Comparing the Effectiveness of Independent and Supervised Study Conditions to Teach Behavioural Principles and Procedures with Computer-Aided Personalized System of Instruction

by

Lindsay H. A. McCombe

A Thesis submitted to the Faculty of Graduate Studies of

The University of Manitoba

in partial fulfillment of the requirements of the degree of

MASTER OF ARTS

Department of Psychology

University of Manitoba

Winnipeg

Abstract

Self-paced online courses are increasingly common and offer practical benefits such as flexibility of time and location. Computer-Aided Personalized System of Instruction (CAPSI) is one example of a well-researched method of online instruction that includes a self-pacing feature. Although flexibility is a benefit, self-paced online instruction is often challenged with high dropouts. The purpose of this study was to evaluate whether supervision of students engaged in CAPSI improves training completion and learning of behavioural principles and procedures, as suggested by previous studies. Participants were randomly assigned to either the independent or supervised study conditions. In both conditions, participants used a self-instructional manual in combination with CAPSI. Participant's declarative and procedural knowledge were evaluated with a written behavioural test and application assessments, respectively, before and after training. Statistically significant main effects were found for acquisition of declarative and procedural knowledge, but between groups differences were not statistically significant with regard to training completion and learning. Reasons for this lack of effect between the supervised and unsupervised groups are discussed.

Keywords: computer-aided personalized system of instruction, participant attrition, applied behaviour analysis

Acknowledgements

I would like to thank my advisor, Dr. Joseph Pear, and my committee members, Drs. Shahin Shooshtari and Kirsten Wirth for their guidance and support of this research. In addition, I would like to acknowledge and thank Drs. Toby Martin and May Lee for their mentorship throughout my study. I would also like to express sincere appreciation to my research assistants for their contributions to this study, especially Katharine Kalinowski, Michelle Fillion, and Karli Pedreira. Finally, I thank the research participants that helped make this research possible.

Table of Contents

List of Tables

List of Figures

Comparing the Effectiveness of Independent and Supervised Study Conditions to Teach Behavioural Principles and Procedures with Computer-Aided Personalized System of Instruction

Self-paced online courses are increasingly common and offer an array of benefits, such as convenience, flexibility, and accessibility. Students are not restricted by set schedules or locations because they have the freedom to study when and where they want (Lee & Choi, 2011). Furthermore, online content is accessible virtually anywhere. Computer-Aided Personalized System of Instruction (CAPSI) is one example of a well-researched method of online instruction that includes a self-pacing feature. For example, CAPSI has been used successfully at universities to teach academic subjects (Pear & Crone-Todd, 1999; Pear, Schnerch, Silva, Svenningsen, & Lambert, 2011) as well as in applied settings to teach behaviour analysis procedures to staff that support persons with developmental disabilities and autism spectrum disorder (Arnal, 2013). However, the flexibility of self-paced systems like CAPSI may present a pitfall. Specifically, when students self-pace they may be at increased risk of not completing the course and decreasing learning outcomes. Strategies aimed at student factors, course factors, and environmental factors have been used to overcome online course dropouts (see Lee & Choi, 2011). Efforts to address attrition have also included supervision (Lee et al., 2013) and supervision with a monetary incentive (Kehler, 2015). The purpose of this study was to evaluate whether supervision of participants engaged in CAPSI promotes training completion and learning of behavioural principles and procedures.

CAPSI

CAPSI is based on Fred S. Keller's (1968) Personalized System of Instruction (PSI). Keller outlined five basic features of a PSI course. One feature is the mastery of course material. Course material is broken down into small units of study, and students must reach a mastery criterion on each unit before proceeding to the next unit. A second feature is the use of proctors,

defined as students proficient with the material who evaluate unit tests and provide feedback. Typically proctors are students in a more advanced course. A third feature is self-pacing, meaning that students proceed through the course material at their own pace. A fourth feature is an emphasis on the written word (e.g., textbooks, manuals) as the primary source of instructional information. A fifth feature is the use of lectures for demonstration and motivation, rather than the primary source of instruction for the course material. Keller demonstrated that PSI is an effective teaching method in that student achievement was high across three different classroom samples. In what Keller described as an "upside down" grade distribution compared to traditional university courses, the relative frequencies of students' "A" grades increased and their "D" grades decreased.

CAPSI is designed as an educational research tool, and most of its features are modifiable. However, it generally includes all of the basic features of PSI but is web-based, which helps alleviate the resource demand issue of traditional PSI methods by automating management and administration of unit tests. As with PSI, CAPSI courses divide course material into small units and the learning objectives for each unit are defined by study questions on the unit. Students study the course material at their own pace and request unit tests from the CAPSI program after studying each unit of material. The unit tests consist of a random sample of short-answer questions based on the study questions.

When a student completes a unit test and submits it for marking, the CAPSI program assigns the test to two peer reviewers. Peer reviewers for a given unit are students within the class who have previously demonstrated mastery of the unit. Students indicate their availability to peer review through the CAPSI program. Students who mark a test assigned to them within 24 hours earn a small amount of credit toward their final grade in the course, but if a student fails

to mark the test within 24 hours they are penalized by a small amount of course credit. Typically, two peer reviewers who have mastered a particular unit of material are assigned to mark a unit test on that material. If there are no available peer reviewers to mark a test, the test is assigned to the instructor or teaching assistant. Peer reviewers mark each test question as either a "pass" (i.e., the student has demonstrated mastery of the material) or a "restudy". All answers on a particular test must demonstrate mastery of the material before the student can proceed to the next unit. Students that do not reach the mastery criterion on a given attempt simply restudy the material and retake the test after a period of restudy as many times as necessary to demonstrate mastery of the material.

The CAPSI peer review system offers a number of benefits. Peer reviewers are students within the class, rather than external resources as in traditional PSI. Both peer reviewers must mark a test as a "pass" before a student can proceed to the next unit, which aids in quality control (Martin, Pear, & Martin, 2002). Additionally, peer reviewing helps to promote the reviewer's learning as well as that of the students who receive the reviewers' feedback (Pear & Crone-Todd, 2002).

Research has demonstrated that CAPSI is an effective teaching method in a university setting (Pear & Crone-Todd, 1999; Pear & Novak, 1996; Pear et al., 2011). Pear and Crone-Todd (1999) examined four different second-year undergraduate psychology courses taught with CAPSI. Student achievement on the midterm and final exams were similar across courses, with mean scores of 86% and 71% overall, respectively. The majority of students were reasonably satisfied with the course as indicated during a course evaluation, with 54% of students reporting the course was good or very good, and 37% of students reporting the course as average. The

high degree of student achievement and positive course evaluations support CAPSI's use as a viable online educational method.

Pear and Novak (1996) evaluated student reactions to CAPSI in two second-year undergraduate psychology courses. Students were asked for both positive and negative reactions to the CAPSI course via questionnaires. Students identified several positive attributes such as (a) the convenience of not having to attend classes, (b) being able to work at your own pace, and (c) having the freedom to work on the course material when and where they wanted. Students were also asked whether they would enrol in other CAPSI courses and 77% indicated that they would. Students also identified (a) the weight and structure of the final exam, (b) the lack of interaction, (c) the absence of classes, and (d) the study questions asked, as components of the course that they liked the least. Regarding (a), above, while a final exam is not an essential part of CAPSI, one is often used in academic CAPSI courses.

CAPSI for Applied Behaviour Analysis Training

Applied behaviour analysis (ABA) involves the application of learning principles in order to measure and modify behaviours in a meaningful way (Martin & Pear, 2015). The learning principles that are fundamental to ABA have been applied across various educational (e.g., Keller, 1968; Pear & Crone-Todd, 1999; Pear & Novak, 1996), health (e.g., Hopko, Lejuez, LePage, Hopko, & McNeil, 2003), athletic (e.g., Roane, Kelly, Trosclair, & Hauer, 2004), environmental (e.g., O'Neil, Blanck, & Joyner, 1980), and workplace (e.g., Geller, 2005) settings. Behavioural interventions have been used effectively in helping persons with developmental disabilities to increase desirable behaviours and decrease undesirable behaviours (e.g., Braithwaite & Richdale, 2000; Cicero & Pfadt, 2002; LeBlanc, Hagopian, & Maglieri, 2000) and are considered evidence-based procedures for children and youth with autism spectrum disorder (National Autism Center, 2015).

