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Training Car Wash Skills to Chinese Adolescents with Intellectual Disability and Autism Spectrum Disorder in the Community

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Abstract

The purpose of this study was to evaluate the effects of video modeling and visual task analysis on the acquisition, maintenance, and engagement of washing cars for three Chinese adolescents with intellectual disability and autism spectrum disorder. Video-based training was conducted in the conference room of a university-affiliated autism research center in China, and the hands-on training using visual task analysis took place in a local car wash. Three male adolescents (16-19 years old) participated in this study. A multiple-probe across four tasks design was used. Results indicated that the training was effective in increasing independent and accurate responses of car wash tasks for all participants, and two of the three participants had a relatively high level of task engagement after the training. The acquired skills and improved task engagement were maintained up to 6 months without practice. Implications in vocational skills training for Chinese adolescents in the community are discussed.

Keywords: vocational skills training, video modeling, visual task analysis, adolescents, autism spectrum disorder, intellectual disability, China.

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Employment is an important domain in quality of living in adulthood (Barneveld, Swaab, Fagel, van Engeland, & de Sonneville, 2014). The benefits of employment include improved mental health, marital/family satisfaction, life satisfaction, perceived health (McKee-Ryan, Song, Wanberg, & Kinicki, 2005), overall quality of life, cognitive functioning, and well-being (Walsh, Lydon, & Healy, 2014). Integrated employment is essential towards full inclusion and participation in community living for individuals with disabilities (TASH National Agenda, 2010). To create a more inclusive society for these individuals, it is critical to maximize their access to quality education and employment training tailored to individual needs, preferences, and abilities, as well as the job market (World Health Organization, 2011).

Currently, employment opportunities are often limited for individuals with intellectual disabilities (ID) and/or autism spectrum disorder (ASD). According to recent US reports, less than one in every five (19%) adults with ID/ASD worked in integrated employment settings from 2015 to 2016 (National Core Indicators, 2017), and 23% of young adults with ID and 32.3% of young adults with ASD have no paid employment after graduation (Newman et al., 2011). Holwerda et al. (2012) reported that approximately 25% of individuals with ASD in US were employed, and Barneveld et al. (2014) found that only 49% of the 169 adults with ASD in their study were employed with a paid position, and 36% of them were on social welfare. Outside of the US, improving employment opportunities for individuals with disabilities is also recognized as an important issue in both developed and developing countries.

In China, considerable efforts to improve access to basic education and employment opportunities have been made by the government (Chinese State Council, 1994; National

People's Congress, 1990). Despite enormous governmental efforts to create and protect job opportunities, employment opportunities for about 35-million working aged people with disabilities are still extremely rare (China Disabled Persons' Federation, 2012). Aside from the poor law enforcement, the lack of resources to access adequate education, employment or vocational skills training for people with disabilities is one of the major reasons contributing to their unemployment (International Labour Organization, 2013). According to a recent report, more than one-third (34.74%) of school-aged Chinese children with ID/ASD had either dropped out of school, or had never gone (Hou, 2015). In addition, transition services for the few adolescents and young adults with disabilities who complete secondary schooling are sparse or even absent (Huang, Jia, & Wheeler, 2013; Liu et al., 2011; McCabe, 2013). With a relatively poor educational foundation, people with disabilities are not equipped with skills to work in competitive employment settings, even under protection of the law. To address this national priority, the Chinese Ministry of Education (2017) has included the development of evidence-based educational programs in their implementation plan.

Evidence-based practices of teaching vocational skills to adolescents and young adults with ID/ASD include video modeling and visual supports (Gilson, Carter, & Biggs, 2017; National Autism Center, 2010). Video modeling has been used to teach various types of employment-related skills to adolescents and young adults with ID/ASD in simulated or community settings, such as a mascot job (Allen, Wallace, Renes, Bowen, & Burke, 2010), watering plants, delivering mail, and changing paper towels (Mechling & Ortega-Hurndon, 2007), as well as basic skills in setting, such as the office, bowling alleys, or grocery stores (Taber-Doughty, Miller, Shurr, & Wiles, 2013). Van Laarhoven et al. (2007) also utilized video modeling by showing a video of to-do tasks on a handheld device, which resulted in an increase

of independent responses and a decrease of prompts in employment settings. Similarly, Riffel et al. (2005) combined video modeling with visual and auditory prompting which effectively increased independent task completion. The results of the above studies support the utility of video-based instruction for the acquisition and independent completion of complex vocational skills. Besides independent task completion, continuous engagement in vocational activities without constant work cessations is important in any employment setting. However, none of these studies measured individual task engagement.

