if the target behavior involves engaging in a multiple-step task and lasts for a longer period of time (e.g., brushing teeth, changing clothes), the video is typically presented at the time when the student has to exhibit the behavior. The hero modeling video can be developed by the use of the Chroma-key compositing effect, which is available as low-cost video software (Described in Hero modeling video in details).

Compared to using a hero as a model in a script as in the traditional PCS, using hero as a model in videos may be applicable to students with lower functioning ASD who have difficulty understanding written and verbal forms of descriptions explaining how the hero behaves in a specific situation (Ohtake, Takahashi, & Watanabe, 2015). Additionally, VHM can provide students with ASD much more realistic images of the heroes who exhibit the students’ targeted behaviors. The realistic nature of the VHM may attract their attention to the videos and motivate them to be like the heroes much more than PCS.

To date, VHM has been demonstrated as effective in improving domestic skills (e.g., drying hands, folding clothes, toileting) of students with ASD (Ohtake, 2015; Ohtake, Takahashi, Takeuchi, Watanabe, & Hamada, 2014; Ohtake et al., 2015). However, the VHM has not been investigated if the strategy can contribute to improving skills other than domestic domains. The purpose of the present study was to examine the effectiveness of VHM in improving the academic performance of an elementary-aged student with ASD.

Method

Participants

The subject of this study was Futoshi, a 10-year-old male student, who was enrolled in a special school in Japan. Futoshi was selected as a participant because (a) he was diagnosed with autistic disorder according to the Diagnostic and Statistical Manual 4th edition text revision (American Psychological Association, 2000), and (b) he was preoccupied by a few characters according to an interview with his teachers and direct observations conducted by the author during free time.

Futoshi’s developmental age was 3 years and 6 months in cognitive/adaptive domains and 3 years and 9 months in social/language domains, as measured by the Kyoto Scale of Psychological Development (Ikusawa, Matsushita, & Nakase, 2002). The measure is commonly used in Japan to provide estimates of developmental age of the children with disabilities in cognitive/adaptive domains and social/language domains. Although Futoshi actively initiated conversations with teachers and peers, using a four or five-word utterance, he was often preoccupied by the world of fantasy in which he became a favorite character of a favorite movie or TV drama and repeated the lines of the character without responding to the listener’s comments or questions. His special interest included Transformer®, especially Optimas Prime® and Bumblebee®.

The investigator’s institute did not have an institutional review board and it, therefore, cannot officially be verified that the study complied with ethical standards. Before starting this study, the author informed the teachers of the participants of the purpose, methods, and expected results of the study and possible negative effects of the video modeling strategies on the emotion of the participants. The teachers, in turn, explained the same information to the parents of the participants. The hero modeling videos were shown to the parents and teachers and evoked their positive comments (e.g., “Wow, this is wonderful!”). Informed consent was obtained orally from the parents and teachers of the participants.
Target Behavior
Futoshi’s target behavior was counting objects correctly up to 30 while moving them from one tray to another. However, his teacher wanted him to improve his counting skills better than his baseline level, even if his performance could not reach the objective. This behavior was selected because the teacher felt teaching this skill was the most difficult among the tasks assigned in the functional academic class. In the first tray, a number of quarter-dollar-sized objects (e.g., tiles) were placed disorderly. The second tray, to which the objects were moved, consisted of three subtrays. Each subtray consisted of 10-framed spaces, which were arranged horizontally. Futoshi was required to move the pieces one-by-one to a framed space in order while counting it out loud with one-to-one correspondence. Futoshi often made double counts while moving one object or single counts while moving two objects. His errorless counting rarely lasted beyond 10 objects.

Setting
Futoshi’s target behavior was taught by a special education teacher, with only one opportunity per class, four times a week during a functional academic class in the school. The space was approximately 4m by 4m, with three independent work areas. Futoshi’s work station was divided by tall screens to reduce distractions. Work system was employed in which four task boxes were arranged from the top to the bottom. The tasks assigned to him included, but are not limited to, counting objects, matching letters, making words, comparing color and size, writing words, and reading letters. Typically, two other students learned in the same room during the period.

Materials
The author developed all videos and edited them for approximately one to two hours. A Sony HandyCam® was used to videotape the target behaviors. Corel Video Studio 12® was used to edit the video footage, and Audacity 1.3 beta (free software) was used to produce a pseudo-voice of the hero. Two types of video materials were produced: hero modeling video and modified self-modeling video.

Hero modeling video. The author, wearing green gloves and sleeves on his hands and arms, motioned a plastic model of Bumblebee® or Optimus Prime® and objects in front of a green-colored wall in ways that it looked as if the character counted the objects with one-to-one correspondence. The scene was videotaped and downloaded to the video editing software. While replaying the motion video, the author counted the objects out loud in ways that corresponded to the movement of the hero. The counting voice was recorded and modified in pitch by using Audacity to produce a pseudo-voice of the character to be either higher or lower (higher for producing a pseudo-voice of Bumblebee® and lower for producing a pseudo-voice of Optimus Prime®). The pseudo-voice was then overlaid on the character motion video. Using the Chroma-key effect of the software, the author made his green hands and arms and the green screen transparent so that it looked as if Bumblebee® or Optimus Prime® counted 30 objects out loud one-by-one correctly and independently in black space. The hero modeling video was updated five times by changing the movement, posture, and size of the hero to minimize the occurrence of satiation in watching the videos. The duration of the hero modeling video was approximately 1.5 minutes.

