Education and Science

Original Article

Vol 48 (2023) No 216 93-111

Does Presenting Non-Target Information in the Antecedent or Consequence Event Make a Difference?

Seray Olçay [1], Elif Tekin İftar [2]

Abstract

In this study, the researchers aimed to compare the effectiveness and efficiency of simultaneous prompting procedure in which non-target information was in the antecedent and consequence of teaching trials while teaching core academic skills from general education curriculum to three students with autism spectrum disorder (ASD) in high school mainstreaming classroom who were aged 16 to 17. For this purpose, the researchers used an adapted alternating treatments design. Additionally, the researchers collected social validity data from students with ASD through subjective evaluation and analyzed them descriptively. The effectiveness findings showed that all students acquired target academic skills and non-target information provided in both teaching procedures. Efficiency findings showed that the procedure in which non-target information in the antecedent was more efficient for all parameters except the number of minutes of instruction to criterion. In fact, the procedure in which non-target information in the consequence was shorter in length for one student. Finally, social validity findings showed that all students indicated positive opinions regarding target skills, intervention process, and the outcomes. Limitations and implications for practice and future research are discussed.

Keywords

Non-target information
Simultaneous prompting
Effectiveness
Efficiency
Autism spectrum disorder

Article Info

Received: 03.11.2022
Accepted: 06.12.2023
Published Online: 10.19.2023

DOI: 10.15390/EB.2023.11725

Introduction

Effective teaching procedures, also called systematic teaching procedures, have been developed based on the principles and strategies of applied behavior analysis. Among these strategies, the most frequently used are response prompting procedures. These procedures can be implemented in various arrangements (e.g., presenting the prompt and waiting for the learner to model it, delaying prompts, decreasing, or increasing the prompt level by using different prompt hierarchies based on student's performance, presenting reinforcers in prompted trials, or presenting reinforcers only in unprompted trials; Collins, 2021). This has led to the development and conceptualization of different teaching procedures (i.e., constant time delay, simultaneous prompting), as well as having researchers to conduct studies regarding effective instruction, which leads to accumulation of knowledge.

[1] Hacettepe University, Faculty of Education, Department of Special Education, Türkiye, solcaygul@gmail.com
[2] Anadolu University, Research Institute for Individuals with Disabilities, Türkiye, eltekin@anadolu.edu.tr

One group in which systematic teaching procedures are used includes individuals with autism spectrum disorder (ASD; National Autism Center [NAC], 2015; National Professional Development Center on Autism Spectrum Disorder [NPDC], 2014; Steinbrenner et al., 2020). The number of individuals diagnosed with ASD is increasing each day (Matthew et al., 2023). This has led to an increase in the number of studies on the education of students with ASD as studies have revealed that they need systematic teaching procedures to acquire a significant number of skills (Smith, Polloway, Patton, & Dowdy, 2006; Tekin-İftar & Değirmenci, 2018; Walker, Douglas, Douglas, & D'Agostino, 2020). Also, this has resulted in the formation of a strong body of research on systematic teaching of individuals with ASD. However, these studies mostly focus on early childhood period. There is an urgent need for research on knowledge and practices that will guide teachers and other professionals in providing systematic instruction regarding the education of students with ASD in adolescence and young adulthood periods (NPDC, 2014; Tekin-İftar, Collins, Spooner, & Olcay-Gul, 2017; Wong et al., 2015).

Furthermore, academic skills get increasingly difficult to manage for the students with special needs, including ASD. Difficulties in academic performance may also increase school dropout rates depending on the grade level. The dropout rates of individuals with special needs are at least twice as high as their typically developing peers (National Center for Education Statistics, 2020). There are similar findings in Turkey. For instance, 55% of the students with typical development in general education settings during 2021-2022 academic year continued secondary education, while only 21% of those with special needs did so (Ministry of National Education [MoNE], 2022). However, difficulties in academic skills alone are not sufficient to explain dropout rates. It may also be the case that students and families cannot find what they expect from education as quality education is not provided in accordance with the academic skills that gradually become more difficult. For instance, previous research found that teachers of students with ASD use pseudoscientific practices instead of quality and evidence-based systematic teaching procedures (Atas, Ozsandikci, Olcay, & Saral, 2023; Hamrick, Cerda, O'Toole, & Hagen-Collins, 2021; Knight, Huber, Kuntz, Carter, & Juarez, 2018; Travers, 2017).