In addition to video models, visual prompts using static pictures have been used to teach a variety of complex tasks for adolescents and young adults with moderate to severe ID/ASD. The skills taught included 18 and 30-step assembly tasks of tool parts (Wacker & Berg, 1983), packaging tasks with a specific number of items placed in designated locations (Wacker, Berg, Berrie, & Swatta, 1985), and activities of daily living (Wacker & Berg, 1984). Specifically, the participants were instructed to follow each picture as a prompt to complete sequenced multi-step tasks. Some pictures contained textual stimuli (e.g., Station 1, Station 2) to indicate a specific location of the compartments and some were colored to match the color of the container to which each item belonged. The researchers reported that picture prompts facilitated skill acquisition of complex skills, enhanced generalization to different tasks and settings, and promoted independent task completion.

In response to the pressing need of evidence-based employment skills training programs for individuals with ID/ASD in China, researchers are called to develop vocational skills training programs and evaluate their effectiveness. Car wash skills are selected as the employment task for this study because car wash services are in high demand in suburban areas in China and several car washes are in the community. Training individuals with disabilities in the community

setting provides an opportunity for competitive and integrated employment. Individual needs of the participants with disabilities, such as preferences, readiness, and willingness, are also taken into consideration as part of the vocational skills training. Both video-based instruction and visual task analysis are evidence-based practices that not only benefit skill acquisition but also facilitate independence in task completion. The purpose of this study was to evaluate the effects of video modeling and visual task analysis on the acquisition, maintenance, and task engagement of washing cars for three adolescents with ID/ASD in China. To our knowledge, this study was the first attempt to address employment skills training pertaining to adolescents and young adults with ID/ASD in China. The following research questions are addressed: (a) To what extent were the car wash tasks completed accurately as a result of training, (b) to what extent was the student task engagement changed before and after training, and (c) to what extent were the acquired car wash skills maintained?

Method

Participants

The participants of this study were recruited from a local parent support group via WeChat (a mobile social media application frequently used in China). The participant was included if s/he (a) was between 13 to 19 years old, (b) had a dual diagnosis of ID and ASD, and (c) could observe and imitate others' actions. The exclusion criterion was that the participant should not have received any training in washing cars prior to the study or planned to obtain such training concurrently with the study. Parental consent and participant assent were obtained.

Kao was a 19-year-old male with ASD and moderate ID. His IQ was 45, measured by the Chinese version of the *Wechsler Intelligence Scale for Children-IV* (WISC-IV; Wechsler, 2003; Zhang, 2008). He was diagnosed with ASD in the severe category (score: 36) using the Chinese

version of the Childhood Autism Rating Scale (CARS; Lu, Yang, Shu, & Su, 2004; Schopler, Reichler, & Renner, 2002) and the criteria of ASD in the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-5; American Psychiatric Association, 2013). Based on the parental report, Kao received full time training in language, academic, and motor skills in a private agency from ages 6 to 13. He also received short-term training in restaurant skills (e.g., dish washing, setting tables, ordering dishes, and cleaning up in a restaurant) and had spent 4 full days per week for a month in a rehabilitation center at age 13. He requested for preferred items, labeled more than 50 common items, answered social questions, and wrote two-word phrases for communication. His reading was approximately at the first-grade level. He had self-help skills, such as dressing himself, grooming, and cleaning his room. However, he needed adult reminders and supervision to complete these tasks.

Ray was a 16-year-old male with ASD and moderate ID. His WISC-IV score was 40, and his CARS score was 38 in the severe category. Ray had attended public schools from elementary to middle school, and his mother had shadowed him throughout his school years. He stayed home with his parents after graduating from middle school, where his mother taught him to do house chores and took him grocery shopping. Ray had basic communication skills, including requesting preferred items, labeling more than 50 common items, and answering social questions. His reading and writing skills were approximately equivalent to the second-grade level. He also had basic self-help skills, such as grooming, showering, dishwashing, and laundry, but required constant reminders and supervision for task completion. He had never received any vocational skills training prior to the study.

Lon was a 19-year-old male diagnosed with mild ID (WISC IQ 67) and mild ASD (CARS score: 29.5). Lon had basic communication skills and he could read and write at the

third-grade level. He followed a daily schedule and was able to take care of himself without assistance (e.g., dressing up, grooming, laundry, cleaning up his room). He could shop in a grocery store without assistance when given a list of items. He could clean up his room and wash dishes after every meal. He had attended a full-time special education school from elementary to high school. He had received vocational skills training in a rehabilitation center (3 days per week, 2 hours per day) after graduating from high school. His vocational skills training program included basic computer skills, using search engines, and delivering office mail.

Settings and Materials

The study was conducted in the suburban area of an inland city in China. Part 1 training consisting of video and instruction was conducted in the conference room of the university-affiliated autism research center. Part 2 training involved hands-on car washing and was conducted in a commercial hand-operated car wash. The probe sessions were also conducted in the car wash. After part 1 was complete, the instructor, the parent, and the student either took a ride, if available, or walked approximately 20 min (1.2 km) from the conference room to the car wash. Due to limited space in the car wash, Part 1 training was conducted in another location.

The instructor was a female graduate student in special education. Only the instructor and the student were present in the conference room during Part 1 training. This room was 5m x 4m x 3m in size, had a computer, a blackboard, a projector screen in front, a table, and two chairs. A video was set on a tripod to record the sessions.

