Using Computer-Aided Personalized System of Instruction (CAPSI) to Teach Discrete-Trials Teaching (DTT) for Educating Children with Autism Spectrum Disorders (ASDs)

by

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Abstract

The present study evaluated the use of a self-instructional manual supported by a computer-aided personalized system of instruction (CAPSI) for teaching Discrete-Trials Teaching (DTT) to university students. Prior to studying the manual, five participants taught three tasks, commonly taught to children with Autism Spectrum Disorders (ASD), to a confederate role-playing a child with an ASD. Using the Discrete-Trials Teaching Evaluation Form (DTTEF), the main researcher assessed the participants' ability to perform DTT accurately. Subsequently, participants studied a self-instructional manual using CAPSI to demonstrate mastery of study questions about DTT. Finally, participants once again attempted to teach the three tasks to a confederate role-playing a child with an ASD. Overall mean baseline accuracy on the DTTEF was 54.86%, and improved to 84.73% in post-treatment, a 30% improvement. Participants' self-recorded study time was an average of 12 hours and 48 minutes.

The results suggest that CAPSI is an effective educational tool for the delivery of the self-instructional manual. Future research should investigate (1) how to make CAPSI even more effective, and (2) whether these results can be generalized to other populations such as ABA tutors, parents, and paraprofessionals working with children with ASD.

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Using Computer-Aided Personalized System of Instruction (CAPSI) to Teach Discrete-Trials Teaching (DTT) for Educating Children with Autism Spectrum Disorders (ASDa)

Discrete-Trials Teaching (DTT) is an effective commonly used approach for teaching children with Autism Spectrum Disorders (ASD) in early intensive behavioural intervention (EIBI) programs (Lovaas, 1987) — also known as Applied Behaviour Analysis [ABA] for children with ASD — (Green, 1996). With the rising prevalence of ASD and government funded EIBI programs in Canada, there is a severe shortage of well-trained tutors and therapists (Fombonne, 2003; Jacobson & Mulick, 2000; Thomson, Martin, Arnal, Fazzio & Yu, 2009). An effective and cost/time efficient system to teach tutors and therapists is needed. Recently, researchers at the University of Manitoba have investigated the use of a self-instructional manual (Fazzio & Martin, 2006; Fazzio & Martin, 2007; Fazzio & Martin, 2009) to teach DTT to mediators, with promising results (Arnal et al., 2007; Thiessen, et al., 2009; Boris, 2010).

The objective of the present study was to evaluate an online computer-aided personalized system of instruction (CAPSI), in combination with the self-instructional manual mentioned above, to train university students how to use DTT for teaching children with ASD. The DTT self-instructional manual has been tested in the presence of a researcher who administers unit tests. In the past, CAPSI has been used successfully to teach complex behavioural principles and applications to university students (Martin, Pear, & Martin, 2002a; Martin, Pear, & Martin, 2002b; Pear, 2002). In the present study, utilizing the manual in combination with CAPSI evaluated whether individuals could learn the manual effectively when unsupervised. If the “CAPSI + self-instructional

manual" training package was proven successful, it could be possible to train a larger number of mediators at the same time in different locations around the world through the Internet, without the need of a supervisor being present.

Autism Spectrum Disorders

ASD are "neurodevelopmental disorder[s] characterized by impairment in social interaction, in communication skills, and in behaviour, which is restricted and repetitive." (Tidmarsh & Volkmar, 2003, p. 517). Autistic disorder, first defined by Kanner (1943), is one of the five pervasive developmental disorders (PDDs) in the *Diagnostic and Statistical Manual of Mental Disorders-IV, Text Revision* (DSM-IV-TR; American Psychiatric Association, 2000) along with Rett's Disorder, Childhood Disintegrative Disorder, Asperger's Disorder, and Pervasive Developmental Disorder—Not Otherwise Specified (PDD-NOS).

Of the five PDDs, Autistic disorder, Asperger's Disorder, and PDD-NOS share the most diagnostic symptoms. In general, Asperger's is said to be a milder version of Autistic Disorder. PDD-NOS diagnosis is reserved for individuals who do not meet all the diagnostic criteria of autistic disorder, such as onset age, or symptom severity. However, PDD-NOS presents more or less the same symptoms – impairment in social interaction, in communication skills, and repetitive and stereotyped behaviour. Thus, Autistic Disorder, Asperger's Disorder and PDD-NOS are often considered part of a spectrum of disorders referred to as ASD (Myers, Johnson & Council on Children With Disabilities, US., 2007). According to White (2010) diagnostic changes in the future DSM-IV, anticipated to be published in May 2013, will label Autistic Disorder, Asperger's Disorder, Childhood Disintegrative Disorder, and PDD-NOS as ASD, while Rett's Disorder will no longer be included. Since the current literature appears to be

inconsistent with regard to the terms ASD, Autistic Disorder, and Autism, ASD will be used to refer to all these conditions in this thesis.

Impairment in social interaction

According to the DSM-IV-TR (American Psychiatric Association, 2000), impairment in social interaction is manifested as:

- marked impairment in the use of multiple nonverbal behaviours such as eye-to-eye gaze, facial expression, body postures, and gestures to regulate social interaction;
- failure to develop peer relationships appropriate to developmental level:
- a lack of spontaneous seeking to share enjoyment, interests, or achievements with other people (e.g., by a lack of showing, bringing, or pointing); and
- a lack of social or emotional reciprocity.

Impairment in communication skills

According to the DSM-IV-TR (American Psychiatric Association, 2000), impairment in communication skills is manifested as:

- a delay in, or total lack of, the development of spoken language (not accompanied by an attempt to compensate through alternative modes of communication such as gesture or mime);
- in individuals with adequate speech, marked impairment in the ability to initiate or sustain a conversation with others;
- stereotyped and repetitive use of language or idiosyncratic language; and
- a lack of varied, spontaneous make-believe play or social imitative play appropriate to developmental level.

Repetitive and stereotyped behaviour

According to the DSM-IV-TR (American Psychiatric Association, 2000), restricted

repetitive and stereotyped patterns of behaviour, interests, and activities, are manifested as:

- encompassing preoccupation with one or more stereotyped and restricted patterns of interest that is abnormal either in intensity or focus;
- apparently inflexible adherence to specific, nonfunctional routines or rituals;
- stereotyped and repetitive motor manners (e.g., hand or finger flapping or twisting, or complex whole-body movements); and
- persistent preoccupation with parts of objects.

ASD occur in children in early infancy (before 30 months of age). Children with ASD are generally males (1.33:16), and often also present with some level of mental retardation (30% of children with ASD have mild to moderate intellectual impairments, and 40% suffer from severe to profound level of mental retardation) and other medical conditions, such as epilepsy. Research also shows children with ASD may have impairments in joint attention (Sigman & Kasari, 1995) and theory of mind (Sprandlin & Brady, 2008). Due to the social nature of the behavioural deficits in ASD, accompanied by lowered intellectual functioning, children with ASD have great difficultly learning. The current estimated prevalence of ASD is one in every 110 children in the United States (CDC, 2009). Unfortunately, the etiology of ASD is yet unknown (Lovaas, 1987), although there is some evidence pointing at genetic correlates (Gómez, Camarena & Nicolini, 1997).

Lovaas (1987) reported that outcomes for untreated children with ASD were “very poor” (p. 3). He described a treatment method for children with Autistic Disorder geared at (1) reducing self-stimulatory and aggressive behaviours; (2) building compliance to verbal requests; (3) teaching imitation, appropriate toy play, expressive language, and

interactive play with peers; and (4) teaching pre-academic reading and writing skills. Children received intensive treatment for most of their waking hours (40 hrs. a week, of one-to-one instruction). EIBI has been recognized by the Surgeon General of the United States as the treatment of choice for children with ASD (Department of Health, 1999; Matson & Smith, 2008). EIBI is increasingly popular among parents of children with ASD who demand effective treatment services.

Discrete-Trials Teaching

DTT consists of presenting children with numerous learning opportunities through the delivery of instructions and consequences for responses. If children make errors, they receive an error correction procedure to maximize the likelihood of correct responses. DTT also includes prompts to help children learn, and fading of these prompts to avoid making children dependent on them. According to De Boer (2006), the main components of DTT involve:

- breaking a skill into smaller parts;
- teaching each part to mastery;
- providing concentrated teaching;
- providing prompting and fading as necessary; and
- using reinforcement procedures.

In children with ASD, learning difficulties stem from impairment in social interaction and communication. Therefore, they need systematic methods that provide extensive exposure to teaching materials, in small units. Every discrete trial is considered a unit. For each unit, EIBI tutors (sometimes referred to as ABA instructors or therapists) implementing DTT are required to present an ordered sequence of components, for which a number of specific skills are needed. These skills include (1) arranging the materials,

(2) delivering a discriminative stimulus, (3) presenting and fading prompts within and across trials, (4) delivering differential reinforcement, (5) correcting errors, (6) recording data, and (7) maintaining brief inter-trial intervals. Tutors also need to be able to read, understand, and use procedures and data sheets that inform them of the DTT program, and on how to collect information about the child's performance.

Teaching How to Conduct DTT

Many EIBI programs face the challenge of training individuals to conduct behavioural procedures (Jahr, 1998), including DTT (Reid, 2005). According to Le Blanc, Ricciardi, and Luiselli (2005), research conducted on the training of DTT is not extensive; however, they were able to conclude that DTT training usually occurs as one-to-one instruction. Therefore, it is costly, intensive, and time consuming. As a result, the field is currently devoted to finding cost/time efficient behavioural training procedures that require less time and money to be implemented, to teach staff how to conduct DTT. For instance, Gilligan, Luiselli, and Pace (2007) used performance feedback to train educational staff to implement DTT. Ryan and Hemmes (2005) conducted training using oral, written, and video instructions, along with modeling, role-playing, in-vivo practice, and performance feedback. Both strategies were successful at teaching educational staff; however, they also required one-to-one training, which reduces their cost/time efficiency. Other research has provided empirical evidence showing that computers and computer software are an effective means to teach DTT. For example, Randell, Hall, Bizo, and Remington (2007) evaluated interactive simulation software (DTkid) for training tutors of children with ASD to perform DTT. DTkid can be used in evaluation, teaching, or

playback mode (see Randell et al., 2007, for a detailed software description). In Randell's study, participants interacted with a virtual child on the screen. The mouse was used to present materials and deliver instructions and reinforcement.

DTkid used performance feedback as a training procedure. When the participant made an error, the software alerted the participant; and it counted correct trials on a corner of the screen (Randell et al., 2007). Both experimental and control participants were also asked to watch video-clips of DTT, and to decide whether each trial was correctly or incorrectly conducted, how confident they were with their decision, and in case of incorrectly conducted trials, what the error was. The experimental group was trained with DTKid, while the control group performed a control task with Snood©, an interactive computer puzzle game.

Across two experiments, the DTkid group performed better than the control group (76.5% vs. 60.7% in experiment 1, and 78.3% vs. 48.7% in experiment 2) at judging trials as correct or incorrect, even in the time-shortened version of training (Experiment 2). Statistical analyses showed that the differences between the two groups were significant; results indicated that "DTKid is training produced significant increases in participants' procedural and declarative knowledge of DTT" (Randell et al, 2007, p. 643).