Previous literature on systematic instruction for students with ASD focuses on the instructional effectiveness and efficiency (e.g., Nottingham, Vladescu, DeBar, Deshais, & DeQuinzio, 2020; Tunc-Paftali & Tekin-İftar, 2021; Wolery et al., 1991). Effectiveness refers to the ability of the student to exhibit a behavior or a skill that (s)he cannot or does not previously know by receiving instruction (Collins, 2021; Wolery et al., 1991). Simultaneous prompting (SP) procedure is one of the effective procedures to teach students with ASD various skills (Morse, 2002). It is one of the response prompting procedures in which the student models the controlling prompt immediately after the target stimulus by the implementer. Tekin-İftar, Olcay-Gul, and Collins (2019) carried out a meta-analysis study to determine whether SP procedure can be recommended as an evidence-based practice, which yielded positive results. The researchers concluded that the procedure had a strong evidence base. Despite the conclusion, they suggested there was only a handful of studies in terms of individual (e.g., age, type, and severity of disability), developmental (e.g., academic, functional, daily life, and self-care), and instructional (discrete or chained) characteristics. In addition, the findings revealed that there were fewer studies in examining the effects of SP procedure in adolescents and young adults, during group instruction, and in inclusive settings, which resulted in the need for research aimed at increasing instructional efficiency with SP.

On the other hand, efficiency refers not only to the effective outcome of the instruction but also that the instruction is better than the other options in several aspects, in other words, it results in "better learning" (Tekin-İftar & Olcay-Gül, 2016). One aspect that describes efficiency in teaching is comprehensive learning. It refers that students acquire the target skills through direct instruction while learning other skills through observational learning and acquisition of non-target stimulus (Ferguson et al., 2020; Olcay, Karabulut, & Saral, 2023; Wolery, Schuster, & Collins, 2000). Thus, comprehensive learning is a viable option in closing the gap between students with ASD and their peers (Vladescu & Kodak, 2013). Studies have shown that non-target information resulting in comprehensive learning has an important role in acquiring a greater number of skills in a shorter time and facilitating future learning (Albarran & Sandbank, 2019; Tekin-İftar & Olcay-Gül, 2016; Werts, Hoffman, & Darcy, 2011). This has led researchers to focus on practices that can increase the instructional efficiency.

Non-target information can be in the antecedent event (e.g., Alig-Cybriwsky, Wolery, & Gast, 1990; Schnell, Vladescu, Kodak, & Nottingham, 2018), consequence event of the teaching trial (e.g., Dass et al., 2018; Grow, Kodak, & Clements, 2017), skill direction (e.g., Smith, Schuster, Collins, & Kleinert, 2011; Tekin-İftar & Olcay-Gül, 2016), as well as the controlling prompt (e.g., Hudson, Hinkson-Lee, & Collins, 2013; Jones & Collins, 1997). Previous research in which non-target information was in the antecedent and consequence event, skill direction, and controlling prompt revealed that the participants acquired the non-target information regardless of where non-target information was added in. Having a teaching arrangement that can be used to close the gap between students with ASD and their peers, resulting in a greater number of learning opportunities in a shorter time and facilitating their future learning has led researchers to focus on studies on how to present the non-target information in the most effective ways.

In terms of the non-target information, these studies can be considered as "the first-generation studies". In accordance with their findings, "the second-generation" studies were conducted nearly 15 years later, since early 2010s. In these studies, the timing (temporal locus) in the presentation of the non-target information was modified. As a result, the studies compared which teaching procedure resulted in more efficient learning. They also focused on whether there would be a difference in terms of effectiveness and efficiency between presenting the non-target information in the antecedent and consequence during the teaching trials. There are only two studies conducted for this purpose (Vladescu & Kodak, 2013; Wolery et al., 2000). Wolery et al. (2000) examined the effectiveness and efficiency of non-target information presented to students with intellectual disabilities aged between 15-19 years using constant time delay. The findings showed that there was no difference between the two procedures in terms of effectiveness. However, the teaching procedure in which non-target information was in the antecedent was more efficient in terms of facilitating future learning. Vladescu and Kodak (2013) compared the effectiveness and efficiency of the non-target information presented to students aged 3-7 years with ASD using progressive time delay. The findings showed there was no difference in terms of effectiveness and efficiency between adding the non-target information to the antecedent and consequence. Both studies showed that no data were collected on whether the participants maintained exhibiting the non-target information and whether they generalized them across different people, settings, and contexts. On the other hand, no studies examined the differences in the presentation of the non-target information to the adolescents with ASD.