Early Intensive Behavioural Intervention, based on the principles of ABA, is the most evidence-supported treatment for autism spectrum disorder (e.g. Eldevik et al., 2009; Makrygianni & Reed, 2010; Matson & Smith, 2008; Reichow & Wolery, 2009). The Centers for Disease Control and Prevention (2014) estimates autism spectrum disorder prevalence at 1 in 68 or 1.5% of 8-year-olds in the United States, and Ouellette-Kuntz et al. (2014) reported annual increases in prevalence as high as 14.6% in Canada among children aged 2-14 years. Therefore, effective ABA training methods are needed to help meet the growing demand for evidence-based services.

CAPSI is one such method that can effectively teach behavioural assessments and procedures. For example, Hu, Pear, and Yu (2012) evaluated the use of a self-instructional manual, and demonstration videos and unit tests accessed via CAPSI in a multiple baseline design across three university students to teach the Assessment of Basic Learning Abilities (ABLA; see Kerr, Meyerson, & Flora, 1977). Participants were given a written test comprised of 15 fill-in-the-blank and true-or-false questions to assess their knowledge of the ABLA before and after training. Participants were also asked to conduct three trials for each of five ABLA levels with a researcher role-playing a client. Baseline knowledge test scores of participants were 44%, 50%, and 32% and improved to 91%, 89%, and 68% in post-training, and increased slightly in follow-up to 94%, 91%, and 72%, respectively. Mean baseline implementation performance across all ABLA levels for participants were 31%, 16%, and 34% and increased after training to 93%, 81%, and 84%, and were 90%, 96%, and 84%, respectively at follow-up. Overall, knowledge and implementation of the ABLA improved considerably with a CAPSI self-instructional training package and assessment scores remained high at follow-up for all three university students.

Arnal (2013) assessed a self-instructional training package using CAPSI to teach participants to conduct a preference assessment, a procedure for identifying preferred items of individuals with limited communication skills. A multiple baseline design across three university students, with replication, and a multiple baseline design replicated across two pairs of staff members who work with persons with special needs were used to evaluate the training package. All training components were delivered online through the CAPSI program including the self-instructional manual, demonstration videos, and unit tests during scheduled sessions with the researcher. Across all university students, mean baseline performance accuracy in conducting preference assessments with a confederate role-playing a person with developmental disabilities was 35% and improved to 94% after training. Across all staff participants, mean baseline performance accuracy was 23% and improved following training to 87%. At follow-up, most university students maintained high performance accuracy, but only one staff participant achieved mastery (over 85%).

Zaragoza Scherman et al. (2015) evaluated a self-instructional manual in combination with CAPSI to teach university students how to conduct discrete-trials teaching, a procedure commonly used in behavioural programming. During baseline and post-training assessments, participants were asked to conduct 12 trials for each of three tasks (matching pictures, pointing to named pictures, and motor imitations) with a confederate role-playing a child with autism spectrum disorder. During training, participants completed 12 unit tests via CAPSI and three self-practice exercises. Five of the seven university students recruited for participation completed the study. Across all participants and tasks, mean performance in baseline was 55% and showed a highly statistically significant improvement to 85% in post-training. Thus, the self-instructional manual in combination with CAPSI was effective in teaching five university

students to implement discrete-trials teaching procedures to a confederate role-playing a child with autism spectrum disorder.

The Problem of Attrition

Despite the growing popularity and practical advantages of self-paced online instruction, student attrition is a major challenge facing online courses (Lee & Choi, 2011). Dropped courses result in missed learning opportunities for the students. Additionally, it may contribute to lower self-confidence and self-esteem (Poellhuber, Chomienne, & Karsenti, 2008). Programs may even be considered inefficient or low quality as a result of high attrition (Poellhuber et al., 2008; Willging & Johnson, 2009).

Lee and Choi (2011) reviewed online course dropout research. They reported that many of the studies on this topic have examined the association between course dropouts and student characteristics or experiences. The research suggests that to reduce dropouts, instructors should attempt to (a) understand students' challenges and potential, (b) deliver quality course activities and establish support systems, and (c) be prepared to handle environmental issues and emotional challenges (Lee & Choi, 2011).

Clay, Rowland, and Packard (2009) provided a rare example of an experimental study identified in the Lee and Choi (2011) review. Clay et al. implemented a combination of two strategies to improve retention in two targeted undergraduate online courses during the 2007 summer semester. First, students wanting to enroll in the online courses had to meet with an advisor and complete a mandatory online orientation and quiz. The advisor reviewed quiz results, followed-up with students if any answers were incorrect, and authorized enrollment. The second strategy involved repetitious communication. Information about the course and important dates were communicated via email, postal mail, and social media: advisors sent weekly emails, and students received a phone call prior to the start of the semester to remind

them how to access the course online. Previous summer retention rates of online courses averaged 73% (range = 69 – 77%) and implementation of advisor involvement/orientation and redundant communication to students led to a retention rate of 82% (Clay et al., 2009).

Attrition has been recognized as an issue in several CAPSI research studies. For example, Wirth (2008) evaluated the effectiveness of a training manual to teach behavioural principles and procedures to staff who work with individuals with developmental disabilities and autism spectrum disorder. Thirty participants were divided into three groups to assess the effectiveness of the manual studied alone (i.e., self-study), the manual in combination with CAPSI, and the manual in combination with facilitator-led lecture sessions. Multiple-choice knowledge tests and generalization tests were administered before and after training. Participants earned points by completing training activities (e.g., pre-test assessments, peer-reviewing) and on the basis of their post-test knowledge test scores, and received a certificate of completion by earning 100 points. All but one of the 15 participants that completed the post-test assessments had increased knowledge test scores following training. Across all participants, differences in pre- and post-test knowledge test scores were statistically significant. Improvements in generalization scores from pre- to post-test assessments were also statistically significant.

Despite the fact that the majority of participants were offered paid work time to participate in the study, and there was no cost associated with the training, there was a withdrawal rate of 50%. Of the 15 participants that withdrew from the study, 2 were from the lecture condition, 5 were from the self-study condition, and 8 were from the CAPSI condition. When asked why they withdrew from the study, most participants indicated they were too busy. The researcher suspected that the relatively lower withdrawal rate in the lecture condition was

influenced by the presence of a social contingency in the lecture group and lack thereof in the other conditions. Wirth (2008) suggested specifying dates and times to attend sessions as a way to establish a social contingency with the use of CAPSI.

Two subsequent CAPSI studies incorporated a supervision feature to reduce attrition. Lee et al. (2013) examined the effect of supervised study on training individuals to conduct discrete-trials teaching procedures, which are commonly used in ABA programs. Participants were 72 university students. In Experiment 1, the effectiveness of a self-instructional manual studied alone was compared to use of the manual in combination with CAPSI. Participants completed training on their own without supervision. Short-answer knowledge tests and application tests were administered before and after training. In Experiment 2, the procedures were the same as Experiment 1, except training was completed during scheduled sessions supervised by a research assistant to address high attrition experienced in Experiment 1.

Participants showed improved performance on knowledge and application tests following training in both conditions (manual and manual with CAPSI) and regardless of whether training was completed with or without supervision. Although performance on knowledge tests improved in both conditions after training, greater improvements were observed in the manual with CAPSI condition. Completing training during supervised study sessions reduced attrition rates in both conditions. In Experiment 1, 71% of participants in the manual condition and 80% of participants in the manual with CAPSI condition withdrew from the study. When supervised study sessions were introduced in Experiment 2, withdrawal rates dropped to 20% in the manual condition and 7% in the manual with CAPSI condition. Overall, using CAPSI in combination with a self-instructional manual was more effective than studying the manual alone in teaching

university students written knowledge of discrete-trials teaching, and supervised study sessions increased training completion rates.

Kehler (2015) evaluated the use of CAPSI to teach the self-regulation program of awareness and resilience in kids (*spark**; Mackenzie, 2010), an approach to teach daily living skills to children with autism spectrum disorder. Written knowledge tests were administered before and after training. In phase 1, participants completed training on their own and only 2 of the 6 participants completed all portions of the study. In phase 2, introducing supervision and a monetary incentive decreased attrition, as 11 of the 13 participants completed the study. Improvement in knowledge test scores following training was statistically significant in phase 2, but not statically significant in phase 1.