The car wash had space to wash one car at a time (5m x 5m x 3.5m by size). The water hose was placed in the front left side close to the entrance. The sponge and the bucket were at the far end of the left side close to a faucet. The liquid soap and towels were on a holder in the front right side close to the entrance. The office and the waiting area were on the right side adjacent to

the wash booth. The owner(s) of the car wash and the parent of the participant were in the office or the waiting area and occasionally came to observe the training sessions. The car wash provided pick-up and delivery services for customers so the customers did not have to wait there. A video camera was placed on a tripod a to record the sessions.

Four video clips were used in Part 1 training sessions, one video clip for each target task. The instructor served as the modeler who described and demonstrated each step involved in a given task. Each video clip lasted about 4 to 6 minutes. The details of each step (e.g., spraying water thoroughly in each section of the car's exterior) were zoomed in for larger images along with the modeler's verbal descriptions and demonstration of each step in a target task. The videos were presented with the computer in the room.

The visual task analysis consisted of a total of 20 laminated picture cards. Each picture card (12.5cm x 15cm by size) contained a picture of one step in a given task and textual descriptions of that step underneath the picture (e.g., pulling out water hose). These pictures were displayed on the wall within the student's sight. Table 1 lists the tasks and the steps involved. The car in the videos and visual task analysis was a sedan while the ones used for hands-on training included sedans, SUVs, minivans, or vans that were voluntarily provided by the customers. The customers were informed that it would take between 30 minutes to an hour because the worker was a student with disabilities in training and no multiple workers would wash the car at the same time.

Experimental Design

This study employed a multiple-probe across four behaviors design (Gast, Lloyd, & Ledford, 2014) to evaluate the effects of the training on the acquisition of car wash skills and task engagement. The target car wash skills were task analyzed and divided into four target tasks

(i.e., Task A: spraying water, Task B: scrubbing the car with soapy water, Task C: rinsing the car with water, and Task D: drying the car with a cloth) with multiple steps in each task. The training included video modeling, visual task analysis, and a pre-determined prompt hierarchy. The training of Task A was introduced once a stable baseline was established and continued until criterion performance of 100% for two consecutive sessions, following which training for Task B would begin. The training of the subsequent tasks followed the same pattern. Follow-up probe sessions were conducted 1 week after each task reached criterion, 2 weeks, and 6 months after completion of the training.

Procedure

Probe sessions across conditions. Probe sessions were conducted in the same manner across baseline, training, and follow-up conditions to evaluate the progress of each student's skill acquisition across conditions and as a measure of mastery criterion for each task under the training condition. A probe session was conducted prior to the Part 2 training session of the day under the training condition. During probe sessions, the instructor gave simple verbal directions with key words for each task (e.g., "Scrub car with soapy water,") and provided the materials. The instructor then waited 10 s for the student to respond. If the student performed the steps of a task, the instructor provided praise for each correct step at the end of each task (e.g., "You did a good job pulling out the water hose"). If the student did not complete the steps correctly or did not respond within 10 s, the instructor ignored incorrect responses and provided a neutral comment (e.g., "Thank you for your work" or "Let's do something else"). All four tasks were probed as chained responses (Tasks ABCD) across conditions. A baseline probe session lasted from 6 to 13 min if the student lacked the skills to perform the given tasks. A follow-up probe session took longer (probe duration: 23-30 min). Under the training condition, Task A was

probed after Task A was acquired (probe duration: 4-5 min); Tasks A and B were probed as chained responses when Task B was acquired (probe duration: 13-20 min). Probe sessions for Tasks A, B, and C were omitted because Task C was identical to Task A and the students acquired Task C without training. Follow-up probe sessions were conducted according to the following timeline: 1 week after mastery of each task, 2 weeks, and 6 months following the completion of the entire training.

Training sessions. Each training session contained two parts. Part 1 training was conducted in the conference room, and Part 2 was conducted in the car wash. Part 1 training was comprised of a video showing and instruction. First, the instructor presented the video of a target task. Second, the instructor paused the video at the end of each step and displayed the corresponding picture. Third, the instructor asked each student to describe the step by reading the text on the bottom of each picture. Fourth, the instructor provided praise for correct responses or echoic prompts to obtain correct responses. Fifth, the instructor repeated the same sequence for the remaining steps until all steps in a task were shown and described in order. Finally, the instructor presented all of the pictures to the student and asked the student to put them in order and describe the steps. Part 1 ended when all of the steps in a task were completed with the procedure described above. Each Part 1 training session lasted approximately 15 minutes. If the student displayed any disruptive behavior during training, the instructor would first provide verbal direction to obtain student attention (e.g., “Look here”) and then physical guidance (e.g., physically guiding the student back to the seat), if necessary. Disruptive behavior did not occur during Part 1 training of the study.