Considering the explanations and rationale given above, there is a need for additional research on (a) including students with ASD who attend high school (Mastropieri & Scruggs, 2010; Smith et al., 2006; Wong et al., 2015); (b) focusing on the instruction of academic skills that will help students with ASD be successful in general education classrooms and be as independent as possible (Fidan & Tekin-İftar, 2022; Kiyak & Toper, 2022; Tekin-İftar et al., 2017); (c) designing and implementing efficient instructional practices to assist the students in acquiring more information in a shorter time due to the inability of students to close the gap with their typically developing peers (Reichow & Wolery, 2011; Vladescu & Kodak, 2013); (d) examining the effects of procedures on non-target information on students with ASD despite previous promising research examining presentation of non-target information for the other disability groups (Ledford, Gast, Luscre, & Ayres, 2008; Reichow & Wolery, 2011; Vladescu & Kodak, 2013); (e) examining the effects of procedures on the non-target information on maintenance and generalization despite previous findings related to instructional parameters including acquisition level, duration of instruction, number of sessions, number of errors and future learning (Vladescu & Kodak, 2013; Wolery et al., 2000). Based on these rationales, the following research questions guided the study:

1. Does the effectiveness of teaching practices with SP procedure in which the non-target information is in the antecedent and consequence of the teaching trials differ in terms of teaching academic skills to high school students with ASD?
2. Does the effectiveness of teaching practices with SP procedure in which the non-target information is in the antecedent and consequence of the teaching trials differ in terms of maintenance and generalization of the skills acquired by high school students with ASD?
3. Does the efficiency of teaching practices with SP procedure in which the non-target information is in the antecedent and consequence of the teaching trials differ?
4. What are the views of high school students with ASD their on teaching practices with SP procedure in which the non-target information is in the antecedent and consequence of the teaching trials (social validity findings)?

Method

Participants

Three male Turkish high school students with ASD attending general education classrooms in Ankara participated in the study. Their ages were between 16 and 17 years. In addition to their diagnosis of ASD, two participants also had intellectual disability. The participants had after-school supportive special education services two hours per week at a special education and rehabilitation center. Prior to the study, ethical approval was obtained from the ethics committee of a university (Ethics approval number: GO 16/513). All procedures performed in this study involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. The researchers also obtained permission from MoNE. Then, the first researcher contacted principals of special education and rehabilitation centers in Ankara and determined eligible students (those in high school and diagnosed with ASD). She reviewed the Medical Board Report and Educational Assessment Report of the students. Then, the first researcher conducted 1:1 interviews with each student and family to give them information about the study. After that, written consent and assent were obtained from all students and their families who volunteered to participate in the study. The prerequisite skills for the students in this study were the ability to (a) imitate vocal expressions, (b) engage in at least 5-min visual and auditory activity, (c) follow instruction of 4-5 words, and (d) answering wh- questions related to a text. The first researcher assessed whether the students have these skills. During the assessment, the researcher (a) emitted an expression and asked the student to repeat it (e.g., “Repeat after me. 0 is the

additive identity."); (b) observed the student while reading a story or watching a video that lasted for 5 min; (c) determined whether the student performed a simple instruction that the researcher presented (e.g., "Write down the sentences about environmental pollution."), and (d) asked questions after reading a text. Table 1 presents the student characteristics.

Table 1. Characteristics of the Participants

Student	Age	Gender	Intelligence Score	Diagnosis
Alp	16	Male	65/WISC-R*	ASD+Mild Intellectual Disability
Ata	17	Male	69/Standford Binet**	ASD+Mild Intellectual Disability
Hasan	16	Male	80/ WISC-R*	ASD

*(Savaşır & Şahin, 1995); **(MoNE, 2010)

The performances of Alp, Ata, and Hasan were similar in social and academic skills. All students were able to initiate and maintain conversations, independently read and write, answer simple questions about the texts they read. They could also solve questions that required mathematical operations, and solve simple math problems. All students had instructional objectives related to ecosystem, the effects of environment on humans, natural resources, radiation, and its impacts in Geography category; characteristics of organisms and current environmental problems in Biology category; negative effectors for health, illnesses and their symptoms in Hygiene category indicated in Individualized Education Program (IEP).