Statement of the Problem

Online instructional methods offer greater accessibility and enhanced flexibility for students compared to direct instructional methods. CAPSI is an effective online teaching method for university courses and teaching behavioural principles and procedures. All online delivery methods face the challenge of high dropout rates. Previous research studies by Lee et al. (2013) and Kehler (2015) identified supervised study as a potential solution to attrition with CAPSI, but neither study experimentally evaluated the impact of supervision on completion rates. Therefore, the purpose of this study was to evaluate the effect of supervision on training completion and learning. The independent variable was the presence/absence of supervision; i.e., whether CAPSI training was done with or without supervision. The dependent variables were training completion rates, performance on written declarative knowledge tests, and performance on procedural knowledge tests.

Method

Participants and Setting

Participants were recruited through St.Amant, an organization that provides a range of services and supports to individuals with developmental disabilities and autism spectrum disorder in Manitoba. Individuals were eligible to participate if they: (1) worked in a direct service role, either through paid employment or volunteering; (2) had no previous education or training in ABA; and (3) had regular access to a computer with an Internet connection in order to access the CAPSI program. A total of 22 direct service providers consented to participate in the study. Two individuals were excluded from the study because they did not meet the eligibility criteria. Of those excluded, one individual had previous behavioural training, and one did not work in a direct service role. Twenty participants completed baseline assessments and were randomly assigned to either the independent study condition (n = 10) or the supervised study condition (n = 10). The former will be referred to as the CAPSI condition and the latter will be referred to as the CAPSI+ condition. Four participants in the CAPSI condition and five participants in the CAPSI+ condition did not complete the training and/or post-training assessments, resulting in a final sample of 11 participants. Table 1 presents descriptive information on the participant's demographic characteristics for the CAPSI and CAPSI+ groups. The sample included 10 females and 1 male. The age of participants ranged from 19 to 59 years (M = 38.8, SD = 14.5). There were no statistically significant differences between groups in terms of age or years of service as assessed with independent t-tests. Additionally, there were no statistically significant differences between groups with regards to whether English was participant's first language, post-secondary education, or previous enrollment in online courses as assessed with chi-squared tests.

Participants who completed the study earned a Certificate of Completion and were entered into a draw to win one of two $50 Visa gift cards (one draw for each training condition), regardless of their performance. Participants who achieved 80% on the post-training knowledge test earned a Certificate of Completion with Excellence.

Baseline, post-training, and follow-up sessions were completed in an assessment room at St.Amant. Participants in the CAPSI condition completed training at a preferred location (e.g., at home) and participants in the CAPSI+ condition completed training in an office at St.Amant, under the supervision of the researcher.

The study received ethical approval from the Psychology/Sociology Research Ethics Board at the University of Manitoba and a St.Amant Research Access Review Committee prior to commencement. Written informed consent was obtained for all participants and research activities were conducted as approved by the University of Manitoba ethics protocol and the St.Amant Research Review Committee.

Materials

The training package consisted of a study introduction, a 40-page self-instructional training manual (Wirth & Pear, 2006), an activity log, and a concise written description of CAPSI. Participants used computers with an Internet connection to access the online CAPSI program during training. Baseline and post-training assessment materials included: a pen, procedural task descriptions, tokens, a puzzle, building blocks, a timer, a written declarative knowledge test, a video camera, and a tripod. A tablet connected to the Internet was also used in the baseline session to assist participants with their initial log-in to the CAPSI program.

Measures

Demographic questionnaire. This questionnaire, administered after written informed consent was obtained, asked 9 questions to confirm participant's eligibility and collect

demographic information such as, age, whether English was their first language, education, years of service in a direct support role, and whether they had previously taken online courses (Appendix A).

Declarative knowledge test. To measure acquisition of declarative behavioural knowledge from the training program, a written knowledge test was administered before and after training (Appendix B). The knowledge test consisted of five short-answer questions from the self-instructional manual. To reduce potential experimenter bias, knowledge tests were marked by research assistants blind to experimental phase and condition. Two research assistants independently marked all knowledge tests with a marking scheme outlining how to score each question. Interobserver agreement was assessed for a representative sample across experimental phases and conditions. Interobserver agreement was assessed for 34% of the total knowledge tests. An agreement occurred if both observers recorded a response as correct or both recorded a response as incorrect. A disagreement occurred if one observer recorded a response as correct and the other observer recorded it as incorrect. Percent agreement was calculated as the number of agreements divided by the number of agreements plus disagreements and multiplied by 100%. Mean percent agreement across knowledge tests was 90.3% (range = 72 – 100%).

Procedural knowledge tests. To assess whether training participants about declarative knowledge of behavioural principles and procedures would generalize to correct procedural knowledge, three role-playing application tests (applying reinforcement to teach simple motor responses, decreasing problem behaviours with extinction, and fading prompts to complete a puzzle) were created by the researcher and administered before and after training (Appendices C – E). As with the knowledge tests, to reduce potential experimenter bias all procedural

knowledge assessments were scored by research assistants blind to experimental phase and condition. Two research assistants independently scored performance on each of the three tests using evaluation forms created by the researcher (Appendices F – H). Performance on the procedural knowledge assessments was scored as the mean percentage of correct responses across the three tests, with the researcher role-playing a child with minimal language skills. The percentage of correct responses in the procedural knowledge assessments was obtained by dividing the number of correct responses by the total number of correct and incorrect responses and multiplying by 100%. Interobserver agreement was assessed for a representative sample across experimental phases and conditions. Interobserver agreement was assessed for 26% of the total procedural knowledge tests. Percent agreement was calculated as the number of agreements divided by the number of agreements plus disagreements and multiplied by 100%. Mean interobserver agreement across procedural knowledge tests was 94.5% (range = 73.3 – 100%).

The researcher's responses during the procedural knowledge tests were scripted. A research assistant blind to experimental phase and condition evaluated procedural reliability for script adherence for a representative sample of 51% of the total procedural knowledge tests. Percentage of script adherence was calculated as the number of scripted responses performed correctly divided by the total number of scripted responses, and multiply by 100%. Mean script adherence procedural reliability for the reinforcement, extinction, and fading tests were 90%, 83%, and 84% respectively. Overall, mean procedural reliability for script adherence across the three procedural knowledge tests was 86% (range = 0 – 100%). Most of the script adherence errors (12/19) for the extinction task were due to the fact that the materials were not available to perform the target response (e.g., the participant removed all of the building blocks). Of the script adherence errors for the fading task, 75% of the errors occurred because participants full

prompted the researcher to insert a puzzle piece into the incorrect puzzled slot, and the remaining errors (2/8) occurred because the participant full prompted the researcher when only a partial prompt was required.

Course completions. Course completions were defined as participants completing baseline assessments, training, and post-training assessments.

Social validity questionnaire. This questionnaire, administered after the post-training assessments, evaluated participants' satisfaction with the training method, the applicability of information learned, and suggestions for improvement. The questionnaire consisted of four Likert-type questions, and three open-ended questions (Appendix I).

Procedural reliability. An independent observer evaluated procedural reliability of the experimenter during 34% of assessment sessions using a procedural checklist (Appendix J). Procedural reliability was calculated by dividing the number of procedural steps correctly followed by the total number of procedural steps, and multiplying by 100%. Mean procedural reliability during the assessment sessions was 99.7% (range = 96 – 100%).

Research Design

A pre-test, post-test between-groups design was used to compare the effectiveness of independent and supervised study conditions to teach direct care service providers behavioural principles and procedures with a self-instructional manual in combination with CAPSI.

Procedure

Baseline. Baseline assessments were conducted to evaluate each participant's declarative knowledge of behavioural principles and procedures and ability to apply behavioural procedures prior to training. Participants were given 50 minutes to complete the written declarative knowledge test (Appendix B). After participants completed the test, they were offered a short break before starting the procedural knowledge tests.