Part 2 training consisted of hands-on practice in the car wash. First, the instructor displayed all of the pictures in order on the wall. Second, the instructor asked the student to

review the pictures by describing each step. Third, the instructor presented the materials needed for the task. Fourth, the student began working on the steps of the task. The instructor provided praise when the student performed each step correctly. If the student omitted a step or did not perform a step correctly, the response was recorded as incorrect, and the instructor provided a gestural prompt (e.g., pointing to the picture) along with the verbal description (e.g., "Pull out the hose") for the student to respond. If the student still did not respond correctly after the gestural and verbal directions, physical guidance was provided. In this study, we only used physical guidance for Ray in beginning training sessions of Task A. Part 2 training ended after all steps in each task were complete. When the student achieved criterion for Task A, the same training procedure was implemented for Task B. The training procedure was repeated until the student achieved criterion for Task D. Each Part 2 training session lasted approximately 15 to 20 min. For each visit, the student started with Part 1 training for the target task, was transported to the car wash, had one probe session of mastered task(s), and finally underwent Part 2 training of the target task. Each student had two to three visits each week, and the entire training condition took approximately 4 to 6 weeks to complete.

Response Definitions

The dependent variables included the percentage of correct responses for each task and the percentage of task engagement during probe sessions across conditions. A correct response was defined as a correct step completed independently by the student matching the description of that particular step. For example, Task A (spraying water) had four steps, and each step was counted as a response. In step 3, the student had to spray water on all exterior sections of the car in order to be scored as a correct response. If the student had one correct response out of the four steps, the percentage of accuracy for Task A was 25% in that probe session.

Task engagement was measured using 30-s momentary time sampling in baseline, training, and follow-up probe sessions during which the students performed all tasks as chained responses. An instance of task engagement was defined as the student engaged in task completion without any work cessation or disruptive behavior for more than 3 s during each time sampling period. An instance of disruptive behavior included talking out of turn, looking away, displaying irrelevant repetitive movements, or walking around.

Social Validity

To assess social validity, we developed questionnaires and solicited responses from each child's parent, the two owners of the car wash station, the car owners whose cars were washed by the students during follow-up probe sessions, and the students who participated in the study. The parents' questionnaire contained 14 items (Items 1-5: training acceptability, Item 6: perceived helpfulness of the training, Items 7-10: feasibility, and Items 11-14: satisfaction). Items 1 to 5 included the acceptability of the instructional strategies used, the content of the training, the car wash protocol, the one-on-one training format, and the practice opportunities. Item 6 asked the parents whether the training was helpful in increasing their child's vocational skills. Items 7 to 10 concerned feasibility of the training in terms of the duration of each session, frequency of training sessions per week, finance, and time involved to receive the training. Items 11 to 14 were related to parents' satisfaction of their child's car wash skills acquisition, task engagement, and vocational skills, as well as their satisfaction about the instructor. Each item was rated on a 5-point Likert scale (1 = not satisfied or not helpful to 5 = very satisfied or very helpful). The last question was an open-ended question for parents to provide suggestions for program improvement, comments on the intervention, and to share their experiences participating in the intervention.

We conducted a brief interview with each student to ask their overall satisfaction with the training. The four questions were “Do you like to wash cars? If yes, what is the best part? If not, why not?” “Do you like the instructor?” “What do you think about the cars you’ve washed?” and “Would you like to work in a car wash in the future? Why or why not?”

The two owners of the car wash were interviewed with open-ended questions. These included: “Are you satisfied with the results of this training,” “Is there anything you may suggest to improve this training,” and “Would you consider hiring adults with ID/ASD to work in your Car Wash? Why or why not?”

We also developed a questionnaire for the customers who provided their cars for the training, but only solicited responses from the customers whose cars were washed completely by our participants during follow-up probe sessions. The questions were: (a) Is the wait time for the car wash acceptable? (b) Is the fee acceptable? (c) Are you satisfied with the service? If not, any suggestions for improvement? (d) Do you worry about your car washed by individuals with disabilities? (e) Are you willing to send your car to a car wash station served by individuals with disabilities? (f) Any other comments or suggestions for the training?

Procedural Fidelity and Interobserver Agreement

Procedural fidelity was assessed by one supervising faculty member from the university who conducted evaluations either on-site or through video recordings for 30% of all of the training sessions for each student and 30% of the probe sessions for each student and in each condition. A checklist containing the items with implementation steps was used. Checklist items for Part 1 training included (a) introducing the target task, (b) presenting the step in the video clip, (c) presenting the picture/question, and (d) providing consequation. Items (b) to (d) were repeated for each step in the task. Items for Part 2 training included: (a) presenting pictures of the

target task, (b) presenting a verbal direction and materials, and (c) providing consequation. In both Part 1 and Part 2 training, the consequation included either praise for correct responses or a prompt in the hierarchy for an incorrect response/no response. The checklist for probe sessions listed all 20 steps in all tasks. Each step included (a) presenting a verbal direction with materials and waited for 10 s, and (b) providing praise for a correct response while ignoring an incorrect response. The percentage of procedural fidelity was calculated by dividing the number of correct items by the total items on the checklist and multiplying by 100. The procedural fidelity for probe sessions was 100% for all sessions assessed. The procedural fidelity for the training sessions ranged from 92.6% to 97.2% with an average of 94% for all sessions observed.