Researchers and Observer

Both researchers had a PhD degree in special education. The first and second researcher had 17 and 30 years of experience in special education, respectively. Both had broad experience regarding teaching non-target information and implementing SP procedure. The first researcher (referred as interventionist) conducted all sessions. The observer was a psychologist who had master's degree and who was working in the center where the study was conducted. The researchers trained the observer about data collection.

Setting and Materials

The study was carried out in a group instructional arrangement at a classroom at special education and rehabilitation center in Ankara. The classroom was furnished with two kidney bean tables, chairs, and a wardrobe for educational materials. The classroom was organized in the way the interventionist and the student could sit on a chair, facing each other with a table between them. During all sessions, there were no other students or teachers in the classroom. Data collection forms and a video recorder for recording videos were used in the study.

Experimental Design

An adapted alternating treatments design in single case research methodology was used to compare the effectiveness and efficiency of teaching procedures with SP procedure in which non-target information was in the antecedent and consequence of the teaching trials. In order to control the sequence effect, the researchers assigned the teaching procedures randomly and presented them unpredictable sequence. In addition to that, care has been provided to present a teaching procedure no more than three times in a row. As a requirement of the design, the independent variables were rapidly alternated. Moreover, a red folder was used in the teaching procedure in which non-target information was in the antecedent, while a green folder in the teaching procedure in which non-target information was in the consequence to control the carryover effect.

Dependent and Independent Variables

The dependent variable of the study was the acquisition level of target academic skills. Furthermore, the interventionist assessed non-target information and used one skill set for each SP procedure for each student, thus making a total of two skill sets. Adapted alternating treatments design requires two dependent variables (target academic skills in this study) that are equal in terms of their difficulty level at the same time independent of each other. In this study, the researches selected the dependent variables meeting these two requirements. The researchers also conducted an experimental analysis to evaluate the difficulty levels of the target behaviors. For experimental analysis, the interventionist taught a 9th-grade 16-year-old typically developing youth with two teaching procedures. The youth acquired both target behaviors in equal number of trials. He acquired behavior sets, which were determined for Alp, in nine trials, and the other behavior sets in 10 trials. Thus, it was experimentally determined that the behavior sets were of equal difficulty.

In identifying target academic skills and non-target information, the researchers examined 9th-, 10th-, and 11th-grade Geography, Biology, and Hygiene course books, IEPs of participating students, and interviewed their parents and teachers. Then, they determined target academic skills that were common in three course, and functional in daily life. It should be noted that care was taken in identifying target skills as prerequisite for acquiring advanced academic skills in later grades by the participants. Furthermore, the researchers revised the terms in target skills and made complex terms clear after receiving expert opinions from special and regular education teachers. Table 2 depicts target academic skills and non-target information.

Table 2. Target Skills and Non-Target Information

	The SP procedure in which the non-target information was in the antecedent		**The SP procedure in which the non-target information was in the consequence**	
Student	**Target Skills**	**Non-Target Information**	**Target Skills**	**Non-Target Information**
Alp	1. Define radiation. 2. What are the main uses of boron? 3. What are examples of non-consumable resources?	1. What are radiation spreading machines? 2. Where is boron found in our country? 3. How does wind form?	1. What is nuclear energy? 2. What are the main uses of Sulphur? 3. What are examples of consumable resources?	1. Who defined nuclear reaction? 2. Where is Sulphur found in our country? 3. Where is natural gas found in our country?
Ata	1. What is habitat? 2. Name three of the effects of water on living things. 3. Name two features of interspecific competition.	1. What is the habitat of camels and fish? 2. How much of the body of living things is water? 3. Give an example of interspecies competition.	1. What is ecology? 2. Count three of the effects of soil on living things. 3. Name two features of the predator-prey relationships.	1. What is the definition of ecology? 2. Define humic soil. 3. Give a prey-predator example.
Hasan	1. Name three of the causes of air pollution. 2. What are the negative effects of noise pollution? 3. Explain the physical contamination of food.	1. What are the negative effects of breathing polluted air? 2. Explain the decibel range of sounds that causes hearing impairment. 3. Which restaurants should we choose?	1. Name three of the causes of water pollution. 2. What are the symptoms of food poisoning? 3. Explain the biological contamination of foods.	1. How are waterborne diseases transmitted to humans? 2. How can we prevent food poisoning? 3. At what temperature should we store the meat so that it does not spoil?