Participants were asked to complete the three role-playing procedural knowledge tests (Appendices C-E) with the researcher to evaluate procedural knowledge. The order of the three tests was counterbalanced across participants. Participants were given 5 minutes to review the test descriptions and then had a maximum of 5 minutes to complete each test. All procedural knowledge assessments were video recorded for later scoring.

Training. Upon completion of the baseline assessments, participants were assigned to one of the two study conditions, CAPSI or CAPSI+. The first participant was randomly assigned to the CAPSI+ condition, as determined by a coin toss, and each subsequent participant was assigned to the opposite condition of the previous participant. The researcher assisted participants with their initial log-in to the CAPSI program (accessed at www.capsiresearch.org).

Participants were instructed that training involved studying the contents of the manual and writing unit tests via CAPSI. Each unit test was comprised of three questions randomly selected from the study questions contained within the manual. Unit tests were marked by the researcher or a research assistant. In order to receive a “pass” and proceed to the next unit, participants had to demonstrate mastery of the tested unit by answering all three questions correctly. If participants received a “restudy”, he or she would re-write the unit test after a 30 minute restudy period, as many times as needed until mastery was demonstrated. Each time a participant re-wrote a unit test, a different random sample of questions was presented. Participants had 60 minutes to write each unit test. Once participants passed the ninth and final unit test, a post-training assessment session was scheduled.

CAPSI condition. Following the log-in demonstration, participants in the CAPSI condition were provided with the training package and began training on their own, as described above.

CAPSI+ condition. Following the log-in demonstration, participants in the CAPSI+ condition began training during supervised study sessions scheduled according to the availability of the participant and researcher. During the supervised study sessions, participants had access to the training package and a computer with an Internet connection in order to access CAPSI. Participants completed training as described above and the researcher did not interact with participants during study sessions. Unit tests were marked by a research assistant as soon as a test was submitted to allow for the participant to proceed through the units as quickly as possible. Multiple study sessions were scheduled and participants determined the duration of each study session. At the end of each study session, the researcher scheduled the participant's next study session. Study sessions were scheduled until the participant passed all nine unit tests.

Progress prompts. For the CAPSI condition, progress prompts were sent to participants according to the following schedule. After two weeks of inactivity with the CAPSI program (i.e., a unit test was not submitted), the researcher emailed the participant to ask how the training was going and advised the participant to contact her should they have any questions. After two additional weeks without submitting a unit test, a second follow-up occurred asking the participant to confirm their continued participation in the study. A third and final follow-up was sent if a unit test was not submitted within two months (i.e., four weeks following the second prompt).

Progress prompts were not administered for the CAPSI+ condition as unit tests were only submitted during scheduled study sessions.

Post-training. Once participants demonstrated mastery of the final unit test, a post-training assessment session was scheduled. During the post-training session, participants completed the same written declarative knowledge test and three role-playing procedural

knowledge tests as were administered in baseline, described previously. Additionally, participants completed the social validity questionnaire (Appendix J).

Follow-up. One month after the post-training session, participants were asked once again to complete the same written declarative knowledge test and role-playing procedural knowledge tests as were administered during the baseline and post-training assessment sessions.

Data Analysis

A two-way repeated measures analysis of variance (ANOVA) was conducted to evaluate declarative and procedural knowledge test performance respectively. The repeated measures ANOVA assumptions of: (1) dependent variables measured at a continuous level, (2) categorical independent variable, (3) no significant outliers, (4) normality, and (5) sphericity were met. A 2 x 3 repeated measures ANOVA, with training condition (CAPSI vs. CAPSI+) as the between-group factor and time (baseline, post-training, and follow-up) as the within-group factor was planned, but given the high attrition at follow-up a 2 x 2 repeated measures ANOVA was conducted, with CAPSI versus CAPSI+ as the between-group factor and time at baseline and post-training as the within-group factor for declarative and procedural knowledge tests respectively.

A chi-square statistic was used to assess whether training condition was associated with course completion. Participants were classified as either course completions or non-completions in the CAPSI and CAPSI+ training conditions for this analysis.

Results

Declarative Knowledge Tests

Table 2 shows the mean knowledge test scores at baseline and post-training between conditions and results of the repeated measures ANOVA. The repeated measures ANOVA revealed a statistically significant main effect of time (baseline vs. post-training). The main

effect of condition (CAPSI vs. CAPSI+) and interaction between time and condition were not statistically significant.

To examine the time effect of written declarative knowledge test performance, participant's test scores were plotted in a bar graph. Figure 1 shows the individual knowledge test scores at baseline, post-training, and follow-up for participants that completed the course. Scores of participants that did not complete the course are omitted from Figure 1. All participants who completed a post-training knowledge test improved their scores relative to baseline. Of the four participants who completed a follow-up knowledge test, three participants (P2, P13, and P19) further improved their score relative to post-training, and the fourth participant (P16) had a slight decline in performance.

Procedural Knowledge Tests

Table 3 shows the mean procedural knowledge test scores at baseline and post-training between conditions and results of the repeated measures ANOVA. The repeated measures ANOVA revealed a statistically significant main effect of time (baseline vs. post-training). The main effect of condition (CAPSI vs. CAPSI+) and the interaction between time and condition were not statistically significant.

To examine the time effect of mean procedural knowledge test performance, participant's test scores were plotted in a bar graph. Figure 2 shows mean application test performance scores at baseline, post-training, and follow-up for participants that completed the course. Scores of participants that did not complete the course are omitted from Figure 2. All participants who completed the post-training procedural knowledge assessments improved their performance relative to baseline. Of the four participants who completed follow-up procedural knowledge assessments, three participants (P2, P16, and P19) had increases in performance relative to post-training, and the fourth participant (P13) had a slight decline in performance.

Course Completions

Six participants (60%) in the CAPSI condition and five participants (50%) in the CAPSI+ conditions completed the baseline, training, and at least one post-training phase. The chi-squared test comparing course completions between groups was not significant, χ^2 (1, N = 20) = 0.20, p = .65). Additionally, only two participants in the CAPSI condition and two participants in the CAPSI+ condition completed follow-up assessments.

In the CAPSI condition, of the four participants who did not complete the study, two participants indicated they were too busy and withdrew from the study. The third participant attempted the first unit test four times and during progress prompts affirmed interest in continuing their participation, but no subsequent tests were submitted. The fourth participant also affirmed interest in completing the training during progress prompts, but never submitted a unit test.

In the CAPSI+ condition, of the five participants who did not complete the study, two withdrew from the study because they were too busy and one withdrew for personal reasons. The fourth participant completed all the unit tests but did not respond to attempts for scheduling the post-training assessments. The fifth participant did not show up for their first study session and did not respond to follow-up attempts to reschedule the session.

Overall, there were six course completions in the CAPSI condition. Of the four non-completions, two participants withdrew from the study and two participants did not complete the training. There were five course completions in the CAPSI+ condition. Of the five non-completions, three participants withdrew from the study and two participants did not complete the training and/or the post-training assessments.

Social Validity

Mean responses per group for the social validity Likert-type questions are presented in Table 4. Across both groups, participants indicated they liked the teaching method, they could apply what they learned in their work, and gained valuable skills. Both groups were neutral about whether they learned more from the teaching method than classroom training led by an instructor.

When asked about what they liked most about the teaching method, across both groups most participants indicated the flexibility of self-pacing. One participant commented on liking the manual content in general, and three specifically liked the examples within the manual.

A variety of responses were provided to what participants liked the least about the teaching method. In the CAPSI group, two participants indicated the ease of procrastination, one participant indicated there was no one to talk to for clarification, one participant didn't like the style of learning and preferred in person instruction, and one participant wanted more explanations in the manual. In the CAPSI+ group, two participants indicated the lack of interaction with a teacher, one participant noted there was no practical experience, and one participant indicated that the supervised sessions constricted the time for training.

Two main themes emerged from the suggestions for improvements to the training. First, four participants suggested some interaction with a teacher or in person training. Second, four participants indicated wanting demonstrations or practice with applying the procedures. Two additional participants commented they wanted more examples and more explanations in the manual.

Discussion

The results show that the self-instructional training manual in combination with CAPSI is an effective method for teaching direct service providers declarative behavioural knowledge.