Modified self-modeling video. During baseline, the author videotaped Futoshi’s engagement in all the tasks assigned in the functional academic class. The author subsequently edited the video by cutting irrelevant scenes to produce a self-modeling video (Buggey, 2009). In addition, using the same process of producing the hero modeling video, the author produced a video in which Optimas Prime® or Bumblebee® commented and praised Futoshi’s performance (e.g., “You are steadily counting the tiles one by one”; “You are great, Futoshi”) with some motions. The author then overlaid the hero motion video on the self-modeling video, activating the Chroma-key effect of the software, so that it looked as if the character was present in the work area with Futoshi, watching, commenting on, and praising his performance. In each subsequent session,
the modified self-modeling video was updated by using Futoshi’s latest performance in the class to minimize the occurrence of satiation in watching the videos. The duration of the video was approximately 2.5 minutes when the hero modeling video (described below in details). During both opportunities, the scene of Futoshi’s object counting lasted for approximately 20 seconds.

In order to determine if Futoshi kept the hero’s performance in mind during counting, the author let Bumblebee® demonstrate two peculiar behaviors in the videos used in Session 8, 9, 10, and 13. One involved saying, “yahoo” a few times when the hero put a piece into a framed space, and the other consisted of patting a piece two or three times after putting it into a framed space. If Futoshi exhibited these behaviors during object counting, that would be evidence that he kept Bumblebee®’s performance in mind while counting objects.

**Data Collection**

The author videotaped Futoshi’s counting session twice a week for 11 weeks. Viewing the recorded sessions on a computer, the author recorded the number of objects counted immediately before the first error occurred. The author also transcribed Futoshi’s utterances that were considered evidence that he kept the hero’s performance in mind during object counting (e.g., “I am like Optimus Prime”). In addition, the author recorded either occurrence or non-occurrence in each session for each of the two peculiar behaviors (i.e., saying, “yahoo,” patting a piece), which was also regarded as evidence that Futoshi kept the hero’s performance in mind during object counting.

**Procedures**

**Baseline.** In the baseline condition, the teacher was asked to use the same strategies that were used before the study was initiated. That is, before starting this study, the teacher typically let Futoshi count objects until he made an error. Once he made an error, the teacher provided verbal or physical prompts sufficient to evoke a correct response.

**Modified video self-modeling + video hero modeling (MVSM+VHM).** The procedures used in this condition were identical to those used in baseline, with the exception of presenting a modified self-modeling video and a hero modeling video immediately before starting the counting session.

**Modified video self-modeling (MVSM).** The procedures used in this condition were identical to those used in MVSM+VHM, with the exception of presenting a modified self-modeling video alone.

**Experimental Design**

An ABCB design was used, with MVSM+VHM in the B phase and MVSM in the C phase, to measure the impact of a component of VHM on Futoshi’s score of counting.

**Reliability**

**Target behavior.** A trained graduate student independently recorded 100% of the counting sessions. The ratio of the two scores was computed by dividing the score of the first observer by the score of the second observer and multiplying by 100. The mean and range for the target behavior was 93% (50%-100%).

**Transcripts of Futoshi’s utterance.** The trained graduate student independently transcribed Futoshi’s utterances, which were considered as evidencing that he kept the hero’s performance in mind during object counting, 100% of the counting sessions. The agreement was computed by dividing the number of agreements by the total number of agreements and disagreements and multiplying by 100. The agreement ratio was 95%.

**Occurrence of “yahoo” and patting.** The trained graduate student independently marked either occurrence or nonoccurrence for “yahoo” and patting behaviors 100% of the counting sessions. The agreement was computed by dividing the number of agreements by the total number of agreements and disagreements and multiplying by 100. The agreement ratio was 100%.

**Procedural Fidelity**

The author checked all sessions to determine
If Futoshi’s teacher presented the two types of videos in the predetermined way. Results showed that the teacher presented the videos appropriately in all sessions. In addition, the author measured Futoshi’s attentiveness to the video in one session from each B phase and one session from each C phase. A 5-second momentary time-sampling procedure was used to quantify the degree of Futoshi’s attentiveness to the videos. The percentage of the attentiveness in both phases was 100%. Furthermore, to measure the consistency of teacher prompts across conditions, the author checked (a) if the teacher waited to provide prompts until an error was happened and (b) if the teacher provided prompts until correct counting was evoked for all sessions. The teacher followed the two procedures for all sessions except Session 3, in which the teacher provided feedback three times during Futoshi’s counting, and Session 18, in which the teacher counted out loud twice at the same time Futoshi put a piece on a framed space.