Computers have also been used to develop other skills in behavioural psychology; such skills are necessary for conducting functional behavioural assessment and positive behavioural support (PBS; Sailor et al., 1999). Such skills are: (1) specifying the problem behaviour, (2) conducting the appropriate assessments, (3) identifying the relevant assessment information, (4) analyzing graphed data depicting the client's behaviour, (5)

formulating a hypothesis or reason for the occurrence of the behaviour, (6) selecting an appropriate treatment that addresses the specific needs of the client, and (7) evaluating the effectiveness of treatment and revising it as needed (Desrochers & Hile, 1993; Desrochers, House, & Seth, 2001).

A DTT Self-Instructional Manual

Fazzio and Martin (2006, 2007, 2009) created a self-instructional manual to teach university students, parents, and paraprofessionals to conduct DTT sessions. Research on the first version of the manual (Fazzio & Martin, 2006) showed that a training package, which included studying the manual and scoring a video of an experienced tutor implementing DTT, produced mastery-level in only one of three participants, although participants did improve their performance from an overall mean of 44% in baseline to 67% in post-treatment (Arnal et al., 2007). Research on the second version of the manual (Fazzio & Martin, 2007) showed that participants' overall mean performance improved from 52% in baseline to 88% in post-treatment. There was a slight decrease from post-treatment to generalization (77%); however, it was still higher than baseline (Thiessen et al., 2009). Based on this research, the latest and third version (Fazzio & Martin, 2009) of the manual includes guided self-practice exercises to promote mastery and a chapter that presents information on how to record data.

Concurrent to the present study, research on the third version of the manual (Fazzio & Martin, 2009) showed that participants reading the latest manual improved accuracy in conducting DTT from 45% in baseline to 82% in post-treatment (Boris, 2010). One participant whose native tongue was not English, but Portuguese, required a

feedback and demonstration session to reach the mastery criterion (Boris, 2010). In the studies carried out by Arnal et al. (2007), Thiessen et al. (2009), and Boris (2010), investigators testing the effectiveness of the manual have opted to have the main researcher always present during the reading of the manual to answer questions, and to administer unit tests during the training session, as part of the research strategy. Some participants required up to 8 hours to be trained. For actual staff training purposes delivered by institutions that provide ABA services this can become costly when a large number of individuals require training, although the manual has been shown to require less training hours than other one-to-one forms of instruction, such as feedback and video or in-vivo demonstration. Therefore, a limitation of the studies mentioned above is that none of them evaluated the manual as a purely "*self-instructional*" manual, which would be ideal for an even more cost/time efficient training procedure. It is noteworthy that Fazzio and Martin's ultimate goal is to provide the manual as a standalone self-instructional manual, which parents and paraprofessionals can study on their own to learn how to conduct a DTT technique (Fazzio & Martin, 2009). Before this is possible, the manual's effectiveness and cost/time efficiency as a *self-instructional* resource needs to be further established.

As a step further to this objective, the present study evaluated the third and latest version of the manual, while using CAPSI, developed by Drs. Joseph Pear and Witold Kinsner at the University of Manitoba, based on Keller's personalized system of instruction (PSI), which is described in more detail below. The introduction of CAPSI was intended to test whether participants could learn how to perform DTT studying the manual on their own, at their own pace, without any supervision during tests, and

interacting online with the main researcher and other participants to obtain and provide feedback.

Although the present study did not evaluate the manual as a purely standalone educational resource to teach DTT to university students to educate children with ASD, it contributed to identifying whether or not the manual is effective without the presence of the main researcher to supervise the reading of the manual, answer questions, and administer unit tests.

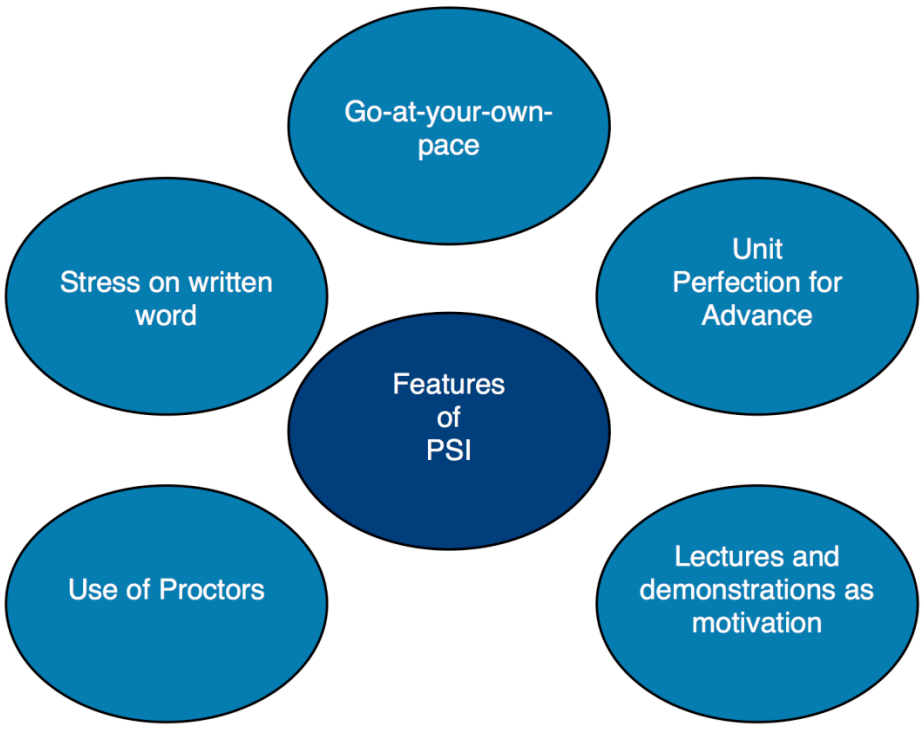
Personalized System of Instruction

Fred Keller, an American psychology professor, developed a Personalized System of Instruction (PSI) during the 1960's. Previously, while World War II was taking place in Europe, Keller worked at a military training centre, teaching Signal Corps personnel in the reception of Morse-code signals. Such instruction had the following characteristics: (1) it was highly individualized and therefore, self-paced; (2) the end-goal was clearly specified; (3) there was a gradual advancement toward the goal; (4) perfection was demanded; (5) classroom instructors were little more advanced than the students themselves; and (6) there was minimal lecture time and maximum hands-on practice and student participation (Keller, 1968).

Based on this experience, Keller and colleagues adapted these characteristics to university teaching and thus PSI, also called The Keller Plan, was developed (Keller, 1968). In its early years it was used at Columbia University, the University of Brasilia, Arizona State University, Georgetown University, and Queens College.

Several core features distinguish PSI courses from more traditional lecture-style courses. Students in a PSI course can cover the material at the speed that they desire; they are required to master the material to a set mastery criterion before they can move on to subsequent units; and they may attend optional lectures and demonstrations designed to enhance the textual material, but not to add new material. Communication between teacher and students is mainly written. Proctors (students who have passed the course) score student's unit tests and provide feedback. These core features of PSI appear in Figure 1.

Figure 1. Core features of the Personalized System of Instruction.



According to Keller (1968), with PSI students' learning is enhanced, their grades are improved, and their motivation and interest in the course is increased. PSI courses tend to have a skewed grade distribution, with a greater number of A's than in non-PSI courses. PSI also allows for a large amount of verbal behaviour and social interaction that provide ample opportunities for positive reinforcement. Furthermore, the vast body of PSI research (see Fox, 2004, for a summary of research conducted on PSI) demonstrates that it is superior to traditional teaching methods (Taveggia, 1976). According to Kulik (1984) "what sets PSI apart from these other individualized systems is its record of effectiveness" (p. 326).

PSI is an effective educational method with empirical research support; however, its popularity has decreased over time (Fox, 2004). According to Fox (2004), and Pear and Martin (2004), one of the reasons for this decline might be that it requires a large number of assistants who serve as proctors, a large amount of preliminary academic input, and a large amount of administrative work to function. In order to increase the administrative effectiveness of PSI, Drs. Joseph J. Pear and Witold Kinsner (Kinsner & Pear, 1988; Pear & Kinsner, 1988; Kinsner and Pear, 1990) developed CAPSI (Pear & Martin, 2004).

Computer-Aided Personalized System of Instruction

CAPSI is an on-line version (Pear & Crone-Todd, 1999) of PSI. CAPSI was first implemented in the 1980's at the University of Manitoba to teach psychology courses. As with PSI, CAPSI allows students to advance through textual learning materials at their own pace, and it requires them to take a test after each unit of material (typically one or two chapters in length). Once they have completed a unit test, CAPSI assigns a student's completed unit test to two other students (peer reviewers) to be marked. Peer reviewers

determine whether a student has demonstrated mastery of the test material and can proceed to the next unit, or whether they should re-study and take another unit test at a later time. It is required that both peer reviewers assign a "pass" for the student to advance to the next unit; otherwise the unit test receives a "re-study". If peer reviewers are not available to mark, CAPSI sends the unit test to the instructor or the teaching assistant (if any have been assigned to the course). Usually the instructor or the teaching assistant marks the first tests taken for each unit since no student has yet passed, or when students indicate that they are not available to serve as peer reviewers. In CAPSI, peer reviewers are students enrolled in the same course who have passed the unit that the other student is being tested on. As mentioned above, during a CAPSI course, students can volunteer to mark other students' unit tests. At the same time, students are able to indicate whether or not they are available to peer review, and when they are available to do so. This feature is built into the CAPSI settings section, where each student can select "yes" or "no", in the "able to peer review" button. This can be changed at anytime, as required. Students can also choose not to peer review, so that CAPSI does not assign any unit tests to be marked during periods of time that they are unavailable. If a student misses a deadline to peer review, the system automatically turns off (changes the peer-review availability status to "no"), and it will not assign any unit tests to that student until the student turns peer reviewing back on. Students who volunteer to be peer reviewers receive bonus points for each unit test they review, and penalty points for each test they fail to review within 24 hours from the time the test was submitted. In order to be assigned a unit test to be marked, participants should have previously passed that unit.

With peer reviewing, students have the opportunity to be exposed to the material a number of times. In addition, CAPSI courses may require students to take a mid-term and

a supervised final exam.

According to Pear and Martin (2004, p. 229), CAPSI makes use of computer technology to enhance the educational features of PSI by providing: (1) immense information-processing and storage for data on a how the course is run; and (2) communication abilities, that permit remote online access to the course, and therefore make it available to more people at a lower cost.

Furthermore, CAPSI developers have also applied a modified version of Bloom's Taxonomy (Bloom, 1956) to the course study questions in order to behaviourally define responses that develop higher-order thinking (Crone-Todd & Pear, 2001). The objective in this line of research is to ensure that study questions are appropriately formulated to cover all the levels of the taxonomy, from knowledge to evaluation, in order to promote critical thinking skills in students.

Along with examining the study questions (antecedents), CAPSI researchers also devote special attention to the delivery of feedback (consequences) provided by peer reviewers. In order for students to benefit from receiving feedback, it is assumed that it should be (1) timely, (2) accurate, and (3) effective. In order to ensure that consequences are timely, bonus and penalty points for peer reviewing are administered. However, accuracy and effectiveness are more difficult to ensure. Since it is peer reviewers who provide the feedback, it might be accurate in some cases and inaccurate in others.

CAPSI research on feedback accuracy (Martin et al., 2002a), based on a sample of 559 instances of peer reviewing (IOPs), found that when inaccurate, peer reviewers tend to provide more false positives (125 IOPs, 22%) than false negatives (25 IOPs, 4%).