Training direct service providers declarative behavioural knowledge generalized to application of procedural knowledge as assessed during role-playing tasks. A larger gain in acquisition of behavioural declarative knowledge was observed in the CAPSI+ condition as hypothesized, however, the difference between the CAPSI and CAPSI+ conditions did not reach statistical significance. Additionally, supervision did not promote greater course completions as the difference in course completions between the CAPSI and CAPSI+ conditions was not statistically significant.

Similar to results of previous research (e.g., Arnal, 2013; Hu et al., 2012; Zaragoza Scherman et al., 2015), this study provides further evidence that CAPSI is an effective teaching method. However, unlike previous research (Kehler, 2015; Lee et al., 2013), the evidence indicates that supervision did not improve course completions even though supervision was implemented similarly across studies. Several reasons may account for the difference across studies. One aspect of the present study that differed from Lee et al. (2013) and Kehler (2015) was population. Both of the previous studies included primarily university students, as compared to direct service providers. A second difference was progress prompts. The use of progress prompts, if any, were not described by Lee et al. or Kehler. This study had a larger proportion of course completions for the unsupervised study condition as compared to Lee et al. and Kehler, which may have been attributed to the progress prompts, and in turn the lack of an effect between groups. A third difference was completion contingencies. Lee et al. offered $100 and Kehler provided $20 honoraria to participants who completed post-training assessments, whereas the current study offered a Certificate of Completion and held a draw for two $50 gift cards. Thus, the participants in the Lee et al. and Kehler studies were guaranteed to receive some remuneration if they completed the study, whereas this was not the case in the present study.

Several limitations should be noted. First, attrition over the course of the study resulted in a small final sample size, especially at follow-up. This may be attributed to the fact that participant reinforcement (i.e., Certificate of Completion and the chance to win a gift card) was provided after the first post-training assessment session. Retention at follow-up may have been improved if participant reinforcement was awarded after the follow-up assessments were completed. Future research should explore this possibility. Second, efforts to recruit staff, the intended population, were unsuccessful and led to additional recruitment of volunteers in direct service roles. This limits the generality of the results to staff in organizational settings, an important audience in the care of persons with developmental disabilities and autism spectrum disorder. Future research should recruit staff participants exclusively.

Future research should also explore more practical interventions to promote course completions that are less time and resource intensive than supervision. Wirth (2008) suggested the difference in attrition rates between the lecture and CAPSI conditions was due to the presence of a social contingency in the lecture group. Based on this assumption, further research should examine how a social contingency may be introduced with CAPSI, meanwhile still offering students the flexibility to work where and when they want.

Despite the limitations and lack of a significant difference between groups, the results of this study have important practical implications. In consideration of a growing demand for direct service providers and an extensive body of literature demonstrating ABA can be used to impact the lives of persons with developmental disabilities and autism spectrum disorder in meaningful ways, there is a need for effective methods of instruction to teach behavioural knowledge. This research demonstrated that the self-instructional manual used in combination with CAPSI was effective in teaching both declarative and procedural behavioural knowledge to direct care

service providers. Further, results of the social validity questionnaire indicated participants liked the teaching method, could apply what they learned to their work, and gained valuable skills. Although direct service providers at one organization were targeted for this study, the utility and benefits observed may be applicable in other organizational settings. Additionally, the accessibility CAPSI offers may help service providers in remote regions to overcome barriers of location that would otherwise require costly travel for traditional facilitator-led training.

In conclusion, this study extends previous research demonstrating CAPSI is an effective method of instruction and participants liked the teaching method which supports the viability of CAPSI as an online educational method in an organizational setting. This study also adds to the literature by experimentally evaluating the effect of supervision with CAPSI. Although supervision did not significantly enhance learning or course completions as predicted, overall the self-instructional manual used in combination with CAPSI was successful in teaching direct service providers behavioural knowledge, a finding that systematically replicates the results of previous studies.

References

Arnal, L. (2013). *Teaching individuals to conduct a preference assessment procedure using computer-aided personalized system of instruction.* (Doctoral dissertation). Available from MSpace at the University of Manitoba Faculty of Graduate Studies – Electronic Theses and Dissertations. Retrieved from http://hdl.handle.net/1993/22083

Braithwaite, K. L., & Richdale, A. L. (2000). Functional communication training to replace challenging behaviours across two behavioural outcomes. *Behavioral Interventions, 15,* 21-36. doi: 10.1002/(SICI)1099-078X(200001/03)15:1<21::AID-BIN45>3.3.CO;2-R

Centers for Disease Control and Prevention. (2014). Prevalence of autism spectrum disorder among children aged 8 years. Autism and Developmental Disabilities Monitoring Network, 11 sites, United States, 2010. 63(SS02), 1-21.

Cicero, F. R., & Pfadt, A. (2002). Investigation of a reinforcement-based toilet training procedure for children with autism. *Research in Developmental Disabilities, 23,* 319-331. doi: 10.1016/S0891-4222(02)00136-1

Clay, M., Rowland, S., & Packard, A. (2009). Improving undergraduate online retention through gated advisement and redundant communication. *Journal of College Student Retention: Research, Theory & Practice, 10*(1), 93-102. doi: 10.2190/CS.10.1.g

Eldevik, S., Hastings, R. P., Hughes, J. C., Jahr, E., Eikeseth, S., & Cross, S. (2009). Meta-analysis of early intensive behavioral intervention for children with autism. *Journal of Clinical Child & Adolescent Psychology, 38,* 439-450. doi: 10.1080/15374410902851739

Hopko, D. R., Lejuez, C. W., LePage, J. P., Hopko, S. D., & McNeil, D. W. (2003). A brief behavioural activation treatment for depression: A randomized pilot trial within an

inpatient psychiatric hospital. *Behavior Modification, 27,* 458-469. doi: 10.1177/0145445503255489

Hu, L., Pear, J. J., & Yu, C.T. (2012). Teaching university students knowledge and implementation of the assessment of basic learning abilities (ABLA). *Journal on Developmental Disabilities, 18,* 12-19.

Kehler, K. (2015). Effectiveness of computer-aided personalized system of instruction in teaching the Self-Regulation Program of Awareness and Resilience in Kids. (Master's thesis). Available from MSpace at the University of Manitoba Faculty of Graduate Studies – Electronic Theses and Dissertations. Retrieved from http://hdl.handle.net/1993/30709

Keller, F. S. (1968). "Good-bye, teacher...". *Journal of Applied Behavior Analysis, 1,* 79-89.

Kerr, N., Meyerson, L., & Flora, J. A. (1977). The measurement of motor, visual, and auditory discrimination skills. *Rehabilitation Psychology, 24,* 95–112.

LeBlanc, L. A., Hagopian, L. P., & Maglieri, K. A. (2000). Token economy to eliminate excessive inappropriate social behaviour in an adult with developmental disabilities. *Behavioral Interventions, 15,* 135-143. doi: 10.1002/(SICI)1099-078X(200004/06)15:2<135::AID-BIN51>3.0.CO;2-3

Lee, M. S. H., Kehler, K., Martin, T., Wightman, J., Pear, J., Yu, C. T., & Oliveira, M. (2013). *The effect of study supervision on attrition and learning in experiments on discrete trials teaching instruction.* Poster presented at the 8th Annual Manitoba Association for Behaviour Analysis Conference, Winnipeg, MB.

Lee, Y., & Choi, J. (2011). A review of online course dropout research: Implications for practice and future research. *Educational Technology Research and Development, 59*, 593-618. doi: 10.1007/s11423-010-9177-y

Mackenzie, H. (2010). *The Autistic Child's Guide to How to Behave – Introducing spark*: Self-Regulation Program of Awareness and Resilience in Kids.* Winnipeg, Manitoba: Wired Fox Publications.

Makrygianni, M. K., & Reed, P. (2010). A meta-analytic review of the effectiveness of behavioural early intervention programs for children with autism spectrum disorders. *Research in Autism Spectrum Disorders, 4*, 577–593. doi: 10.1016/j.rasd.2010.01.014

Martin, G. L., & Pear, J. J. (2015). *Behaviour modification: What it is and how to do it (10th ed.).* Upper Saddle River, NJ: Prentice Hall.