There were two independent variables of the study as the teaching procedure with SP procedure in which non-target information was in the antecedent (prior to target stimulus) event, and the teaching procedure with SP procedure in which non-target information was in the consequence (after the that was presented to student) event of the teaching trial.

General Procedure

There were baseline, intervention, maintenance, and generalization sessions. All sessions occurred in a one-to-one format. A correct response was defined as the student answering the question correct within 4 s, while an incorrect response as the student answering the question incorrect within 4 s. No response was defined as the student emitting no response within 4 s. The interventionist coded correct responses as "+", incorrect responses and no responses as "-" into a data collection form.

The interventionist ignored incorrect responses and verbally reinforced correct responses on a continuous schedule of reinforcement during baseline, daily probe, and intervention sessions, and on a fixed-ratio schedule of reinforcement (FR-9) during maintenance and generalization sessions. Three trials were conducted for each skill set in each session, which made a total of nine trials.

Baseline sessions. Baseline sessions were conducted across both skill sets until obtaining stable data for the target academic skills. These sessions were planned to assess students' performance on target skills before intervention sessions. During baseline, all variables except the independent variables were controlled. The baseline sessions were conducted as follows: The interventionist started baseline sessions by presenting a specific attentional cue to the student (e.g., "Hasan, I want to ask you questions about environment and nutritional pollution. I want you to listen to me very carefully and answer the questions. Let's start if you are ready!"). When the student expressed his readiness verbally or with a signal, the interventionist provided verbal praise (e.g., "Great!"). Then, the interventionist presented the skill direction (e.g., "Tell me three reasons for water pollution") and waited for the student's response for 4 s. The interventionist verbally reinforced correct responses (e.g., "Yes! That's great!"). However, the interventionist started the next trial if the student emitted an incorrect response or did not emit a response.

Additionally, baseline sessions for non-target information were conducted to measure students' performances on non-target information. In these sessions, the same procedure as in baseline sessions for target skills was followed. The only difference was that the interventionist presented the skill direction regarding non-target information (e.g., "How do waterborne illnesses spread humans?").

Intervention sessions. During intervention, there were two teaching procedures as SP procedures in which the non-target information is in the antecedent and consequence. Daily probe sessions were conducted before each intervention session to test acquisition level for both teaching procedures. A daily probe session was not conducted before the first session but conducted for each preceding session. There was a total of nine trials in each intervention session. The response interval and trial interval were four seconds and one second respectively. The interventionist randomly allocated skill sets to teaching procedures and waited at least one hour before each teaching procedure. Intervention sessions were terminated when the students responded correctly at 100% in three consecutive sessions. The interventionist provided a verbal prompt for each student, reinforced correct responses, and ignored incorrect responses in both teaching procedures. The only difference between the teaching procedures was that non-target information was provided just after the student attention was secured in the SP procedure in which non-target information was in the antecedent, whereas they were provided just after the student exhibited a response in the SP procedure in which non-target information was in the consequence. The interventionist behaviors were presented in Table 3.

Table 3. Interventionist Behaviors

Baseline/Daily Probe Sessions	**The SP procedure in which the non-target information was in the antecedent**	**The SP procedure in which the non-target information was in the consequence**
Presents attentional cue	Presents attentional cue	Presents attentional cue
Provides praise for securing attention	Provides praise for securing attention	Provides praise for securing attention
Presents skill direction	**Presents non-target information**	Presents skill direction
Waits throughout response interval	Presents skill direction	Presents controlling prompt
Presents consequences for student's responses	Presents controlling prompt	Waits throughout response interval
Records student responses	Waits throughout response interval	Presents consequences for student's responses
Waits throughout trial interval	Presents consequences for student's responses	**Presents non-target information**
	Records student responses	Records student responses
	Waits throughout trial interval	Waits throughout trial interval

Note: The same procedure as in baseline/daily probe sessions was followed during generalization and maintenance sessions.