Interobserver agreement (IOA) was assessed for 30% of the probe sessions for each student from each condition by a graduate student who was trained to record student responses from the video recordings. IOA was calculated by dividing the number of agreements by the number of agreements plus disagreements and multiplying by 100. The average IOA was 94% (range: 92-96%) for car wash tasks and 93% (range: 89-100%) for all sessions observed.

Results

Task Accuracy

Figures 1, 2, and 3 depict the percentage of correct responses for Tasks A, B, C, and D across all conditions for Kao, Ray, and Lon, respectively. During baseline, Kao's task accuracy was stable at a relatively low level for all tasks (Task A: *M* = 38.1%, range: 28.6-42.9%; Task B: *M* = 43.1%, range: 30.8-46.2%; Task D: *M* =35.1%, range: 31.6-36.8%), with the exception of Task C (range: 28.6-100%). The performance of Task C was at the same level as other tasks in the baseline before the mastery criterion for Task A was achieved. Under the training condition, Kao's accuracy immediately increased to a relatively high level and he achieved criterion in five

sessions for Task A (range: 85.7-100%), seven sessions for Task B (range: 76.9-100%), and six sessions for Task D (range: 78.9-100%). No data overlapped between baseline and training conditions. During follow-up sessions, Kao remained at 100% accuracy one week following mastery of Task A. He also performed at 100% when acquired tasks were chained (i.e., AB and ABCD). He maintained 100% accuracy for all tasks in 1 week, 2 weeks, and 6 months following the completion of the training.

Similarly, Ray had a stable and low level of accuracy in baseline for Task A (*M* = 28.6%, range: 28.6-28.6%), Task B (*M* = 14.1%, range: 7.7-15.4%), and Task D (*M* =18.4%, range: 10.5-21.1%), and acquired Task C (range: 28.6-100%) after mastering Task A. His accuracy of each task immediately increased to a relatively high level and ascended to criterion performance under the training condition. He acquired Tasks A, B, and D in five, seven, and six sessions, respectively (Task A: *M* = 82.9%, range: 71.4-100%; Task B: *M* = 81.3%, range: 53.9-100%; Task D: *M* = 75.4%, range: 52.6-100%). No overlaps of data occurred between baseline and training conditions. He maintained acquired tasks and performed them in a chained sequence with 100% during 1 week, 2 weeks, and 6 months follow-up probe sessions.

Compared to Kao and Ray, Lon had a relatively high level of task accuracy during baseline (Task A: range: 42.9-71.4%; Task B; range: 46.2-61.5%; Task C: range: 42.9-100%; Task D: range: 21.1-42.1%). He also acquired Task C after reaching criterion for Task A. His accuracy immediately increased to a high level at or close to criterion performance during training and mastered Task A, B, and D, in two, four, and three sessions, respectively (Task A: *M* = 100%, range: 100-100%; Task B: *M* = 98.1%, range: 92.3-100%; Task D: *M* = 96.5%, range: 89.5-100%). Probe data between baseline and training conditions did not have any

overlap. He also maintained acquired tasks at 100% when chained together in 1-week, 2-week, and 6-month follow-up probe sessions.

Task Engagement

Figure 4 depicts the percentage of student task engagement across the baseline, training, and follow-up conditions. Compared to baseline (*M* = 86.8%, range: 85.2%-88%), Kao's task engagement was slightly high under the training condition (*M* = 89.8%, range: 87.2-92%), and continue to increase to a slightly high level in follow-up sessions (*M* = 94.6%, range: 93.7-95.5%). One data point overlap was observed between baseline and training conditions with no overlaps between baseline and follow-up sessions.

Ray had a similar pattern of task engagement with Kao. His task engagement was stable at a relatively low level during baseline (*M* = 69.4%, range: 60-75%), increased with an ascending trend to a relatively high level under the training condition (*M* = 83.7%, range: 75-93.3%), and stayed at a high level during follow-ups (*M* = 93.7%, range: 91-96.8%). Only one data point overlap occurred between baseline and training with no overlaps between baseline and follow-up sessions.

Lon's task engagement was stable and consistently high at 100% across the baseline, training, and follow-up conditions. No change of data trend was observed.

Social Validity

The average ratings provided by the three parents were 4.87 (*SD* = 0.14) for training acceptability, 4.58 (*SD* = 0.43) for the perceived helpfulness of the training, 5 (*SD* = 0) for the feasibility, and 4.58 (*SD* = 0.31) for their satisfaction of the training.