Martin, T. L., Pear, J. J., & Martin, G. L. (2002). Analysis of proctor marking accuracy in a computer-aided personalized system of instruction course. *Journal of Applied Behavior Analysis*, *35*(3), 309–312. doi: 10.1901/jaba.2002.35-309

Matson, J. L., & Smith, K. R. M. (2008). Current status of intensive behavioral interventions for young children with autism and PDD-NOS. *Research in Autism Spectrum Disorders, 2,* 60-74. doi: 10.1016/j.rasd.2007.03.003

National Autism Center. (2015). *Findings and conclusions: National standards project, phase 2*. Randolph, MA: Author

O'Neil, G. W., Blanck, L. S., & Joyner, M. A. (1980). The use of stimulus control over littering in a natural setting. *Journal of Applied Behavior Analysis, 13,* 379-381. doi: 10.1901/jaba.1980.13-379

Ouellette-Kuntz, H., Coo, H., Lam, M., Breitenbach, M. M., Hennessey, P. E., Jackman, P. D., ... Chung, A. M. (2014). The changing prevalence of autism in three regions of Canada. *Journal of Autism and Developmental Disorders*, 44(1), 120-136. doi: 10.1007/s10803-013-1856-1

Pear, J. J., & Crone-Todd, D. E. (1999). Personalized system of instruction in cyberspace, *Journal of Applied Behavior Analysis, 32,* 205-209.

Pear, J. J., & Crone-Todd, D. E. (2002). A social contructivist approach to computer-mediated instruction. *Computers & Education, 38,* 221-231.

Pear, J. J., & Novak, M. (1996). Computer-aided personalized system of instruction: A program evaluation. *Teaching of Psychology, 23,* 119-123.

Pear, J. J., Schnerch, G. J., Silva, K. M., Svenningsen, L., & Lambert, J. (2011). Web-based computer-aided personalized system of instruction. In W. Buskist & J. E. Groccia (Eds.), *New directions for teaching and learning. Vol. 128: Evidence-based teaching* (pp. 85-94). San Francisco, CA: Jossey-Bass.

Poellhuber, B., Chomienne, M., Karsenti, T. (2008). The effects of peer collaboration and collaborative learning on self-efficacy and persistence in a learner-paced continuous intake model. *Journal of Distance Education, 22*(3), 41-62.

Reichow, B., & Wolery, M. (2009). Comprehensive synthesis of early intensive behavioral interventions for young children with autism based on the UCLA Young Autism Project model. *Journal of Autism and Developmental Disorders, 39,* 23–41. doi: 10.1007/s10803-008-0596-0

Roane, H. S., Kelley, M. E., Trosclair, N. M., & Hauer, L. S. (2004). Behavioral momentum in sports: A partial replication with women's basketball. *Journal of Applied Behavior Analysis, 37,* 385-390. doi: 10.1901/jaba.2004.37-385

Willging, P. A, & Johnson, S. D. (2009). Factors that influence students' decision to dropout of online courses. *Journal of Asynchronous Learning Networks, 13*(3), 115-127.

Wirth, K. M. (2008). *An evaluation of a staff training manual for teaching behavioural principles and procedures to direct-care staff.* (Doctoral dissertation). Available from MSpace at the University of Manitoba Faculty of Graduate Studies – Electronic Theses and Dissertations. Retrieved from http://hdl.handle.net/1993/21226

Wirth, K., & Pear, J. J. (2006). *Orientation to applied behaviour analysis for autism and developmental disabilities: A manual for tutors and parents.* Unpublished manuscript, Department of Psychology, University of Manitoba, Winnipeg, Canada.

Zaragoza Scherman, A., Thomson, K., Boris, A., Dodson, L., Pear, J., & Martin, G. L. (2015). Online training of discrete-trials teaching for educating children with autism spectrum disorders: A preliminary study. *Journal on Developmental Disabilities, 21*(1), 22-33.

Table 1

Participant Characteristics

	CAPSI group	CAPSI+ group
N	6	5
Females/males	6/0	4/1
Age range (years)	19 – 59	31 – 57
English is first language	67% (4)	40% (2)
Highest education		
High school diploma	0%	20% (1)
Some post-secondary	33% (2)	0%
Certificate or trade certification	17% (1)	0%
Bachelor's degree	50% (3)	60% (3)
Master's degree	0%	20% (1)
Mean years of service	2.2	5.7
Previously taken online courses	50% (3)	60% (3)

Table 2

Mean Percentage and Repeated Measures Analysis of Variance for Written Declarative Knowledge Test Performance

Condition	Baseline *M* (*SD*)	Post-training *M* (*SD*)	Main Effect of Condition	Main Effect of Time	Condition x Time Interaction
CAPSI	32.67% (21.42)	68.33% (30.68)	F (1, 9) = 0.035, p =.86	F (1, 9) = 60.90, p < .001	F (1, 9) = .255, p = .63
CAPSI+	32.60% (21.27)	73.20% (11.03)			

Note. CAPSI (n = 6); CAPSI+ (n = 5).

Table 3

Mean Percentage and Repeated Measures Analysis of Variance for Procedural Knowledge Test Performance

Condition	Baseline *M* (*SD*)	Post-training *M* (*SD*)	Main Effect of Condition	Main Effect of Time	Condition x Time Interaction
CAPSI	19.83% (11.18)	40.00% (13.76)	$F(1, 9) = 2.14$, $p = .18$	$F(1, 9) = 32.16$, $p < .001$	$F(1, 9) = .203$, $p = .66$
CAPSI+	34.20% (20.40)	51.40% (16.58)			

Note. CAPSI ($n = 6$); CAPSI+ ($n = 5$).

Table 4

Mean Social Validity Likert-type Question Responses

Question	CAPSI *M*	CAPSI+ *M*
I liked the teaching method used in this training.	4	4.6
I feel that I learned more from the teaching method than I would from classroom training led by an instructor.	2.8	3
I feel that I can apply what I learned to my work.	4.3	4.6
I feel that I have gained valuable skills for my work with individuals with developmental disabilities or autism spectrum disorder.	4.7	5

Note. CAPSI (n = 6); CAPSI+ (n = 5). 1 = strongly disagree, 2 = disagree, 3 = neither agree or disagree, 4 = agree, 5 = strongly agree.

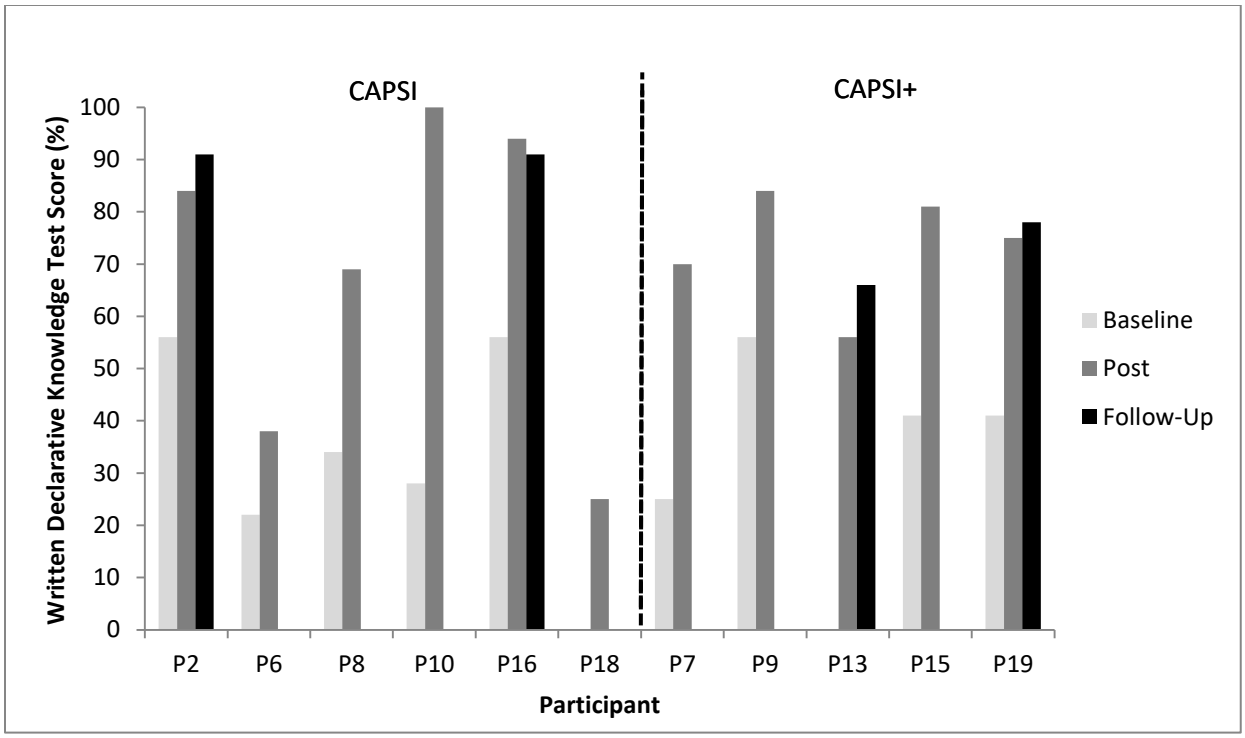

Figure 1. Written declarative knowledge baseline, post-training, and follow-up performance for participants that completed the course. The x-axis represents ID numbers of participants that completed the course. Participants P13 and P18 had baseline scores of zero.