The interventionist started intervention sessions for the SP procedure in which the non-target information was in the antecedent by providing a specific attentional cue to the student (i.e., "Hasan, we will learn information about environment and nutritional pollution today. I will ask you questions and tell the answers. I want you to repeat the answers. Ready? Shall we start?"). When the student expressed readiness with a signal or verbally, the interventionist provided a verbal praise (e.g., "Great!"). The interventionist provided non-target information by stating, "Breathing polluted air will increase the likelihood of heart attack and respiratory tract diseases." Then, the interventionist presented the skill direction, "Tell me three reasons for air pollution", and gave the controlling prompt with the answers as "1. Rapid and overurbanization, 2. Industry and vehicle waste, and 3. Decrease in green areas." with no delay. The response interval was determined as four seconds for the student to respond. The interventionist reinforced correct responses by providing a verbal praise (e.g., "Yes, great!"), while she transitioned to the next trial upon incorrect or no responses.

The interventionist started intervention sessions in the SP procedure in which the non-target information was in the consequence by providing a specific attentional cue to the student (i.e., "Hasan, today we will learn information about environment and nutritional pollution. I will ask you some questions and tell the answers. I want you to repeat the answers. Ready? Shall we start?"). When the student expressed readiness with a signal or verbally, the interventionist provided verbal praise (e.g., "Great!"). Then, the interventionist presented the skill direction, "Tell me three reasons for water pollution", and gave the controlling prompt with answers as "(1) Domestic waste and mix of industrial waste in pure water, (2) Inaccurate construction of underground boreholes, and (3) Increase in oxygen-consuming matters in water." with no delay. The response interval was determined as four seconds for the student to respond. The interventionist reinforced correct responses by providing a verbal praise (e.g., "Yes, great!"), and provided non-target information by saying "Waterborne illnesses spread humans while drinking water, brushing teeth, washing foods, and bathing." On the other hand, the interventionist ignored incorrect and no responses and yet provided non-target information by saying "Waterborne illnesses spread humans while drinking water, brushing teeth, washing foods, and bathing." Then, the interventionist waited for trial interval time to transition to the next trial.

Maintenance and generalization sessions. The interventionist conducted maintenance and generalization sessions to test both target skills and non-target information. The same procedure as in daily probe sessions was followed. Maintenance sessions were conducted one and four weeks after the students met the identified criteria to assess if they maintained exhibiting target skills and non-target information. Generalization sessions across people were conducted with teachers who were experienced in implementing SP procedure in special education and rehabilitation centers where the participating students attended. Generalization pre-and post-test sessions were carried out before and after intervention condition.

Social Validity

Social validity data were collected based on subjective evaluation strategy through semi-structured interviews with students. During interviews, students' opinions were investigated regarding target skills, SP procedure, their performances after the study, and their preferences on non-target information. Therefore, they were asked (a) which skills they learned, (b) what they thought about contributions of acquired skills to school subjects, (c) what they thought about contributions of acquired skills to daily living, (d) what they thought about intervention procedures, (e) what they liked during the study, (f) what they unliked during the study , (g) what they thought about the order of non-target information presentation, (h) how they felt about their performances after the study, and (i) whether they would like their teachers to use SP procedure to teach them various skills. The answers were analyzed descriptively.

Reliability

Two types of reliability data were assessed as interobserver agreement (IOA) and procedural fidelity (PF) for 33% of baseline, 100% of daily probe, and intervention, 50% of maintenance and generalization sessions. When calculating the IOA, the number of agreements divided by the number of agreements and disagreements was multiplied by 100. For PF, the number of observed interventionist behaviors divided by the number of planned interventionist behaviors was multiplied by 100 (Tawney & Gast, 1984). The mean IOA was 100% across all students. Also, the interventionist implemented all experimental procedures at 100% accuracy.

Results

Three types of data were collected and analyzed as effectiveness, efficiency, and social validity.

Effectiveness Findings

The findings showed that participating students acquired target skills and non-target information in both teaching procedures. There are graphs for each student that depicts students' performances on target academic skills and non-target information in Figure 1 to 3.