However, overall, peer reviewers accurately marked questions in 84% (409 IOPs) of all IOPs. Hence, peer-reviewers' feedback was accurate a majority of the time.

To investigate feedback effectiveness (Martin et al., 2002a; Martin et al., 2002b) CAPSI researchers considered feedback to be effective if students complied with the comments and suggestions to improve the answer if the same question appeared on a retake of the unit test. From a sample of 155 instances of feedback (IOF) students complied with 61% (95 IOFs).

Other lines of research have focused on performance measures, such as performance on final exams, amount of peer reviewing, and progress rates (Springer & Pear, 2008), the effect of using prompts to prevent procrastination (Schnerch, 2007); and the effect of peer reviewing on final grades (Lambert, 2009).

Due to its success at teaching students complex behavioural principles and applications, there is an increasing interest at the CAPSI research lab at the University of Manitoba, directed by Dr. Joseph J. Pear, in using CAPSI for training and clinical purposes. This study represents the first attempt to test the efficiency of CAPSI to serve as the instructional method to deliver a manual that trains individuals to perform DTT to teach children with ASD.

Statement of the Problem

The present study evaluated the use of CAPSI to train university students to perform DTT with a confederate role-playing a child with autistic disorder, using the latest version of the DTT self-instructional manual (Fazzio & Martin, 2009).

It was hypothesized that before studying the DTT self-instructional manual, participants' DTT performance during baseline would have less than 50% accuracy on each of the three baseline tasks, and that after studying DTT via CAPSI they would improve to greater than 90% DTT accuracy on each of the three tasks. It was also hypothesized that the "CAPSI + self-instructional manual" procedure would be as effective or more effective than the self-instructional manual alone as compared to previous studies conducted to test the manual.

Method

Participants and Setting

Seven university students were randomly selected from a pool of eligible research participants, who were recruited from a Distance Education psychology course (course number PSYC 2440 D01, Behaviour Modification Principles) taught at the University of Manitoba, Canada. These students did not have any previous DTT experience. Only 5 participants completed the study. The script for recruiting students is presented in Appendix A. Baseline, self-practice, and post-treatments sessions took place at a testing room at the University of Manitoba, containing a table, and two chairs. The study of the manual occurred at the participants' home or their preferred study place.

Instruments and Materials

CAPSI was used as the teaching strategy, and the DTT self-instructional manual was used as the teaching material. During baseline, three one-page abbreviated DTT instructions for tasks commonly taught to children with ASD in behavioural intervention programs were used (see Appendix B). These abbreviated instructions are accompanied by corresponding data sheets for each task (see Arnal et al. (2007) for a detailed description). A 21-item checklist, called the DTT Evaluation Form (DTTEF; Babel,

Martin, Fazzio, Arnal, & Thomson, 2008) was used to evaluate the accuracy with which participants conducted DTT. The components of the DTTEF are presented in Appendix C.

A laptop with a built-in video camera, data sheets, and pencils were used for data collection purposes. In addition, students required a personal computer and an Internet connection to access CAPSI. After baseline, a laptop with an Internet connection was used to provide a short demonstration of how to access CAPSI.

Procedure

The experiment consisted of Baseline, Training, and Post-training phases.

Baseline. During baseline participants were tested individually. Each participant read an outline of the study and signed the consent form (Appendix D). Once testing began, the participant was asked to read the summary guidelines mentioned previously, which provided three sets of abbreviated instructions on how to conduct a DTT session with children with ASD — one set for each of the three tasks. These tasks included: (1) matching-to-sample, which consisted of presenting a set of 3 pictures and giving a picture for the child to match with the identical picture from the 3-picture set to make a pair; (2) pointing to a picture that was named by the instructor when a set of 3 pictures was presented; and (3) motor imitation, which involved asking the child to "do this", while the instructor modeled an action such as touching one's nose or covering one's eyes with one's hands. After reading the instructions for one task, the participant was then asked to attempt to teach that task to a confederate role-playing a child with an ASD. This procedure was repeated two more times until the participant had the opportunity to teach all three tasks. The order of the tasks was randomized across participants. Baseline sessions were videotaped and later scored with the DTTEF in order to evaluate each

participant's accuracy at performing DTT.

Training. Immediately after the baseline phase was completed, the participant was given her or his CAPSI username and password to enter the system. Using a laptop with an Internet connection, and in the company of the main researcher, the participant accessed the CAPSI website. Once logged on the participant accessed the CAPSI manual on a "downloads" section of the program (see Appendix E for a summary), and the main CAPSI features were explained. The participant was then given a short demonstration on how to submit and review unit tests. After this demonstration the participant was given a hard copy of the recently revised self-instructional DTT manual (Fazzio & Martin, 2009), and time-keeping sheets in which he or she was asked to record the time spent (1) reading the manual, (2) studying the study questions, (3) taking unit tests on CAPSI, (4) peer reviewing, and (5) doing the self-practice exercises.

The participant was instructed to complete the study at home, at his or her own pace. He or she was told to read the manual, and go on to CAPSI to take a unit test after completing each unit.

Each participant decided when to begin and finish training; that is, training commenced any day after the baseline session, when the participant started reading the manual on his or her own time, and finished as soon as she or he was finished reading the manual, taking all unit tests, and doing the self-practice exercises.

The manual contained twelve chapters; each chapter was one unit in CAPSI. Participants were required to read the material for each chapter and pass a unit test on CAPSI before proceeding to the next chapter. Each unit test consisted of three study questions randomly selected by the system. Once the participant answered the test, it was sent to either the principal researcher or two peer reviewers for feedback. Feedback could

either be designated a “pass”, in which case the participant was allowed to move on to the next unit, or a “re-study”, in which case he or she was asked to go back to the reading material and re-study the study questions. After a re-study period of an hour, he or she could request a second test for that unit.

Participants were also instructed on the peer reviewing process. Specifically, they were informed that they had 24 hours to mark a unit test after its submission; and that because of the unpredictability of when a unit test would be submitted, participants were asked to access CAPSI to check regularly for other participants’ unit tests to be peer reviewed. Participants were instructed that the other participants’ progress depended on how promptly they marked unit tests.

Once the study began, the main researcher monitored the system regularly to make sure participants were moving along. Around the fourth week it was noticed that some students started late and were not progressing; i.e., by day 36, participant 2 still had to complete eleven unit tests, and three self-practice sessions and one post-treatment session, while participants 4 and 5 still had to complete seven unit tests, and three self-practice sessions and one post-treatment session. At that point, participant 1 was almost finished, and participant 3 had only three more units, two self-practice sessions, and one post-treatment session, to complete. Furthermore, participants’ progress was being slowed down in cases when the first two peer-reviewers (or either one of them) did not mark the unit test within the first 24 hours after submission. When this occurred CAPSI automatically turned off the participant’s availability to peer review until he or she turned it back on, and the unit test went to the next available participant(s). If those participants also missed the opportunity to peer-review, then a test could take up to 48 hours or more to be marked. In order to accelerate the completion of the tests and the completion of the

study by the end of the semester, the following procedural changes were introduced on day 36:

The following procedural changes were introduced on day 36:

(1) Students were allowed to turn on/off their availability to peer review at their convenience. They were instructed to do this on a daily basis, for the remainder of the study. This prevented a test taking too long to be marked and impeding participants from advancing.

(2) If a test was not marked within 24 hours, then the main researcher marked it, thus preventing the test from being assigned to the next two available participants.

(3) To increase the chances of peer-reviewing, and people moving along through the chapters, the main researcher monitored CAPSI throughout the day, and an e-mail message was sent to participants to notify them that they (a) had a test to be marked, (b) had missed marking a test on time, or (c) their test had been marked and they could now move on to the next chapter.

Chapters 8, 10, and 11 not only required the participant to answer study questions, but also required the participant to conduct a self-practice role-playing exercise on the implementation of DTT, and to self-evaluate his or her performance. For these units, participants were required to schedule a session with the main researcher. During these sessions, participants performed the self-practice exercises contained in the manual. These sessions were videotaped, and the information on the videotapes was used for observational purposes by the researcher, but was not part of the "pass" requirements for the units. Practice exercises videos were not scored for DTT accuracy.

Participants did not receive bonus or penalty points for marking or failing to mark another student's unit test on time. Participants received 10 points towards their course

grade for participating in the study.

Reminder e-mails were sent after baseline was completed on day 1, on day 10 after ten days, and once the modifications were introduced on day 36.

Post-training. The post-training phase occurred after participants had mastered the contents of the DTT manual according to the CAPSI program criteria, and had completed the self-practice sessions. During this phase participants were asked, individually, to teach the same three tasks they taught in baseline to a confederate who role-played a child with an ASD as described previously for the baseline.

Reliability and Procedural Integrity Checks

Interobserver reliability (IOR) checks were conducted for 30% of all sessions (baseline, training, and post-training) across participants. The DTTEF was used for this purpose. Two investigators observed the videotaped sessions; using the DTTEF, they independently scored whether the participant completed each step correctly or incorrectly. A step was scored as an agreement if both observers scored the component identically; otherwise, it was considered a disagreement. Percent agreement was calculated by dividing the number of agreements by the number of agreements plus disagreements and multiplying by 100% (Martin & Pear, 2007). Mean percentage agreement during research sessions was 95.53%, ranging from 88.2% to 100%. Procedural Integrity (PI) was also measured with PI checks performed by an observer during 30% of sessions to ensure that the researcher correctly implemented all steps. Percentage correct for all observed sessions in PI was 100%.

Social Validity

The participants' acceptability of the DTT manual was measured with a 5-item rating scale questionnaire containing 15 questions (see Appendix F). Participants rated the

difficulty of each unit study questions and self-practice exercises.

Evaluation of CAPSI as a teaching platform was done through a 4-item Likert Scale (see Appendix G). Participants were asked to evaluate the main CAPSI components: short-essay questions, self-pacing, and peer reviewing; as well as its usefulness to learn the teaching material.