All three students responded that they liked the training. Kao said that the best part was scrubbing the car with soapy water because soapy bubbles made the car clean. Ray liked

spraying water because he was good at it. Lon liked to dry the car because it was the final step and made the car really clean. All three students liked the instructor and were satisfied with the cars they had washed. Kao and Ray said that they were happy that they could wash the entire car all by themselves. Lon said that he made the cars clean by paying attention. Kao and Ray said that they would like to work in a car wash because they could make money. Lon said, "Car washing is tiring, so I don't want to work there." The instructor asked, "What if they pay you to do it?" To which Lon replied, "Oh, I will do it then."

Both owners of the car wash station indicated that they were satisfied with the results of the training. One suggested that the instructor could have taught the students to use less water and soap during training. Another indicated that the customers' wait time could have been shortened. Both owners expressed their willingness to continue providing their car washes as a job training site for people with disabilities. Further, they would consider hiring people with ID/ASD to work there.

Nine out of 35 customers whose cars were completely washed by our students were asked to complete the questionnaire. They indicated that the wait time of 60 minutes was acceptable with the pick-up and delivery services provided by the car wash. They also considered the fees reasonable, compared to other car washes. They were also satisfied with the quality of the service received. One customer commented that it was good that a supervisor was onsite. For example, one of his car windows were not dried off completely, but the problem was quickly fixed after he communicated with the supervisor. All customers said that they did worry about their cars being scratched accidentally by the students, but the results showed otherwise. One customer noticed that the student who washed his car paid attention to details and washed his car very carefully. The customers all said that they have no problem letting individuals with

disabilities wash their cars in the future.

Discussion

Developing and evaluating evidence-based practices to teach vocational skills to individuals with ID/ASD is a research priority in China. This study was one of the initial attempts conducted to evaluate the effects of video modeling and visual task analysis on the acquisition, maintenance, and engagement of washing cars for adolescents with ID/ASD. Results indicated that the training was effective in teaching and maintaining the skills for all three participants. Two of the participants' task engagement were improved after the completion of the training and during follow-up probe sessions.

Consistent with previous research on vocational skills training (Allen et al., 2010; Riffel et al., 2005; Taber-Doughty et al., 2013; Van Laarhoven et al., 2007; Wacker & Berg, 1983; D P Wacker et al., 1985; Wacker & Berg, 1984), the result of our study indicated that the use of video modeling and visual task analysis effectively improved performance of car wash skills for the three participants with ID/ASD in the employment setting. Video-based instruction provides step-by-step visual demonstrations of complex tasks in sequence and presents the outcome or final product at the end, particularly suitable for teaching complex skills. Because video presentations were not easily accessible in the car wash station, we first presented the videos with verbal instruction in the conference room and then used picture task analysis as a visual prompt for hands-on training sessions in the car wash. As reported previously, videos or pictures not only increased independent task completion but also decreased the amount of prompts required for task completion (Riffel et al., 2005; Van Laarhoven et al., 2007). It is possible that video presentations provided an overview of car wash steps, while the picture task analysis used during hands-on training enhanced independent and accurate task completion. However, such a

speculation warrants further investigations using component analysis to determine the primary controlling variable(s).

Previous research using videos or pictures as antecedent presentations for vocational skills training did not evaluate task engagement as a collateral effect. Two of the three participants engaged in the tasks at a higher level in the training and follow-up conditions than in the baseline, suggesting that the training improved task engagement. Additionally, the duration of car wash performed by our participants during follow-up was only slightly longer (23-30 min) than the time required by a regular worker (18-20 min). The work efficiency of our participants was at a close level with regular workers. Lon's task engagement remained high across all conditions, despite his accurate responses in baseline being at a relatively low level. Lon's teacher suggested that his high-level task engagement was probably due to the self-management training Lon received in the previous year. However, such a correlation was not verified.

Social validity data indicated that the people (i.e., the employers, the parents, the students, and the customers) involved in this study were satisfied with the results of the training. The positive feedback from the employers and the customers was particularly encouraging, as hiring people with disabilities to work in the community setting is still a challenging idea for many people in China (International Labour Organization, 2013). We attributed the success of the training primarily to the use of behavior-analytic strategies informed by research. It is critically important to demonstrate work performance of these individuals not only to increase their competitiveness in employment but also to promote public awareness in Chinese society.

Limitations of the study include the lack of experimental control for Task C, the lack of allowance for component analysis in the experimental design, and the lack of generalization of acquired skills to other settings. In our experiment, we taught a chained behavior with four

discrete tasks and used a multiple-probe design across the four tasks. Because Task A and C consisted of identical steps, all students acquired Task C without training after Task A was acquired, which interfered with experimental control required by the design. A multiple-probe across participant design may be more appropriate. Further, without component analysis, it was difficult to determine whether all components involved in the training sessions were necessary. Additionally, each visit may last for one hour under the training condition (i.e., Part 1 training, walking to the car wash, a probe session, and Part 2 training). This raises the concern regarding the efficiency and feasibility of the training. It may be necessary to present videos in the car wash facility and use video prompting procedures with short-duration video clips that teach one behavior after another, along with total task training. Finally, generalization of car wash skills to other car washes or generalization should be evaluated in future studies.