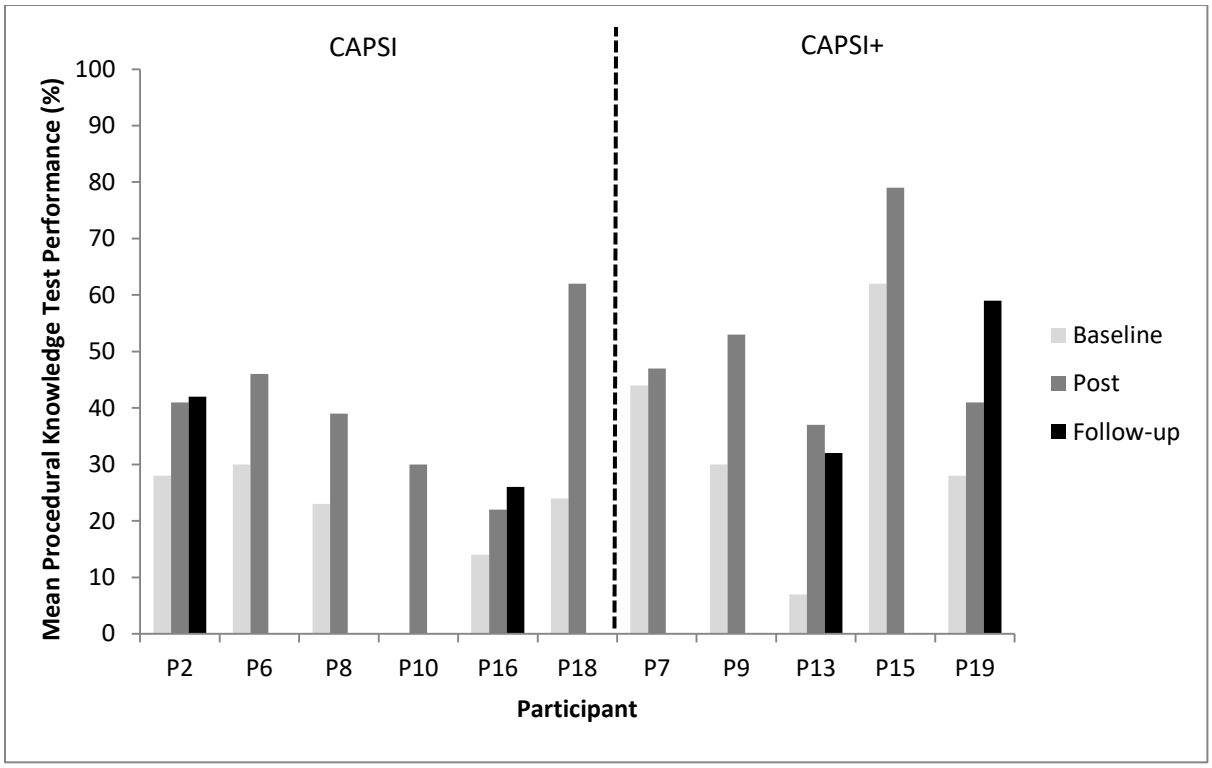

Figure 2. Mean procedural knowledge baseline, post-training, and follow-up performance for participants that completed the course. The x-axis represents ID numbers of participants that completed the course. Participant P10 had a baseline score of zero.

Appendix A

Demographic Questionnaire

Tell Us About Yourself

Please answer the questions below to tell us a bit about yourself. **Do not put your name on this form. The researcher will assign an arbitrary code for you to mask your identity. You don't have to give any information that you do not want to.**

1. Age (years): _____
2. Is English your first language? ☐ Yes ☐ No
3. What is the highest degree or level of school you have completed?
   If currently enrolled, please indicate the highest degree you have received.
   - ☐ Some high school, no diploma
   - ☐ High school diploma
   - ☐ Some post-secondary education
   - ☐ College or trade certification
   - ☐ Bachelor's degree
   - ☐ Master's degree
   - ☐ Doctorate degree
   - ☐ Other, Please specify: _____
4. Do you currently work in a direct support role, either through paid employment or volunteering with people with developmental disabilities or autism? ☐ Yes ☐ No
5. How long have you worked in a direct support role, either through paid employment or volunteering with people with developmental disabilities or autism, counting current and past positions? _____ Years
6. Company name: _____
   Department:_____
   Job title:_____
7. Specific Applied Behaviour Analysis (ABA) experience/training:
   Have you taken any of the following courses/training: (please check all that apply)
   - ☐ PSYC 2440 Behaviour Modification Principles (or the former 17.244 Behaviour Modification Principles) or PSYC 2450 Behaviour Modification Applications (or the former 17.245 Behaviour Modification Applications) at the University of Manitoba
   - ☐ 44.3720 Behaviour Modification at the University of Winnipeg
   - ☐ Other university or college courses in behaviour modification or ABA
   - ☐ Specialized Behaviour Management Training at St.Amant
   - ☐ Other staff training or workshops in behaviour modification or ABA
   - ☐ Parent training in ABA
   - ☐ Currently or previously employed as an ABA tutor/therapist or senior tutor/therapist
   - ☐ Other training in behaviour modification or ABA, Please specify:
     _____
8. Have you taken a course offered by *computer mediation (e.g., Computer-aided Personalized System of Instruction)?* ☐ Yes ☐ No
9. Do you have regular access to a computer with an Internet connection (e.g., at home)?
   ☐ Yes ☐ No

Appendix B

Written Declarative Knowledge Test

Participant ID: _____ Date: _____

Please use the space provided to answer the following 5 short-answer questions. You will have up to 50 minutes to complete this test. Good Luck!

1. Define antecedent and consequence. Give two examples of behavioural contingencies.

2. Define positive reinforcement. Give two examples of positive reinforcement of desirable behaviours.

3. What is a mand? Give an example.

4. Define extinction. Give two examples of extinction – one of a desirable behaviour, and one of an undesirable behaviour.

5. What are the four points to consider when applying shaping?

Appendix C

Reinforcement Procedural Knowledge Test

Reinforcement Task

Introduction

For this task you will attempt to teach this person who will play the role of a child with minimal language skills to perform simple motor responses. Please review the entire page and let me know when you are ready to begin. You will have a maximum of five minutes to complete this task, or let me know if you are finished sooner.

Behaviour Definitions

Correct: perform the target response within 5 seconds

Incorrect: perform any response other than the target response within 5 seconds or no response within 5 seconds

Materials Provided*

Pencil, tokens, blocks, puzzle

* Not all materials may be necessary for each task

Datasheet

Trial	Target Response	Correct Response
1	clap	Y / N
2	thumbs up	Y / N
3	raise hand	Y / N
4	touch head	Y / N
5	wave	Y / N
6	raise hand	Y / N
7	thumbs up	Y / N
8	wave	Y / N
9	clap	Y / N
10	touch head	Y / N

To be filled in by researcher:

Date:_____

Participant ID:_____

☐ Baseline

☐ Post-Training

☐ Follow-Up

Appendix D

Extinction Procedural Knowledge Test

Extinction Task

Introduction
For this task you will engage this person who will play the role of a child with minimal language skills in a block building activity for five minutes while you attempt to decrease the problem behavior of a child. Please review the entire page and let me know when you are ready to begin.