Results

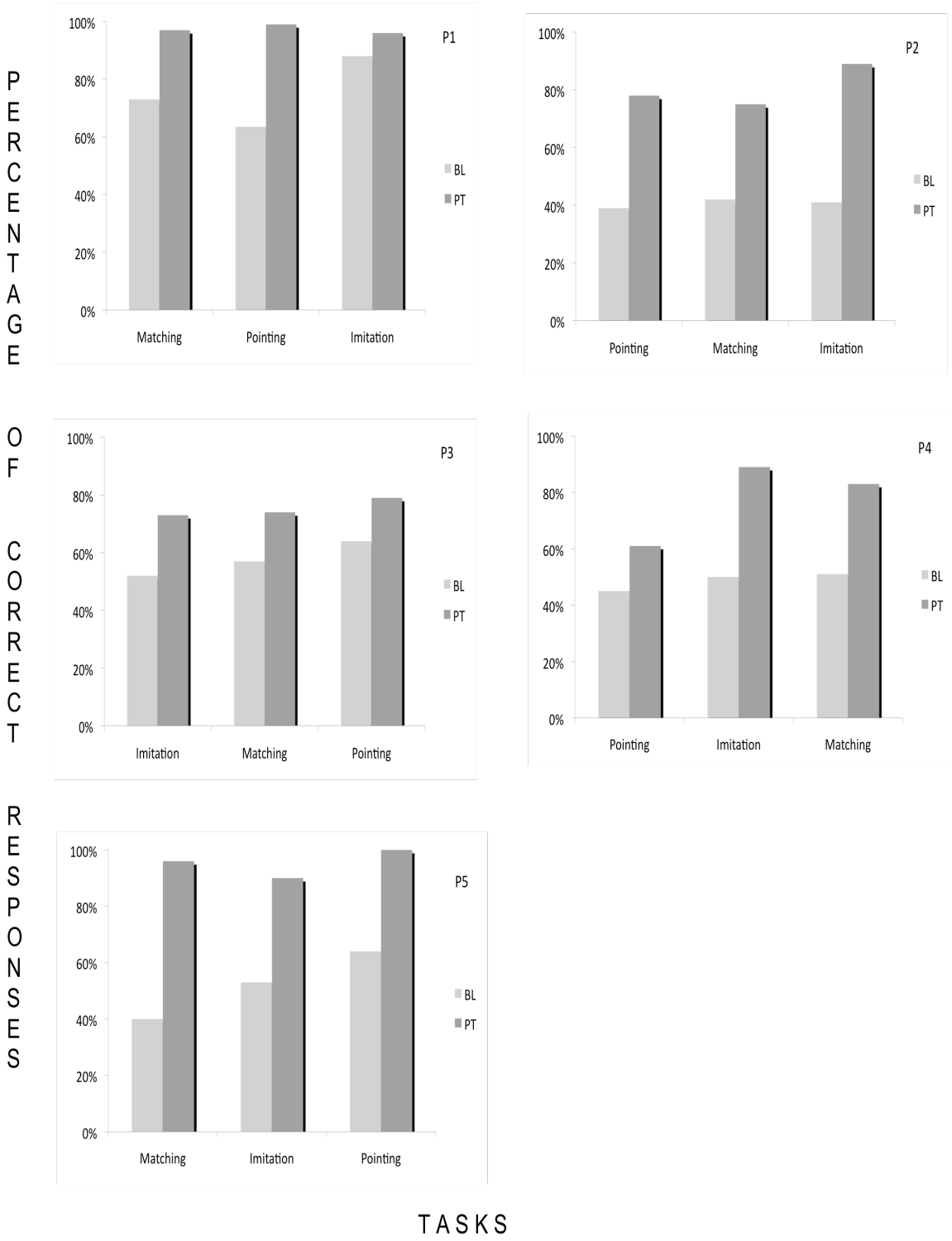
Results are presented in the following order. Variables regarding the self-instructional manual are reviewed first. Such variables include DTT performance and study time. CAPSI variables, such as participants' rate of progress and peer reviewing are presented second. Social validity measures are presented last.

Self-instructional Manual Variables

DTT performance. DTT performance, as measured by the DTTEF is shown in Figure 2. Only 5 participants completed the study; therefore, only data for these participants are presented. Percentage of correct responses is presented for both phases: baseline and post-treatment. Each data point represents one of the three tasks (matching, pointing, and imitation) that participants were required to teach.

P1 had baseline scores of 73% (matching), 64% (pointing), and 88% (imitation), for a mean of 73%. P2 had baseline scores of 42% (matching), 39% (pointing), and 41% (imitation), for a mean of 40.67%. P3 had baseline scores of 57% (matching), 50% (imitation), 64% (pointing), for a mean of 57.67%. P4 had baseline scores of 51% (matching), 45% (pointing), and 50% (imitation), for a mean of 48.67%, and P5 had baseline scores of 40% (matching), 64% (pointing), 53% (imitation), for a mean of 52.33%.

Figure 2. Percentage of correct responses for baseline (BL) and post-treatment (PT) for all three tasks: matching, pointing, and imitation.



The DTT accuracy mean score across participants during baseline was 54.86%. Overall baseline accuracy mean scores by tasks were: 52.6% (matching), 55.2% (pointing), and 56.8% (imitation).

P1 had post-treatment scores of 97% (matching), 99% (pointing), and 96% (imitation), for a mean of 97.3%. P2 had post-treatment scores of 75% (matching), 78% (pointing), and 89% (imitation), for a mean of 80.67%. P3 had post-treatment scores of 74% (matching), 73% (imitation), and 79% (pointing,) for a mean of 75.33%. P4 had post-treatment scores of 83% (matching), 61% (pointing), and 89% (imitation), for a mean of 75%. P5 had post-treatment scores of 96% (matching), 90% (imitation), and 100% (pointing) for a mean of 95.33%.

The DTT accuracy overall mean score across participants for post-treatment was 84.73%. Overall post-treatment accuracy mean scores by tasks were: 85.0% (matching), 83.4% (pointing), and 85.8% (imitation). It can be seen that post-treatment DTT performance accuracy was consistently higher than in baseline.

A statistical analysis was performed to evaluate the combined treatment effects over all the DTT tasks (see bottom row of Table 1). A paired-sample *t*- test was conducted to compare the mean group DTT score during baseline to the mean group post-treatment DTT performance score. There was a significant difference in the mean scores for baseline (M=54.89, SD=12.84) and post-treatment (M=84.72, SD=10.85); $t(4)= 6.014$, $p < .004$. These results indicate that studying the self-instructional manual in combination with CAPSI improved overall DTT performance significantly.

Treatment effects for each task were also analyzed (see first three rows of Table 1). Paired-sample *t*- tests were conducted to compare the mean group baseline scores to the mean post-treatment scores for the matching, pointing, and imitation tasks. There was a

significant difference in the mean baseline versus post-treatment scores across all three tasks. These results indicate that studying the self-instructional manual in combination with CAPSI improved DTT performance significantly for teaching all three tasks.

Table 1.

Paired sample *t*-tests for the matching, pointing, and imitation tasks, and combined scores.

	Baseline M (SD)	Post-treatment M (SD)	Significance
Matching	52.60 (13.31)	85.00 (11.07)	$p < .008$
Pointing	55.20 (12.24)	83.40 (16.35)	$p < .006$
Imitation	56.80 (18.07)	85.80 (8.93)	$p < .013$
Combined scores	54.89 (12.84)	84.72 (10.85)	$p < .004$

Study/Researcher Time. Participants reported spending an average of 12 hours and 48 minutes (range 9 hours and 23 minutes to 19 hours and 21 minutes) to complete all components in the training phase: reading the manual and answering the study questions, taking unit tests on CAPSI and re-taking unit tests in case mastery criterion was not reached, peer reviewing, and doing the self-practice exercises. Experimenter time during training was 10 hours, which were spent monitoring CAPSI, marking tests, sending notification e-mails, and facilitating the self-practice exercises. This time was distributed over 55 days.

CAPSI Variables

Participants' progress. Figure 3 shows a graphical representation of participants' progress over the span of the 55 days of the study. The horizontal axis shows the days,

while the vertical axis shows the unit tests completed, from 0 to 12. It can be seen on what day a participant completed a particular unit test. Each data point is also labeled with the unit test number, for easier identification.

Participant 1 showed an early start, on day 2, with a steady progression from unit test 1 to unit test 9 during the first 17 days of the study. After taking a break, the participant continued on day 29, and by day 41, had completed the last three units.

Participant 2 started late, on day 34, but then progressed steadily, completing unit 12 by day 52. Both units 7 and 8 were completed on day 47, and both units 11 and 12 were completed on day 52.

Participant 3 started in the middle of the study, on day 22, and showed a steady progress from unit 2 to unit 9. After a 10-day break, units 10, 11, and 12 were completed in the span of 6 days. Both units 11 and 12 were completed on day 46.

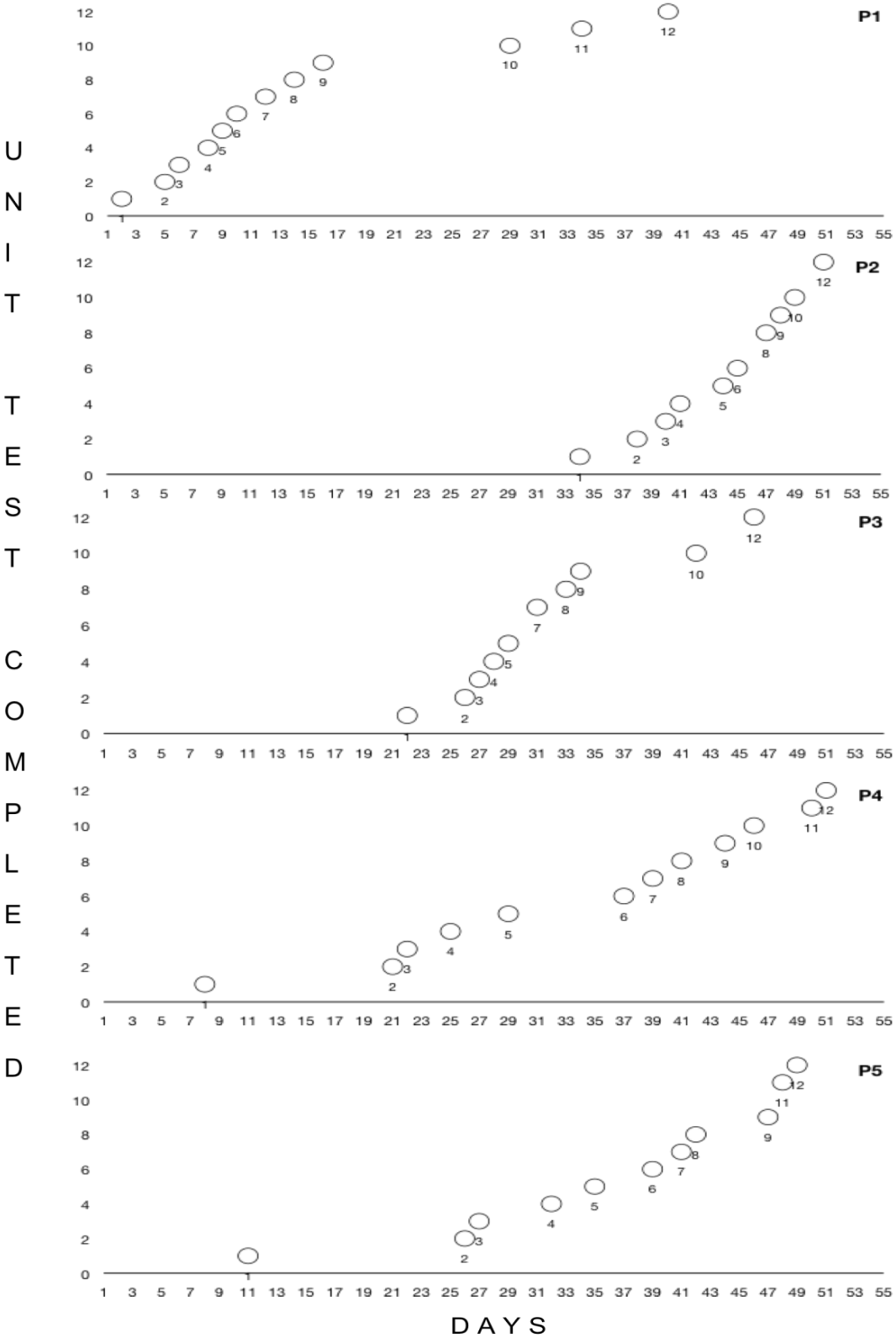
Participant 4 started on day 8 with unit test 1, and did not complete unit 2 until day 21. Units 3 to 6 were completed from days 22 to 29, while units 6 to 12 were completed in a steady progression from day 37 to day 52.