**Results**

**Target Behavior**

Futoshi’s performance in each condition is presented in Figure 1. Only one piece of data was collected in the baseline condition because Futoshi frequently exhibited interrupting peers’ learning or escaped from the room, before starting the present study. Implementing MVSM+VHM was expected to function as an antecedent event reducing the problem behaviors. As shown in Figure 1, immediately after implementing MVSM+VHM, Futoshi’s score reached 30. However, a downward trend was observed during the MVSM+VHM condition. Futoshi’s score was dropped to 3 immediately after the component of VHM was withdrawn from the package of video modeling interventions. His score remained 3 during the first MVSM condition. Immediately after reintroducing the component of VHM, Futoshi’s score increased to 30. However, his score was not stable, with a downward trend for the first three sessions and an upward trend for the last four sessions, during the second MVSM+VHM condition. Immediately after withdrawing the component of VHM, Futoshi’s score was dropped to 3. During the second MVSM condition his score varied between 2 and 18. After reintroducing the component of VHM, Futoshi’s score increased from 2 to 21 and reached 30 in the second session during the third MVSM+VHM condition.

The score of nonoverlap of all pairs (NAP) (Parker & Vannest, 2009) was 93.2%, meaning that the probability that the datum chosen randomly from the B phases is higher than the datum chosen randomly from the C phases is 93.2%.

**Ancillary Behaviors During Counting**

Futoshi exhibited behaviors evidencing that he kept the hero’s performance in mind during object counting. He said, “I will do as Optimus Prime (or Bumblebee) did” immediately before counting objects in Session 2 and Session 8. He also said, “Am I like Bumblebee?” immediately after finishing the counting task in Session 8. Further, in Session 8 and Session 9, he said, “yahoo,” while counting objects, as Bumblebee did in the video. In Session 9, Futoshi patted a piece several times while counting objects, just as Bumblebee did in the video.

**Discussion**

Given that neither researchers nor practitioners utilized a special interest or hero of a student with ASD as a model in video instructions, the author invented the technology actualizing the idea by utilizing Chroma key effect, which is available in a low-cost video editing software for novice people. The present study was conducted to determine if the new technology contributes to improving not only daily living skills but also academic skills of students with ASD.

Every time a component of VHM was added to the MVSM intervention, Futoshi’s object counting performance was improved. In contrast, every time the component of VHM was withdrawn from the package of video modeling interventions, his performance was deteriorated. Because Futoshi’s score of object counting depended on whether the component of VHM was introduced or not, it is safe to conclude that a component of VHM contributed to some improvement of Futoshi’s performance.

In some of the MVSM+VHM sessions, a
marker behavior was observed, which would evidence that Futoshi kept the hero’s performance in mind during object counting (e.g., saying, “I will do as Optimus Prime® did,” imitating a peculiar behavior exhibited by Bumblebee®). Interestingly, Futoshi obtained the highest (i.e., 30) or the second highest score (i.e., 24) in the sessions when these markers were detected. This finding implies that his counting score depended partly on the extent to which he kept the hero’s performance in mind during the counting task. In other words, even if he watched the hero modeling video in the MVSM+VHM phase, the level of his consciousness of hero performance is quite different from day to day in the same condition. Futoshi failed to keep his score around 30 although he watched self-modeling videos and hero-modeling videos. The variation of the level of his consciousness may influence the unstable feature of his performance. Physiological conditions (e.g., running nose) and social conditions (e.g., receiving reprimands from his teacher before the class) seemed to influence his attitudes toward the academic task. Systematic observations were not conducted to identify if those factors impacted his performance, however.

Both MVSM and VHM included Futoshi’s hero. However, MVSM alone, in which it looked as if the hero watched, commented on, and praised Futoshi’s performance in the work area, did not improve his performance. His performance was not remarkably improved until the author let the hero engage in counting objects. For this participant it appears that the way in a hero is used is more important than whether or not a hero is used in video-based strategies.

Several limitations of the present study should be noted. First, MVSM was implemented in all sessions except in the baseline session because the teacher and the author wanted Futoshi to reduce his challenging behaviors as quickly as possible during the period and improve his academic performance not only in counting objects but also in other tasks assigned in the period. This consideration did not allow the present study to investigate the extent to which VHM alone could improve the student’s performance. Therefore, this study demonstrated that VHM was a necessary component to improve Futoshi’s counting but did not demonstrate that VHM was a sufficient component to improve his performance (Ward-Horner, & Sturmey, 2010). Therefore, the study demonstrated that VHM was a necessary component in improving Futoshi’s counting but did not demonstrate that VHM was sufficient for improving his performance. For the same reason, the study should not be regarded as a direct comparison between MVSM and VHP as means of improving Futoshi’s object counting.

Second, the study collected a small number of data in each condition. This occurred because the data collection started just three months
before the end of the school year and the teacher provided Futoshi only one opportunity to count the objects per class. It is unknown, therefore, if implementing the VHM for a longer period of time would have improved Futoshi’s performance to the level where he could constantly count 30 objects without mistakes. Third, the study collected only one piece of data during baseline, which makes it difficult to determine if MVSM or MVSM+VHM was better at improving Futoshi’s performance than no implementation of the video modeling strategies. Finally, the study applied VHM to only one student and one target behavior. Consequently, more studies are needed to expand the external validity of the present study.

References