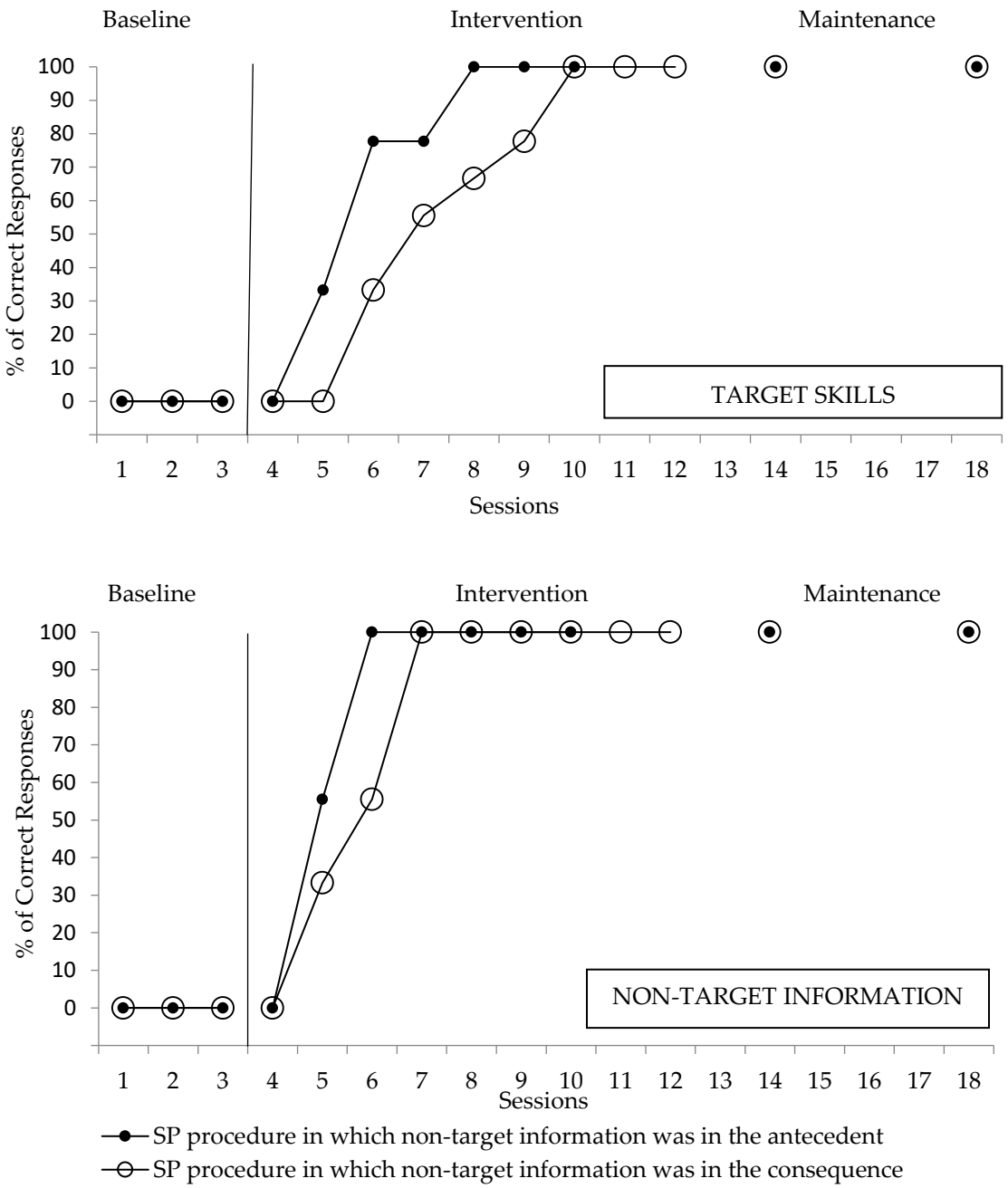

Figure 1. Alp's Performance on Target Skills and Non-Target Information

Alp, Ata, and Hasan did not exhibit any correct responses during baseline and acquired the target academic skills at 100% during intervention for both teaching procedures. It should be noted that all students acquired target academic skills with the SP procedure in which the non-target information was in the antecedent faster than the other procedure in which non-target information was in the consequence. Alp and Hasan acquired non-target information at 100% in both teaching procedures, while Ata at 100% in the SP procedure in which the non-target information was in the antecedent and at mean of 77% in the SP procedure in which the non-target information was in the consequence. The intervention sessions with both teaching procedures were conducted until all students exhibited target academic skills at 100% in three consecutive sessions.