Participant 5 started completing unit tests on day 11. By day 26, unit 2 was completed. From then on, unit tests were completed steadily up to day 49.

All five participants who completed the study performed self-practice exercises after units 8, 10 and 11. Post-treatment occurred after unit 12 had been completed.

After the reminder on day 1 only participant 1 started training. After the reminder on day 10 participant 5 started training. After reminder on day 36, participant 2 completed eleven units; participant 3 completed two units; and participants 4 and 5 completed seven units each.

Figure 3. Participants' progress in the completion of unit tests, across days in the experiment



Progress Index. In previous CAPSI research Springer (2008) developed a progress index to serve as a numerical representation of students' self-pacing. To produce this index, Springer first calculated how many days the courses lasted. Then, she assigned consecutive numbers to each day, starting with number 0. After that she consulted students' records to see how many unit tests had been completed up to each day. She wrote the unit test number that had been completed for each day (and assigned a zero for any days for which no unit tests had yet been passed), and then added these numbers. Following this procedure, a progress score was obtained. The earlier a participant completed unit tests, the higher the score. Table 2 shows progress scores for participants in this study. Participant 1 obtained the higher score, while participant 2 obtained the lowest one. Participants 3, 4 and 5 distributed work similarly with mid-range scores, as can also be seen in Figure 3.

Table 2.

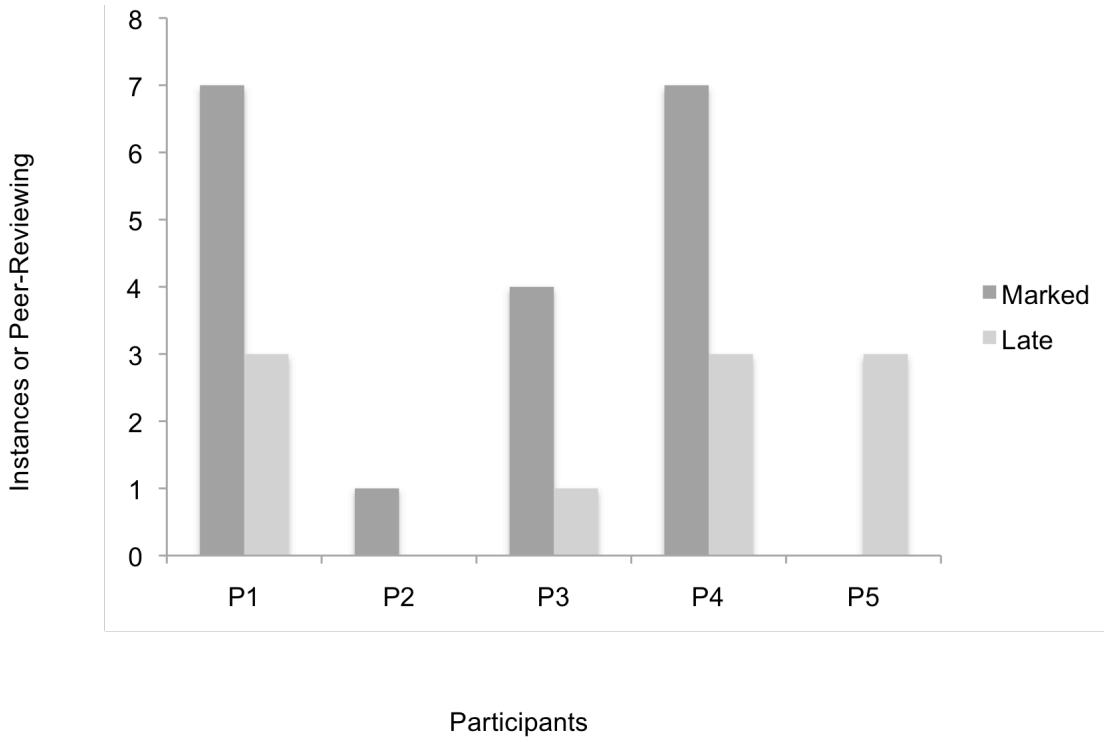
Progress scores per participant.

Participant	Progress Score
Participant 1	487
Participant 2	137
Participant 3	277
Participant 4	259
Participant 5	227

Peer reviewing. Figure 4 shows how many unit tests each participant marked and failed to mark on time. The dark bars (marked) represent how many tests were marked on time, while the light bar (late) shows how many tests the participants failed to mark on time (within 24 hours after the test submission). The latter were then sent to another participant to be marked. Participant 1 was assigned ten tests in total, of which seven were marked on time, and three were not marked on time. Participant 2 was assigned only one test, which was marked on time. Participant 3 was assigned five tests, of which four were marked on time, and one was not marked on time. Participant 4 was assigned ten tests in total, of which seven were marked on time, and three were not marked on time. Participant 5 was assigned three tests in total, of which none were marked on time.

Once the modifications to the peer-reviewing process were introduced on day 36, and students had the opportunity to indicate whether and when they were available to mark tests, only participants 2 and 4 were available to mark up to day 39. The rest of the participants maintained their availability off at all times after day 36. After day 39 all students turned off their availability for the rest of the study. Therefore, the main researcher marked all tests that were completed after that day.

Figure 4. Instances of marked tests and late peer reviewing per participant



Social Validity

The self-instructional manual. Four out of five participants completed the questionnaire for evaluating the difficulty of the study questions in the manual. The mean score was 1.4 from a possible range of 1 (very easy) to 5 (very difficult). On average, participants rated the study questions and practice exercises to fall between very easy and easy.

CAPSI. Three out of five participants completed the CAPSI questionnaire. Table 3 shows the percentage of responses to favorable responses (strongly agree or agree) and unfavorable responses (strongly disagree or disagree) to CAPSI components.

Table 3.

Percentages of responses to forced-choice items regarding satisfaction with CAPSI.

Item	Strongly agree or agree	Strongly disagree, or disagree
1. This computer-aided teaching method was useful for teaching the manual.	100% (n = 3)	0% (n = 0)
2. Peer reviewing other students' unit tests helped me learn the material.	33% (n = 1)	67% (n = 2)
3. One can learn as much in a course using this computer-aided teaching method as in a more traditional lecture-style course.	67% (n = 2)	33% (n = 1)
4. I would recommend a course using this computer-aided teaching method to a friend.	100% (n = 3)	0% (n = 0)
5. Other things being equal, I would choose to take a course using this computer-aided teaching method rather than one using a more traditional teaching method.	67% (n = 2)	33% (n = 1)
6. I liked the self-paced component of the study.	100% (n = 3)	0% (n = 0)
7. I liked the fact that the questions in the course were essay rather than multiple-choice.	67% (n = 2)	33% (n = 1)

Discussion

On the "Self-instructional manual + CAPSI" Package Effectiveness

Post-treatment DTT accuracy scores in the present study were very similar to those in Boris'. Participants in Boris' study had a larger improvement than participants in the present study; however, this might have been because participants in the present study

had higher baselines. Therefore, they had less room for improvement (i.e., a "ceiling effect" may have occurred). Results from the present study suggest that CAPSI is an effective educational technology to accompany the third version of the self-instructional manual to teach university students to perform DTT.

On How to Improve the "Self-instructional manual + CAPSI" Package Effectiveness

Efforts should be made to improve the "self-instructional manual + CAPSI" package effectiveness. Previous CAPSI-based courses evaluations have reported that students find peer reviewing to be beneficial for learning material because students are exposed to it several times, they are exposed to other people's answers, and they gain the opportunity to provide feedback. Since participants in the present study engaged in little peer reviewing, incorporating bonus and penalty points for marking unit tests could increase peer reviewing and therefore improve the "self-instructional manual + CAPSI" package effectiveness.

Alternatively, CAPSI's capabilities to distribute media content on the Internet could be used to insert visual demonstrations of DTT performance. Therefore, the manual could also be enriched with video and audio on CAPSI.

On the "Self-instructional manual + CAPSI" Package Cost/time Efficiency

In order for CAPSI to be a good addition to the manual, the training procedure needs not only to be effective, but also to be cost/time efficient; that is require less money and time to be implemented than other training procedures. Boris (2010) did not report how many hours took the main researcher to train all 3 participants, however she reported that participants required an average of 6 hours and 41 minutes (range: 4 hours and 53 minutes to 7 hours and 57 minutes) to master the manual; therefore training for 3 participants might have taken about 18 hours. For the main researcher in the present study

it took 10 hours to train 5 participants with the "self-instructional manual + CAPSI" package. Therefore, this package is more cost/time efficient in researcher time. On the other hand, participants in the present study required an average of 12 hours and 48 minutes (range: 9 hours and 23 minutes to 19 hours and 21 minutes). Both Boris' study and the present study had one participant whose mother tongue was not English. Participants who used CAPSI overall took double the time to study the manual and complete unit tests. This difference could have resulted from several factors, which are described below:

Participants in the CAPSI study recorded on their own the time it took them to study the manual, while in the Boris' study it was the main researcher who recorded the time that participants took to study the manual. As a result, the study time difference could result from recording errors or an overestimation from participants in the CAPSI study.

Participants in the CAPSI study recorded how much time it took them to mark other students' unit tests, while in the Boris' study it was not reported how much time it took for the main researcher to mark participants' tests. Therefore, studying time for her experiment could be longer if these periods of time were included.

Participants in the CAPSI study read the manual on their own, at their own pace, while participants in the Boris' study read the manual in a span of two days, under the supervision of the main researcher. The presence of the supervisor might have prompted them to advance through the manual faster. Additionally, participants in the Boris' study might have a higher reading ability, causing them to read the manual faster. Finally, one participant in the present study reported having taken an exceptionally long time (19 hours and 21 minutes) to study the manual; this might have inflated the overall mean for

the participants in this study. It is also noteworthy that this participant's mother tongue was not English, but Spanish. However, Boris' study also had one who required extra training, and whose mother tongue was not English, but Portuguese.

Although participants in the "self-instructional manual + CAPSI" package study seemed to have taken longer to study the manual, this package can still be considered cost/time efficient in the sense that the main researcher was not required to be present all the time while reading or taking tests occurred, or even at the same moment and space with participants in this study. As a result, compared to Boris' study time invested by the researcher is less, while time invested by the participant is more due to the independent study and self-paced nature of CAPSI. The manual's cost/time efficiency in time invested by the researcher was enhanced with CAPSI because it offered participants the flexibility to complete unit tests at any time during the day once they felt ready to master the material, without the need of a supervisor to provide feedback at that time. Feedback occurred at a later time, within the next 24 hours, from another participant or from the main researcher if peer reviewers were not available.

Also, CAPSI is cost/time efficient in the sense that the system is maintained by its use across many settings, i.e., university courses; therefore the cost is minimized. Moreover, the cost of using CAPSI does not increase depending on the number of students; therefore, it can be used to train large numbers of individuals at the same time in different locations around the world for a low cost. Furthermore, computers and a simple Internet connection are more and more available everywhere. At the same time, CAPSI does not need any special software other than an Internet browser, which are widely available for free. CAPSI also offers users the convenience of any online-provided services in the sense that they do not have to commute to receive training, and therefore

people can save money and time on transportation, especially when they come from rural or remote areas. Finally, CAPSI is cost/time efficient in that it does not require one-to-one instruction. One person is enough to administer and run a CAPSI course for a large number of people, and is not required to be present while training occurs. Time invested will depend on the number of students and tests to be marked by the instructor, researcher, or trainer, depending on the setting, but in general it is not exceptionally time consuming, and it is certainly not more time consuming than one-to-one instruction or than supervising the entire course of treatment.