Problem Behaviour: throwing objects

***Results of a Functional Assessment*:** the child's target behaviour has been reinforced by attention

Materials Provided*
Pencil, tokens, blocks, puzzle
* Not all materials may be necessary for each task

Datasheet

Date	Aggression	Total

To be filled in by researcher:
Date:_____
Participant ID:_____
☐ Baseline
☐ Post-Training
☐ Follow-Up

Appendix E

Fading Procedural Knowledge Test

Fading Task

Introduction

For this task you will attempt to teach this person who will play the role of a child with minimal language skills to complete a puzzle. Please review the entire page and let me know when you are ready to begin. You will have a maximum of five minutes to complete this task, or let me know if you are finished sooner.

Procedure

Fade prompts across 10 trials (1 puzzle piece per trial) according to the datasheet to teach a child to "do the puzzle".

Materials Provided*

Pencil, tokens, blocks, puzzle

* Not all materials may be necessary for each task

Datasheet

Trial	Fading Steps	Correct Response
1	Physical prompt	Y / N
2	Physical prompt	Y / N
3	Physical prompt	Y / N
4	Physical prompt	Y / N
5	Gestural prompt	Y / N
6	Gestural prompt	Y / N
7	Gestural prompt	Y / N
8	Gestural prompt	Y / N
9	No prompt	Y / N
10	No prompt	Y / N

To be filled in by researcher:

Date:_____

Participant ID:_____

☐ Baseline

☐ Post-Training

☐ Follow-Up

Appendix F

Reinforcement Procedural Knowledge Performance Assessment

Participant Performance Datasheet: Reinforcement Test

Date: _____ Video Code: _____ Observer: _____

Scoring Guidelines:
Correct Instruction = name the target response. Instruction must be an antecedent for a trial (e.g., "clap" may be used as a consequence if praising). Ignore all instructions other than the target responses for this task.

Correct Consequence
Correct confederate response = praise or presentation of reinforcer before next trial
Incorrect confederate response = proceed to next trial without providing reinforcer; may or may not error correct (do not score error correction procedure)

Record Data (Y) = participant accurately recorded confederate's response on datasheet

Trial	Target Response	Confederate Response Correct	**Correct Instruction**	**Correct Consequence**	**Record Data**
1	clap	Y / N	**Y / N**	**Y / N**	**Y / N**
2	thumbs up	Y / N	**Y / N**	**Y / N**	**Y / N**
3	raise hand	Y / N	**Y / N**	**Y / N**	**Y / N**
4	touch head	Y / N	**Y / N**	**Y / N**	**Y / N**
5	wave	Y / N	**Y / N**	**Y / N**	**Y / N**
6	raise hand	Y / N	**Y / N**	**Y / N**	**Y / N**
7	thumbs up	Y / N	**Y / N**	**Y / N**	**Y / N**
8	wave	Y / N	**Y / N**	**Y / N**	**Y / N**
9	clap	Y / N	**Y / N**	**Y / N**	**Y / N**
10	touch head	Y / N	**Y / N**	**Y / N**	**Y / N**

Total Y	
Total Y + N	

Appendix G

Extinction Procedural Knowledge Performance Assessment

Participant Performance Datasheet: Extinction Test

Date: _____ Video Code: _____ Observer: _____

Scoring Guidelines:
Target behaviour = throwing stimuli

Correct Consequence for target behaviour = be neutral (or turn face away from the confederate) and does not speak to confederate for a minimum of 5 seconds (may or may not return thrown object)

Record Data (Y) = participant recorded data on datasheet following target behaviour

Only score instances of target behaviour. Score NA for items if target behaviour was not observed.

Target Behaviour	**Correct Consequence**	**Record Data**
1	**Y / N / NA**	**Y / N / NA**
2	**Y / N / NA**	**Y / N / NA**
3	**Y / N / NA**	**Y / N / NA**
4	**Y / N / NA**	**Y / N / NA**
5	**Y / N / NA**	**Y / N / NA**
6	**Y / N / NA**	**Y / N / NA**
7	**Y / N / NA**	**Y / N / NA**
8	**Y / N / NA**	**Y / N / NA**

Total Target Behaviours of confederate observed	
Total Target Behaviours recorded by participant	
Agreement	**Y / N**

Total Y	
Total Y + N	

Appendix H

Fading Procedural Knowledge Performance Assessment

Participant Performance Datasheet: Fading Test

Date: _____ Video Code: _____ Observer: _____

Scoring Guidelines:
1 puzzle piece per trial

Correct Instruction = concise instruction that targets completing the puzzle, e.g. "do the puzzle", "try the puzzle", "where does it go?", "put it in"

Correct Consequence = using the fading step indicated. The first prompt used is scored as consequence for a given trial (e.g., if a gestural prompt first used on Trial 1 and physical prompt used later, correct consequence is scored as N)
- Physical: any instance of touching a learner to assist performance
- Gestural: conveying a cue through motioning

Record Data (Y) = participant accurately recorded confederate's response on datasheet

If all 10 trials are not completed within 5 minutes, score remaining trials as N.

Trial	Fading Steps	Confederate Response Correct	**Correct Instruction**	**Correct Consequence**	**Record Data**
1	Physical prompt	Y / N	**Y / N**	**Y / N**	**Y / N**
2	Physical prompt	Y / N	**Y / N**	**Y / N**	**Y / N**
3	Physical prompt	Y / N	**Y / N**	**Y / N**	**Y / N**
4	Physical prompt	Y / N	**Y / N**	**Y / N**	**Y / N**
5	Gestural prompt	Y / N	**Y / N**	**Y / N**	**Y / N**
6	Gestural prompt	Y / N	**Y / N**	**Y / N**	**Y / N**
7	Gestural prompt	Y / N	**Y / N**	**Y / N**	**Y / N**
8	Gestural prompt	Y / N	**Y / N**	**Y / N**	**Y / N**
9	No prompt	Y / N	**Y / N**	**Y / N**	**Y / N**
10	No prompt	Y / N	**Y / N**	**Y / N**	**Y / N**

Total Y	
Total Y + N	

Appendix I

Social Validity Questionnaire

Date: _____ Participant ID : _____ Group: _____

To what extent do you agree or disagree with each of the following statements: (Place checkmark where applicable)					
	Strongly disagree	Disagree	Neither agree or disagree	Agree	Strongly agree
1. I liked the teaching method used in this training.					
2. I feel that I learned more from the teaching method than I would from classroom training led by an instructor.					
3. I feel that I can apply what I learned to my work.					
4. I feel that I have gained valuable skills for my work with individuals with developmental disabilities or autism spectrum disorder.					

What did you like most about the teaching method?

What did you like least about the teaching method?

Suggestions for improvement or additions to the training:

Appendix J

Procedural Reliability Checklist

Experimenter Procedural Reliability Datasheet

Date: _____ Participant: _____

Experimenter: _____ Observer: _____

Condition: ☐ CAPSI ☐ CAPSI+
Phase: ☐ Baseline ☐ Post-Training ☐ Follow-Up

Written Declarative Knowledge Test

administer declarative knowledge test	Y / N / NA	
maximum 50 minutes	Y / N / NA	total time:
offer break	Y / N / NA	

Procedural Knowledge Tests

	Task A	Task B	Task C
provide procedural knowledge materials	Y / N / NA	Y / N / NA	Y / N / NA
administer procedrual test description	Y / N / NA	Y / N / NA	Y / N / NA
maximum 5 minutes to review description	Y / N / NA	Y / N / NA	Y / N / NA
when participant ready, start video recording	Y / N / NA	Y / N / NA	Y / N / NA
start 5 minute timer	Y / N / NA	Y / N / NA	Y / N / NA
maximum 5 minutes	Y / N / NA	Y / N / NA	Y / N / NA

Baseline Session

administer study overview description	Y / N / NA
assist participant with initial log-in to CAPSI	Y / N / NA
administer training package (*CAPSI only*)	Y / N / NA
schedule study session (*CAPSI+ only*)	Y / N / NA

Post-Training Session

administer social validity questionnaire	Y / N / NA

Total Y	
Total Y + N	