The results have important implications in developing effective vocational skills training for individuals with ID/ASD in China. To train complex vocational skills, practitioners can consider using video modeling during initial training and visual task analysis in an actual work setting to teach car wash or related skills for adolescents with ID/ASD. This type of training can also be implemented in special education schools or employment support facilities for individuals with ID/ASD, as the procedure is effective and encourages independent task completion. For employers who may consider hiring individuals with ID/ASD to work in their facilities, the training is practically feasible so long as these individuals are provided with supervising staff and video technology in the work settings.

References

Allen, K. D., Wallace, D. P., Renes, D., Bowen, S. L., & Burke, R. V. (2010). Use of video modeling to teach vocational skills to adolescents and young adults with autism spectrum disorders. *Education and Treatment of Children*, *33*(3), 339–349.

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders (DSM-5®)*. Washington, D. C.: Author.

An, Z. G., Hu, X., & Horn, E. (2018). Chinese inclusive education: The past, present, and future. *Intervention in School and Clinic*, 1053451218765244.

Barneveld, P. S., Swaab, H., Fagel, S., van Engeland, H., & de Sonneville, L. M. J. (2014). Quality of life: A case-controlled long-term follow-up study, comparing young high-functioning adults with autism spectrum disorders with adults with other psychiatric disorders diagnosed in childhood. *Comprehensive Psychiatry*, *55*(2), 302–310.

China Disabled Persons' Federation. (2012). The total number of persons with disabilities ad the numbers of different disabilities by the end of 2010. Retrieved from http:// www.cdpf.org.cn/sytj/content/2012-06/26/content_ 30399867.htm.

Chinese State Council. (1994). Regulations on the education of persons with disabilities. Beijing: Huaxia Publisher.

Gast, D. L., Lloyd, B. P., & Ledford, J. R. (2014). Multiple baseline and multiple probe designs. In D. L. Gast and J.R. Ledford (Eds.) *Single Case Research Methodology: Applications in special education and behavioral sciences* (2nd ed., pp. 252–296). New York: NY: Routledge.

Gilson, C. B., Carter, E. W., & Biggs, E. E. (2017). Systematic review of instructional methods to teach employment skills to secondary students with intellectual and developmental disabilities. *Research and Practice for Persons with Severe Disabilities*, *42*(2), 89–107.

Holwerda, A., Klink, J. J. L. van der, Groothoff, J. W., & Brouwer, S. (2012). Predictors for work participation in individuals with an autism spectrum disorder: A systematic review. *Journal of Occupational Rehabilitation*, *22*(3), 333–352.

Hou, J. (2015). Wǒ guó cán jí ér tóng shī xué dí xiàn zhuàng yǔ yǐng xiǎng yīn sù yán jiū [Report on the Situation, Influences, and Factors that Prevent Disabled Children in Our Country from Attending School]. *Zhōng Guó Tè Shū Jiào Yù [Chinese Special Education]*, *1*, 3-9. Retrieved from http://www.cssn.cn/jyx/jyx_tsjyx/201505/t20150522_1977101.shtml.

Huang, A. X., Jia, M., & Wheeler, J. J. (2013). Children with autism in the People's Republic of China: Diagnosis, legal issues, and educational services. *Journal of Autism and Developmental Disorders*, *43*(9), 1991–2001.

International Labour Organization. (2013). Inclusion of people with disabilities in China. Switzerland: Author. Retrieved from http://www.ilo.org/wcmsp5/groups/public/@ed_emp/@ifp_skills/documents/publication/wcms_112380.pdf.

Liu, J., Ma, H., He, Y.-L., Xie, B., Xu, Y.-F., Tang, H.-Y., … Yu, X. (2011). Mental health system in China: history, recent service reform and future challenges. *World Psychiatry*, *10*(3), 210–216.

Lu, J. P., Yang, Z. W., Shu, M. Y., & Su, L. Y. (2004). Er tong gu du zheng liang biao ping ding de xin du xiao du fen xi [Reliability and validity analysis of the Childhood Autism Rating Scale]. *Zhong Guo Xian Dai Yi Xue Za Zhi*, *14*(3), 119–123.

McCabe, H. (2013). Bamboo shoots after the rain: Development and challenges of autism intervention in China. *Autism*, *17*(5), 510–526.

McKee-Ryan, F., Song, Z., Wanberg, C. R., & Kinicki, A. J. (2005). Psychological and physical

well-being during unemployment: a meta-analytic study. *The Journal of Applied Psychology, 90*(1), 53–76.

Mechling, L. C., & Ortega-Hurndon, F. (2007). Computer-based video instruction to teach young adults with moderate intellectual disabilities to perform multiple step, job tasks in a generalized setting. *Education and Training in Developmental Disabilities*, *42*(1), 24–37.