On How to Improve the "Self-instructional manual + CAPSI" Package Cost/time Efficiency

Subsequent to the completion of the present study, CAPSI has incorporated an automatic e-mailing notification system similar to the one that was employed manually here, and is already being implemented in CAPSI-taught university courses. This new feature promptly notifies participants when they have a test to mark, so that they do not have to constantly check the system for tests. At the same time, students have the opportunity to mark a unit test immediately after it has been submitted, provided of course, that they have immediate access to an e-mail system, and that they are available to mark it. The e-mail system should also reduce the likelihood of participants missing the deadline to mark a test. With this, three important outcomes result: (1) the likelihood of participants receiving penalty points for late reviewing is reduced; therefore, the likelihood of punishment is minimized, (2) if a test is promptly marked, then students can advance to the next unit right away if they desire to do so; that is, they do not have to be held back for 24 hours, and (3) if participants do not miss the deadline, then the test will be marked by the first peers reviewers it was assigned to, preventing it from bouncing

from peer reviewer to peer reviewer, and therefore taking longer to be marked.

On peer reviewing and participants' progress

CAPSI research is usually conducted on psychology courses taught with CAPSI, in classes with an average of 25 students, with a range from 15 - 40. This study is the first attempt to use CAPSI for teaching practical tasks. Therefore, some modifications were made to the typical CAPSI course procedure in order to adapt it to this study. Such modifications might have heavily influenced how many tests participants reviewed and the pace at which they advanced through the manual during the 55 days of the study.

It is possible that the removal of the "peer-reviewing availability notification" and bonus and penalty points influenced participants' peer reviewing and rate of progress as follows:

The fact that participants marked a low number of tests, and did not always peer review on time, may have resulted from the fact that participants did not receive points for peer reviewing. At the same time, participants not being able to indicate their availability to peer review might have also resulted in tests not being marked on time. Also, because it was impossible to predict what time a test would be written participants were encouraged to check CAPSI at least twice a day, which was not always possible. As the social validity questionnaire for CAPSI showed (see Table 3), participants had less favorable opinions about peer reviewing compared to other CAPSI components, perhaps because they did not peer review enough times for it to benefit their learning. Only three participants (P1, P2 and P5) completed questionnaire. P1 marked seven unit tests and agreed with the statement "Peer reviewing other students' unit tests helped me learn the material", while P2 marked only one unit test and P5 did not peer review any. Both of them disagreed with the statement "Peer reviewing other students' unit tests helped me

learn the material". Therefore, the low number of unit tests marked could be the reason why P2 and P5 reported an unfavorable opinion on the peer-reviewing component. Points may be necessary to motivate individuals to peer review. Overall, participants appear to have a highly favourable view of CAPSI components; although with the small sample size no definite conclusions can be reached.

The possibility for participants to indicate whether or not they were available to mark resulted in faster completion of the study, but not more peer reviewing by the participants. Unfortunately, the instances of peer reviewing were too few to evaluate meaningfully, especially taking into account that participants were unavailable to peer review for a good part of the study. However, if participant baseline means are compared to post-treatment means to evaluate the amount of points gained from baseline to post-treatment (improvement), it can be seen that instances of peer reviewing did not have a reliable effect on DTT performance. For example participant 5 had a post-treatment mean of 95.33%; however, he did not mark any tests. In the same manner, participants 1 and 4 marked the same amount of tests (seven), and obtained highly different post-treatment scores, 97.3% and 75% respectively.

As can be appreciated, the rate at which a participant could advance depended not only on when he or she completed the unit test, but also on when (and how quickly) the unit test was marked. Since the study only had 5 participants, a particular person only had 4 potential peer-reviewers. This is a lower number than in regular CAPSI courses. At the same time, students advancing at a slower pace may have resulted from late marked unit tests and/or the lack of bonus points for peer reviewing.

Reminders at day 1 and 10 were partially effective in prompting people to begin

training. Reminder 36 was effective in prompting people to continue and advance training; however procedural modifications were introduced at the same time as reminder 36 was sent. Therefore, it is difficult to tell whether it was the reminder or the modifications that caused people to advance at this point. At the same time, the fact that the end of the term was also approaching might have also contributed to participants advancing faster at this point.

Limitations

Boris (2010) concurrently evaluated the third version of the manual using the traditional research strategy that incorporates a researcher administering the manual. Therefore, results in the present CAPSI study are compared to the results in Boris' study. However it could be argued that Boris participants are not a proper control group for the CAPSI participants. As a result, one of the limitations of the present study is that it did not include a control group to which a CAPSI group could be compared to.

Another limitation of this study is that it did not include a generalization phase in which participants were assessed for using DTT to teach children with ASD. If participants can demonstrate DTT accuracy when teaching children with ASD instead of a confederate playing a child with ASD, conclusions about the efficiency of the self-instructional manual could have been stronger.

The peer-reviewing CAPSI component was difficult to implement with a small sample and possibly the lack of bonus and penalty points; therefore, a meaningful analysis of the effects of peer reviewing was not possible due to the low number of instances of peer reviewing.

At the same time, without any mechanism that alerted participants that they had a test to review, logging on to CAPSI not to find any tests to mark could have led to

extinction of the behaviour, especially if it is taken into account that some participants began training at a later time than the participants who began early. The latter became able to peer review well before the former started writing tests.

Future research

Future research could include one or more control groups and generalization phase to better evaluate the manual for teaching children with ASD. One control group could be a control group matched on age, sample size, reading ability, DTT experience, mother tongue, educational background, and sex, while another control group could test the manual as a standalone self-instructional manual.

Also, research should look at testing the manual with other populations, such as parents of children with ASD, tutors in training, or other paraprofessionals who work with children with ASD, such as teachers and educational assistants. In the case of tutors in training, it is important to take into account that ABA training programs usually devote a couple of days to train tutors on DTT; therefore future research could investigate whether CAPSI is still effective when implemented in shorter periods of time. At the same time some modifications and conditions might be required, especially for the self-paced and peer reviewing components; i.e. continuous access to a computer during training, a large number of trainees, and shorter deadlines to mark tests.

Future research could also investigate whether there is a more effective order of presenting the teaching tasks to increase participants' DTT performance; e.g., perhaps participants who start with a matching task have better results than participants who start with an imitation task. It would be necessary to determine (1) whether a particular task is easier to teach than others, and (2) whether there is better skills transference from teaching pointing to matching, than from matching to pointing, etc.

Future studies could incorporate videos from the self-practice sessions into CAPSI for peer reviewing. These videos could serve as both feedback opportunities and demonstrations. Perhaps participants could benefit from seeing another person perform DTT. Participants might also benefit from using a checklist to evaluate DTT performance on videos.

It is also suggested that bonus and penalty points for peer reviewing and failure to review on time, respectively, be incorporated to investigate whether or not these variables increase instances of peer reviewing in a small sample, since in this study there was a low number of instances of peer reviewing. Alternatively, another mechanism can be used for marking, such as using fill-in-the-blank questions that can be marked by the computer, providing immediate feedback; or imposing deadlines on unit test completion. In training settings, staff could receive bonus points for peer reviewing that could be exchanged for privileges at work, such as a day off work.

Future training research using CAPSI can make use of the new automatic e-mail notification feature to promptly notify participants when they have a test to mark, so that they do not have to constantly check the system for tests. At the same time, they can also mark the test immediately after it has been submitted, provided of course, that they have continuous access to an e-mail system, and that they are available to mark the test when they receive the notification. It might be possible that this instant notification increases instances of peer reviewing, and therefore, learning opportunities. It is possible that instant notification could also accelerate students' progress. In addition, this addition to the CAPSI system further increases cost/time effectiveness by not requiring the researcher (or instructor/trainer) to send out these e-mail notifications.

Future research could also evaluate CAPSI with other training manuals for ABA–

based procedures, such as the Assessment of Basic Learning Abilities (ABLA) manual (DeWiele & Martin, 1998), the Preference Assessment Manual (Nguyen & Yu, 2009); or with other clinical applications such as mindfulness training.

Conclusion

CAPSI was found to be an effective educational method to teach five individuals to conduct a DTT technique to teach a confederate role-playing a child with autistic disorder, using the latest version of the DTT self-instructional manual. Participants learned how to conduct DTT to teach a confederate role-playing a child with autistic disorder when they worked on their own, at their own pace, without supervision to write tests, and interacted online with each other and with the researcher to obtain and provide feedback.

In the past, CAPSI technology has been demonstrated to be effective to teach university students complex behavioural principles. This study suggests that CAPSI is also effective and cost/time efficient to teach behavioural procedures such as DTT. Therefore, the use of a "self-instructional manual + CAPSI" training procedure is recommended for teaching individuals to educate children with ASD using DTT. The self-instructional manual can be greatly enhanced when being used with CAPSI, since the latter allows training a large number of people at the same time in different locations around the world through Internet. At the same time, CAPSI gives participants the flexibility of working on the own and at their own pace, while interacting with a community of learners to obtain and provide feedback. Future research should investigate (1) how to make CAPSI even more effective and (2) whether these results can be generalized to other populations such as ABA tutors, parents, and paraprofessionals working with children with ASD.

Institutions who provide ABA-based services for children with ASD could benefit greatly from having effective and cost/time efficient DTT training procedures for their staff, parents, and other paraprofessionals in the field. Effective training programs produce well-trained individuals, which results in better treatment service delivery for children with ASD and their families, helping them realize their full potential. In addition, cost/time efficient training programs provide more opportunities for institutions to train personnel at lower costs, in short periods of time. This could translate into more available capable human resources to accommodate a larger number of children with ASD in their programs.

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Appendix A

Script for Recruiting Students

Opportunity to Participate in a Research Project and Receive Partial Course Credit for PSCY 2440 D01

Dear Students in Psych 2440 D01,

A Master's student will be conducting her M.A. thesis to investigate a self-instructional manual for teaching university students to conduct behavioral training sessions with children with autism. The thesis will be supervised by Dr. Joseph J. Pear, Professor of Psychology. I am writing to ask if you would be interested in participating in this experiment. If you agree to participate you will be asked to:

- Read 3 brief summaries of steps for teaching 3 tasks to a child with autism.
- Conduct 3 brief training sessions in which you attempt to teach those tasks to another university student who will role-play a child with autism.
- Study a 60-page self-instructional manual on teaching children with autism until you can: a) correctly answer a pool of study questions based on the manual; b) complete self-practice sessions.
- Attempt to re-teach a university student, role-playing a child with autism, to perform the 3 training tasks.

The total time commitment is approximately 10 hours, which will be met at the rate of approximately 2 or 3 hours/week over approximately 3-5 weeks during the months of October and November.

As stated in the course manual, 10% of your grade is based on your answers to application exercises spread over 4 assignments. If you agree to participate in this project, and if you complete all phases of the project, then you will be awarded the full points that are normally assigned to the application exercises, and you will not be required to complete the application exercises. However, if you begin participation in the project, and then withdraw part-way through, you will receive partial course credit. Specifically, if you complete one quarter of the experiment, you will receive credit for Assignment 1, if you complete half of the experiment, you will receive credit for Assignments 1 & 2, and if you complete three quarters of the project, you will receive credit for the first 3 assignments. Of course, if you complete the entire experiment, you will receive credit for all four assignments.

If you are interested in participating in this project, please contact Alejandra Zaragoza Scherman (Ph: (204) 298-5292, umzaraga@cc.umanitoba.ca) by September 20th, 2009. You will be informed by email on September 21st as to whether or not you have been accepted into the study. This project can accommodate a maximum of 8 students. If more than 8 students volunteer to participate (which we predict will happen), then the 8 participants will be selected randomly.

Sincerely,

Garry L. Martin, PhD

Appendix B

Abbreviated Instructions for Teaching Children with Autism to Point to Pictures When Named Using Discrete-Trials Teaching

- For this task you will role-play a tutor who is attempting to teach a child with autism who has minimal language skills. Do your best at providing what you think would be appropriate instructions, prompts or cues, and consequences while attempting to teach the "child", based on the guidelines listed below.
- Here are three pictures. Your task is to teach this person (who will be role-playing a child with autism) to point to the correct picture after you place the three pictures on the table and name one of them. Across trials, try to teach the "child" to point to each picture as they are named.
- Take a few minutes and study the attached data sheet. Then return to this page and read the "Summary of Steps" below.

Summary of Steps

1. Arrange necessary materials.
2. Decide what you will use as consequences for correct responses and consequences for incorrect responses.
3. On each trial:
    a. Secure the child's attention.
    b. Present the correct materials
    c. Present the correct instruction.
    d. Provide whatever extra help (i.e., prompts or cues) you think are necessary for the child to respond correctly.
    e. Once the "child: responds, provide what you consider to be an appropriate feedback or reward for a correct response, or provide an appropriate reaction for an error.
    f. Across trials gradually provide less and less prompts or cues by prompting less (i.e., fade out the extra prompts).
    g. Continue in this manner until you have conducted 12 teaching trials. After each response by the "child", record the child's performance as directed on the attached data sheet. This task typically takes

approximately 10-15 minutes to complete. Please let us know when you have finished.

Baseline □ Participant #:_____ Confederate: _____
Post-Manual □

Data Sheet for Pointing-To-Named Pictures

Materials Required: Pictures of a banana, balloons, and a dog. Set-Up for Each Trial: A row of three pictures on the table in front of the child.	Child's Response on Each Trial: Points to the item named by teacher. Instructions at start of each trial: Teacher says, "(name of object)" in picture.
Prompts or Cues to Consider Using: Full prompt (F): Full physical guidance Partial prompt 1 (P1): Light physical guidance and pointing to correct picture Partial prompt 2 (P2): Gestural prompt, pointing to correct picture only No prompt (NP)	

On each trial, record child's response as correct (✓) or error (x) in the appropriate column, and indicate prompting level (F, P1, P2, or NP).

Teaching Trials	Position of Pictures on Table			Name of Item to Say	Standard Trials		Error Correction Trials (next trial after an error)	
	Banana	Balloons	Dog		Correct	Error	Correct	Error
1	R	M	L	Banana				
2	L	R	M	Balloons				
3	M	L	R	Dog				
4	R	M	L	Balloons				
5	L	R	M	Dog				
6	M	L	R	Balloons				
7	R	M	L	Banana				
8	L	R	M	Dog				
9	M	L	R	Banana				
10	R	M	L	Balloons				
11	L	R	M	Banana				
12	M	L	R	Dog				

Abbreviated Instructions
for Teaching Children with Autism to Match Pictures Using Discrete-Trials Teaching

- For this task you will role-play a tutor who is attempting to teach a child with autism who has minimal language skills. Do your best at providing what you think would be appropriate instructions, prompts or cues, and consequences while attempting to teach the child, based on the guidelines listed below.
- Here are three pictures. Your task is to teach this person (who will be role-playing a child with autism) to place a card on top of the identical card presented on the table when you say "Match" and give him/her a picture. Across trials, try to teach the "child" to match the three pictures.
- Take a few minutes and study the attached data sheet. Then return to this page and read the "Summary of Steps" below.

Summary of Steps

1. Arrange necessary materials.
2. Decide what you will use as consequences for correct responses and consequences for incorrect responses.
3. On each trial:
    a. Secure the child's attention.
    b. Present the correct materials.
    c. Present the correct instruction.
    d. Provide whatever extra help (i.e., prompts or cues) you think are necessary for the child to respond correctly.
    e. Once the "child: responds, provide what you consider to be an appropriate feedback or reward for a correct response, or provide an appropriate reaction for an error
    f. Across trials gradually provide less and less prompts or cues by prompting less (i.e., fade out the extra prompts).
    g. Continue in this manner until you have conducted 12 teaching trials. After each response by the "child", record the child's performance as directed

on the attached data sheet. This task typically takes approximately 10-15 minutes to complete. Please let us know when you have finished.

Baseline □ Participant #:_____ Confederate: _____

Post-Manual □

Data Sheet for Matching

Materials Required: Double pictures of a cat, a house, and a tree.	Child's Response on Each Trial: Accept picture from teacher and place it on top of corresponding picture on the table.
Set-Up for Each Trial: A row of three pictures on the table in front of the child.	Instructions at start of each trial: Say "Match."
Prompts or Cues to Consider Using: Full prompt (F): Full physical guidance. Partial prompt 1 (P1): Light physical guidance and pointing to correct picture. Partial prompt 2 (P2): Gestural prompt, pointing to correct picture only. No prompt (NP).	

On each trial, record child's response as correct (✓) or error (x) in the appropriate column, and indicate prompting level (F, P1, P2, or NP).

Teaching Trials	Position of Pictures on Table			Picture to give to child	Standard Trials		Error Correction Trials (next trial after an error)	
	Cat	House	Tree		Correct	Error	Correct	Error
1	R	M	L	Cat				
2	L	R	M	House				
3	M	L	R	Tree				
4	R	M	L	House				
5	L	R	M	Tree				
6	M	L	R	House				
7	R	M	L	Cat				
8	L	R	M	Tree				
9	M	L	R	Cat				
10	R	M	L	House				
11	L	R	M	Cat				
12	M	L	R	House				

Abbreviated Instructions
for Teaching Children with Autism to Imitate Simple Actions
Using Discrete-Trials Teaching

- For this task you will role-play a tutor who is attempting to teach a child with autism who has minimal language skills. Do your best at providing what you think would be appropriate instructions, prompts or cues, and consequences while attempting to teach the child, based on the guidelines listed below.
- Your task is to teach this person (who will be role-playing a child with autism) to imitate some actions you will present using your arms and hands, immediately after you present the action. The actions are: clapping, raising both arms (arms up), and placing one hand on top of the other on the lap. Across trials, try to teach the "child" to imitate the three actions.
- Take a few minutes and study the attached data sheet. Then return to this page and read the "Summary of Steps" below.

Summary of Steps

1. Arrange necessary materials.
2. Decide what you will use as consequences for correct responses and consequences for incorrect responses.
3. On each trial:
    a. Secure the child's attention.
    b. Present the correct materials.
    c. Present the correct instruction.
    d. Provide whatever extra help (i.e., prompts or cues) you think are necessary for the child to respond correctly.
    e. Once the "child: responds, provide what you consider to be an appropriate feedback or reward for a correct response, or provide an appropriate reaction for an error.
    f. Across trials gradually provide less and less prompts or cues by prompting less (i.e., fade out the extra prompts).

g. Continue in this manner until you have conducted 12 teaching trials. After each response by the "child", record the child's performance as directed on the attached data sheet. This task typically takes approximately 10-15 minutes to complete. Please let us know when you have finished.

Baseline □ Participant #:_____ Confederate: _____

Post-Manual □

Data Sheet for Imitation of Simple Actions

Materials Required: None.	Child's Response on Each Trial: Child imitates the action modeled by teacher.
Set-Up for Each Trial: Teacher models an action to be imitated.	Instructions at start of each trial: Teacher says, "Do this."
Prompts or Cues to Consider Using: Full prompt (F): Full physical guidance. Partial prompt 1 (P1): Light physical guidance. Partial prompt 2 (P2): Gestural prompt, pointing to the child's hand that was previously guided. No prompt (NP).	

On each trial, record child's response as correct (✓) or error (x) in the appropriate column, and indicate prompting level (F, P1, P2, or NP).

Teaching Trials	Action to Model for Child	Standard Trials		Error Correction Trials (next trial after an error)	
		Correct	Error	Correct	Error
1	Arms Up				
2	Arms Up				
3	Hands Ready				
4	Clap				
5	Hands Ready				
6	Clap				
7	Hands Ready				
8	Arms Up				
9	Clap				
10	Arms Up				
11	Hands Ready				
12	Clap				

Appendix C

DTTEF SCORE FORM

SCORING

✓= performed correctly

☒= performed incorrectly

/ = did not apply

INSTRUCTIONS FOR SCORING

- Score "Preparing to Conduct a Session", Components 1-6, using the space below.
- During a DTT session, score the components for conducting DTT trials, Components 7-20, on the other side of this form.
- Following a DTT session, score Component 21 by examining the data sheet used by the teacher and record your results below.

COMPONENTS	**SCORE**
Preparing to Conduct a Teaching Session	
1. Determine Teaching Task(s)	
2. Gather Materials	
3. Gather Potentially Effective Reinforcer(s)	
4. Arrange the Teaching Setting	
5. Determine the Prompt-Fading Procedure and the Initial Fading Step	
6. Invite Child to the Table and Give a Reinforcer Choice	

21. Fade prompts across trials as described on the data sheet.	

RECORDING ON EACH DTT TRIAL

- On Standard Trials, record Components 7, 8, 9, 10, 11, *12, or 13,* 14, & 15a
- If the child responded correctly on a Standard Trials (e.g., Trial 1), then start recording the next trial (e.g., Trial 2) at Component 7.
- If the child responded incorrectly on a Standard Trial (e.g., Trial 1), then start recording the error correction trial (e.g., Trial 2) in the column below, and record Components 16, 17, 18, 19, 20, & 15b.
- As indicated and illustrated above, Standard and Error Correction Trials should be recorded in sequential and different trial columns.

STANDARD TRIALS		1	2	3	4	5	6	7	8	9	10	11	12
7. Check the data sheet for the arrangement of teaching materials or action to be imitated													
8. Secure the child's attention													
9. Present the teaching materials or model action													
10. Present the correct instruction													
11. Present Prompts													
On a trial, Score 12 **OR** 13 **Not** both	12. Following a **correct response**, praise & present an additional reinforcer												
	----------												
	13. Following an **incorrect response**, block gently if possible, remove materials or stop gesturing & show a neutral expression for 2 or 3 seconds												
14. Record the response immediately/accurately													
15. (a)Allow brief inter-trial interval of 3-5 seconds													

COMPONENTS **TRIALS**

ERROR CORRECTION TRIALS												
16. Secure the child's attention												
17. Re-present the materials												
18. Re-present the instruction & prompt immediately to guarantee correct response												
19. Praise only												
20. Record error correction immediately/ accurately												
15. (b) Allow brief inter-trial interval of 3-5 seconds												

Appendix D
Project Description and Consent to Participation Form
For Students

Research Project Title: Using a Computerized-Aided Personalized System of Instruction to Teach University Students to Use a Discrete-Trial Teaching Technique to Teach Children with Autism

Researchers: Alejandra Zaragoza Scherman, Principal Investigator and Graduate student, Department of Psychology, University of Manitoba, (204) 298-5292.

Research Supervisor: Dr. Joseph J. Pear, Professor, Department of Psychology, University of Manitoba, (204) 480-1466.