Ministry of Education. (2017). Second special education enhancement program (2017- 2020). Retrieved from http://www.moe.edu.cn/srcsite/A06/s3331/201707/t20170720_309687.html.

National Autism Center. (2010). *An educator's manual to evidence-based practice and autism, 2nd edition*. Downloaded from National Autism Center website at www.nationalautismcenter.org/resources/for-educators/.

National Core Indicators. (2017). Adult consumer survey: 2015-2016 final report. Cambridge, MA: Human Services Research Institute. Retrieved from https://www.nationalcoreindicators.org/upload/core-indicators/2015-16_ACS_Report_Part_I_0623.pdf.

National People's Congress. (1990). Law of the People's Republic of China on the protection of disabled persons. Beijing: Legal System Publisher.

Newman, L., Wagner, M., Knokey, A. M., Marder, C., Nagle, K., Shaver, D., … Schwarting, M. (2011). The post-high school outcomes of young adults with disabilities up to 8 years after high school: Key findings from the national longitudinal transition study-2 (NLTS2). Menlo Park, CA: SRI International. Retrieved from https://ies.ed.gov/ncser/pubs/20113005/pdf/20113005.pdf.

Riffel, L. A., Wehmeyer, M. L., Turnbull, A. P., Lattimore, J., Davies, D., Stock, S., & Fisher, S.

(2005). Promoting independent performance of transition-related tasks using a palmtop PC-based self-directed visual and auditory prompting system. *Journal of Special Education Technology*, *20*(2), 5–14. https://doi.org/10.1177/016264340502000201

Schopler, E., Reichler, R. J., & Renner, B. R. (2002). *The childhood autism rating scale (CARS)*. Los Angeles, CA: Western Psychological Services.

Taber-Doughty, T., Miller, B., Shurr, J., & Wiles, B. (2013). Portable and accessible video modeling: Teaching a series of novel skills within school and community settings. *Education and Training in Autism and Developmental Disabilities*, *48*(2), 147–163.

TASH National Agenda. (2010). Employment. Washington, DC: Author. Retrived from https://tash.org/about/resolutions/tash-resolution-integrated-employment/.

Van Laarhoven, T., Van Laarhoven-Myers, T., & Zurita, L. M. (2007). The effectiveness of using a pocket PC as a video modeling and feedback device for individuals with developmental disabilities in vocational settings. *Assistive Technology Outcomes and Benefits*, *4*(1), 28–45.

Wacker, D P, & Berg, W. K. (1983). Effects of picture prompts on the acquisition of complex vocational tasks by mentally retarded adolescents. *Journal of Applied Behavior Analysis*, *16*(4), 417–433. https://doi.org/10.1901/jaba.1983.16-417

Wacker, D P, Berg, W. K., Berrie, P., & Swatta, P. (1985). Generalization and maintenance of complex skills by severely handicapped adolescents following picture prompt training. *Journal of Applied Behavior Analysis*, *18*(4), 329–336.

Wacker, David P., & Berg, W. K. (1984). Training adolescents with severe handicaps to set up job tasks independently using picture prompts. *Analysis and Intervention in Developmental Disabilities*, *4*(4), 353–365.

Walsh, L., Lydon, S., & Healy, O. (2014). Employment and Vocational Skills Among Individuals with Autism Spectrum Disorder: Predictors, Impact, and Interventions. *Review Journal of Autism and Developmental Disorders*, *1*(4), 266–275.

Wechsler, D. (2003). *Wechsler Intelligence Scale for Children® - Fourth Edition*. San Antonio, TX: Psychological Corporation.

World Health Organization. (2011). World report on disability. Switzerland: Author. Retrieved from http://www.who.int/disabilities/world_report/2011/report.pdf.

Zhang, H. C. (2008). *Wei shi er tong zhi li liang biao-di si ban [The Wechsler Intelligence Scale for children--4th edition]*. Zhuhai, Guangdong: King-May Psychological Assessment Technology Development, Ltd.

Table 1. *The car wash steps in each task*

Task	**Steps**
A: Spray water	A1: pulling out the water hose
	A2: turning on the water hose
	A3: spraying the car (front, windshield, top, back windshield, left side and the wheels, right side and the wheels)
	A4: turning off the water hose and put it pack
B: Scrub the car with soapy water	B1: pulling out the soap hose
	B2: turning on the soap hose
	B3: spraying the soap hose (front, wind shield, top, back wind shield, left side and wheels, right side and wheels)
	B4: turning off the soap hose and put it back
	B5: filling water in the bucket and soak sponge in water
	B6: scrubbing the car (front, wind shield, top, back windshield, left side, and right side)
	B7: washing the sponge and dump water in
	B8: putting the sponge and the bucket back
C: Rinse the car with water	C1-C4: same as A1-A4
D: Dry the car with a cloth	D1: getting a clean cloth
	D2: drying the car (front, windshield, top, and back windshield)
	D3: drying left and right sides
	D4: putting the used cloth in the laundry basket