This consent form, a copy of which will be left with you for your records and reference, is only part of the process of informed consent. It should give you the basic idea of what the research is about and what your participation will involve. If you would like more detail about something mentioned here, or information not included here, you should feel free to ask. Please take the time to read this carefully and to understand any accompanying information.

What is the purpose of the study?

Discrete-trials teaching is the main method of teaching used in the St. Amant Applied Behaviour Analysis (ABA) Preschool Program for Children with Autism. The purpose of this research is to investigate a self-instructional manual for teaching university students to conduct discrete-trials teaching sessions with adults role-playing children with autism. This research will be the M.A. thesis of Alejandra Zaragoza Scherman, the principal investigator.

What are the study procedures and how long will the study take?

Phase 1:

You will be asked to study a 1-page summary of steps for teaching a child with autism to imitate, a 1-page summary for teaching a child with autism to match pictures of objects, and a 1-page summary for teaching a child

with autism to point to pictures of objects named by a teacher. This will require an estimated 10 minutes per page for a maximum for approximately 30 minutes.

After reading each of the summaries, you will be asked to attempt to practice discrete-trials teaching while you teach an adult (who will role-play a child with autism) to perform each of the three tasks, one 10-minute training session (12 trials) per task. During each of the three mini-training sessions, we will assess your ability to practice discrete-trials teaching.

Phase 2:

You will then be asked to read and study a 60-page self-instructional manual on discrete-trials teaching, and to answer and study the questions contained in the manual, until you are able to answer, with 100% accuracy, a random sample of the study questions without looking at the manual. Your mastery of the manual will involve an approach to teaching referred to as Computer-Aided Personalized System of Instruction (CAPSI) and you will receive instructions in how to use it. Several times you will also be required to do a self-practice session on discrete-trials teaching. We estimate that the total reading, and studying time; and self-practice sessions will be in the range of 5-6 hours.

Phase 3:

You will then attempt to practice discrete-trials teaching while you teach an adult (who will role-play a child with autism) to perform each of the three tasks that you attempted to teach in Phase 1, one 10-minute training sessions (12 trials) per task. Once again we will assess your ability to practice discrete-trials teaching.

All phases will take place at the University of Manitoba.

The total time commitment is approximately 10 hours. For some students, the commitment will be met at the rate of approximately 2 or 3 hours a week for 3 weeks. For other students, the time commitment will be spread over 6 weeks. This depends on the pace students decide that they want to set to meet the requirements. The experiment is expected to occur during October and November 2009.

What are the risks and benefits in taking part in the study?

The procedures of this study present no risks.

A benefit is that you might acquire expertise in discrete-trials teaching, which will be of considerable benefit for you if you should become interested in working in this field, for example by applying for a position as a tutor in the St. Amant ABA Program for Children with Autism. Another benefit, as described later, is that you can substitute your participation in this project for the application exercise required of all students in PSYC 2440 D01. Declining to participate or withdrawing from this study will not affect either the instruction or services that you are receiving or may receive in the future from the University of Manitoba.

Will any recording devices be used?

Yes. All role-playing while you attempt to teach the confederate during Phases 1 and 3; and self-practice sessions will be videotaped for data analysis purposes. The videotapes will show your interactions with yourself, and with the confederate; and will be used to assess the accuracy with which you apply discrete-trials teaching. Tapes will only be accessible to the researcher and will be kept in a locked filing cabinet. Following data analysis by the researcher, the videotapes will be destroyed.

Will I be asked to provide personal information about myself?

Yes. You will be asked to provide your age, educational background, and whether or not you have experienced conducting behavioral training sessions with children with autism or persons with developmental disabilities.

Will personal information about you be kept confidential?

Yes. All information will be handled in compliance with Section 24 of the Personal Health Information Act (PHIA). All information will be kept confidential and stored in a locked office. Only the research staff will have access to the information. Any presentations, reports, or publications about the project will not contain any identifying information. The information will be kept for approximately five years (until December 31, 2014) after the completion of the study and will then be destroyed in a confidential manner. However, at the completion of Phase 3 of the study, participants will be assigned individual numbers and all personal identifiers will be eliminated from the data.

Will I receive the results of the study?

If you wish to be informed of the results, please check YES in the appropriate box at the end of this form and we will send to you a summary of the findings within approximately 4 months after the completion of the study (by approximately March 31, 2010).

Is there payment or cost for participating?

There is no cost and no monetary payment for participating. As described in

the course manual for PSCY 2440 D01, all students are required to complete an application exercise worth a total of 10% of their grade. If you satisfactorily complete all phases of participation in this study, that will satisfy the application requirement for PSYC 2440 D01. However, if you begin participation in the project, and then withdraw part-way through, you will receive partial course credit. Specifically, if you complete one quarter of the experiment, you will receive credit for Assignment 1, if you complete half of the experiment, you will receive credit for Assignments 1 & 2, and if you complete three quarters of the project, you will receive credit for the first 3 assignments. Of course, if you complete the entire experiment, you will receive credit for all four assignments.

Is participation voluntary?

Participation is voluntary. Whether you give consent to take part in this study will in no way affect the instruction that you are receiving now or may receive in the future from the University of Manitoba.

Moreover, even after you give your consent; you can stop at any time and for any reasons by simply calling the principle investigator listed at the beginning of the consent form. Again, your decision to stop will not affect any services that you may be receiving now or in the future from the University of Manitoba.

All students who sign up for PSYC 2440 D01 will receive an invitation to participate in this research as described previously. If more than 8 students volunteer to participate (which we predict will happen), then the 8 participants will be selected randomly.

Will I be contacted in the future for other studies?

No.

Signing the Consent Form

Your signature on this form indicates that you have understood to your satisfaction the information regarding participation in the research project and agree to your participation. In no way does this waive your legal rights, nor release the researchers, sponsors, or involved institutions from their legal and professional responsibilities. You are free to withdraw from the study at any time, and you are free to refrain from answering any questions you prefer to omit, without prejudice or consequences.

Please Check Yes or No for the Following Items:

	Yes	No
1. Do you agree to participate in the experiment as described previously?		

2. Would you like to receive a summary of the findings upon completion of the study?		
3. If you said yes to #2, would you like to receive a summary by surface mail __or by email ___ (please check your preference)?		

This research has been approved by the Psychology/Sociology Research Ethics Board at the University of Manitoba. If you have any concerns or complaints about this project you may contact any of the above-named persons of the Human Ethics Secretariat at 474-7122, or e-mail margaret_bowman@umanitoba.ca. A copy of this consent form has been given to you to keep for your records and reference.

Participant's Signature _____ Date _____

Participant's Phone Number: _____

Participant's Email Address (optional): _____

Appendix E

CAPSI Manual Summary and CAPSI Components

The CAPSI Manual instructed participants on how to use the system on-line. It specified the URL for CAPSI, log-in instructions, contact information, materials needed, the teaching method and its goals, how to use the messaging system, how to write and review unit tests, and how to appeal a unit test.

CAPSI Components

Here is presented a list of the CAPSI components, for detailed descriptions see the method section.

1. Self-pacing.
2. Peer-reviewing.
3. Peer-reviewing availability.
4. Unit tests.
5. Appeal feature.
6. Mid-term exam (not used in this study).
7. Final exam (not used in this study).

Appendix F

Reader Evaluation of the DTT Manual

After reading and mastering each chapter of the DTT manual, please rate the difficulty of the study questions by circling the appropriate number. Also, as indicated below, please list the study questions that you rate as difficult. Also, for Chapters 8, 10, & 11, please rate the difficulty of performing the practice exercises by circling the appropriate number. Thank you for your feedback.

		Rating Scale				
		Very Easy				Very Difficult
Chapter	Questions					
1	How easy or difficult was it to understand the questions in the chapter? Please list the question numbers that you would rate as a 4 or 5. _____	1	2	3	4	5
2	How easy or difficult was it to understand the questions in the chapter? Please list the question numbers that you would rate as a 4 or 5. _____	1	2	3	4	5
3	How easy or difficult was it to understand the questions in the chapter? Please list the question numbers that you would rate as a 4 or 5. _____	1	2	3	4	5
4	How easy or difficult was it to understand the questions in the chapter? Please list the question numbers that you would rate as a 4 or 5. _____	1	2	3	4	5
5	How easy or difficult was it to understand the questions in the chapter? Please list the question numbers that you would rate as a 4 or 5. _____	1	2	3	4	5
6	How easy or difficult was it to understand the questions in the chapter? Please list the question numbers that you would rate as a 4 or 5. _____	1	2	3	4	5
7	How easy or difficult was it to understand the questions in the chapter? Please list the question numbers that you would rate as a 4 or 5. _____	1	2	3	4	5

8	How easy or difficult was it to understand the questions in the chapter? Please list the question numbers that you would rate as a 4 or 5. _____	1	2	3	4	5
	How difficult was it to understand the requirements of the self-practice exercise?	1	2	3	4	5
9	How easy or difficult was it to understand the questions in the chapter? Please list the question numbers that you would rate as a 4 or 5. _____	1	2	3	4	5
10	How easy or difficult was it to understand the questions in the chapter? Please list the question numbers that you would rate as a 4 or 5. _____	1	2	3	4	5
	How difficult was it to understand the requirements of the self-practice exercise?	1	2	3	4	5
11	How easy or difficult was it to understand the questions in the chapter? Please list the question numbers that you would rate as a 4 or 5. _____	1	2	3	4	5
	How difficult was it to understand the requirements of the self-practice exercise?	1	2	3	4	5
12	How easy or difficult was it to understand the questions in the chapter? Please list the question numbers that you would rate as a 4 or 5. _____	1	2	3	4	5

<u>Additional Questions About the Self-Practice Exercises</u>

Chapter 8: If you rated the difficulty of understanding and following the Self-Practice Exercise on "Preparing to Conduct a Teaching Session" (Components 1-6 of the DTTEF) as a 4 or a 5, what aspects of the exercise were difficult to follow?

_____
_____
_____

Chapter 10: If you rated the difficulty of understanding and following the Self-Practice Exercise on "Managing Antecedents and Consequences and Recording Data" (Components 7-15 of the DTTEF) as a 4 or a 5, what aspects of the exercise were difficult to follow?

_____
_____
_____

Chapter 11: If you rated the difficulty of understanding and following the Self-Practice Exercise on “Managing Antecedents and Consequences, and Conducting Error Correction Trials” (Components 7-21 of the DTTEF) as a 4 or a 5, what aspects of the exercise were difficult to follow?

_____
_____
_____

Appendix G

CAPSI Questionnaire

Please, read the following statements and questions. For statements 1-7 Indicate with an “X” whether you agree or disagree with the statement. For statements 8-10, please type your answer in the cell next to the statement. Thanks for your feedback.

	Statements / Questions	Strongly Agree	Agree	Disagree	Strongly Disagree
1	This computer-aided teaching method was useful for teaching the manual.				
2	Peer-reviewing other students' unit tests helped me learn the material.				
3	One can learn as much in a course using this computer-aided teaching method as in a more traditional lecture-style course.				
4	I would recommend a course using this computer-aided teaching method to a friend.				
5	Other things being equal, I would choose to take a course using this computer-aided teaching method rather than one using a more traditional teaching method.				
6	I liked the self-paced component of the study.				
7	I liked the fact that the questions in the course were essay rather than multiple-choice.				
8	What are the strengths of this teaching method?				
9	How could CAPSI be improved?				
10	Add any other comments you might have.				