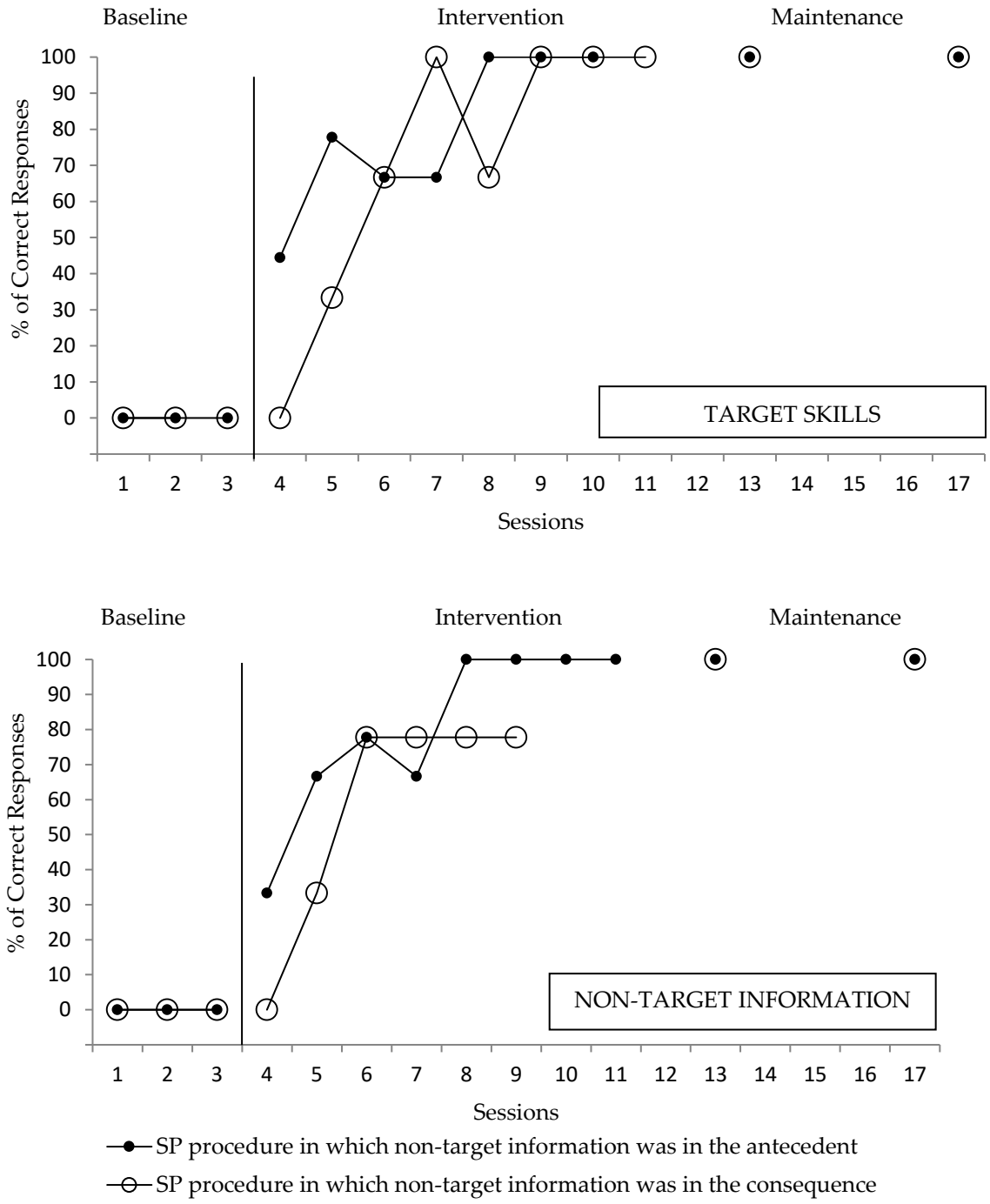

Figure 2. Ata's Performance on Target Skills and Non-Target Information

Alp, Ata, and Hasan maintained exhibiting target academic skills and non-target information at 100% one and four weeks after the intervention was concluded. Also, all students generalized the skills across different people at 100% except Alp. Alp generalized non-target information taught in the SP procedure in which the non-target information was in the antecedent across different people averaging 77%, and at 100% in the other SP procedure. In fact, the teaching procedures presented resulted in difference only in Alp's generalization performance regarding non-target information.

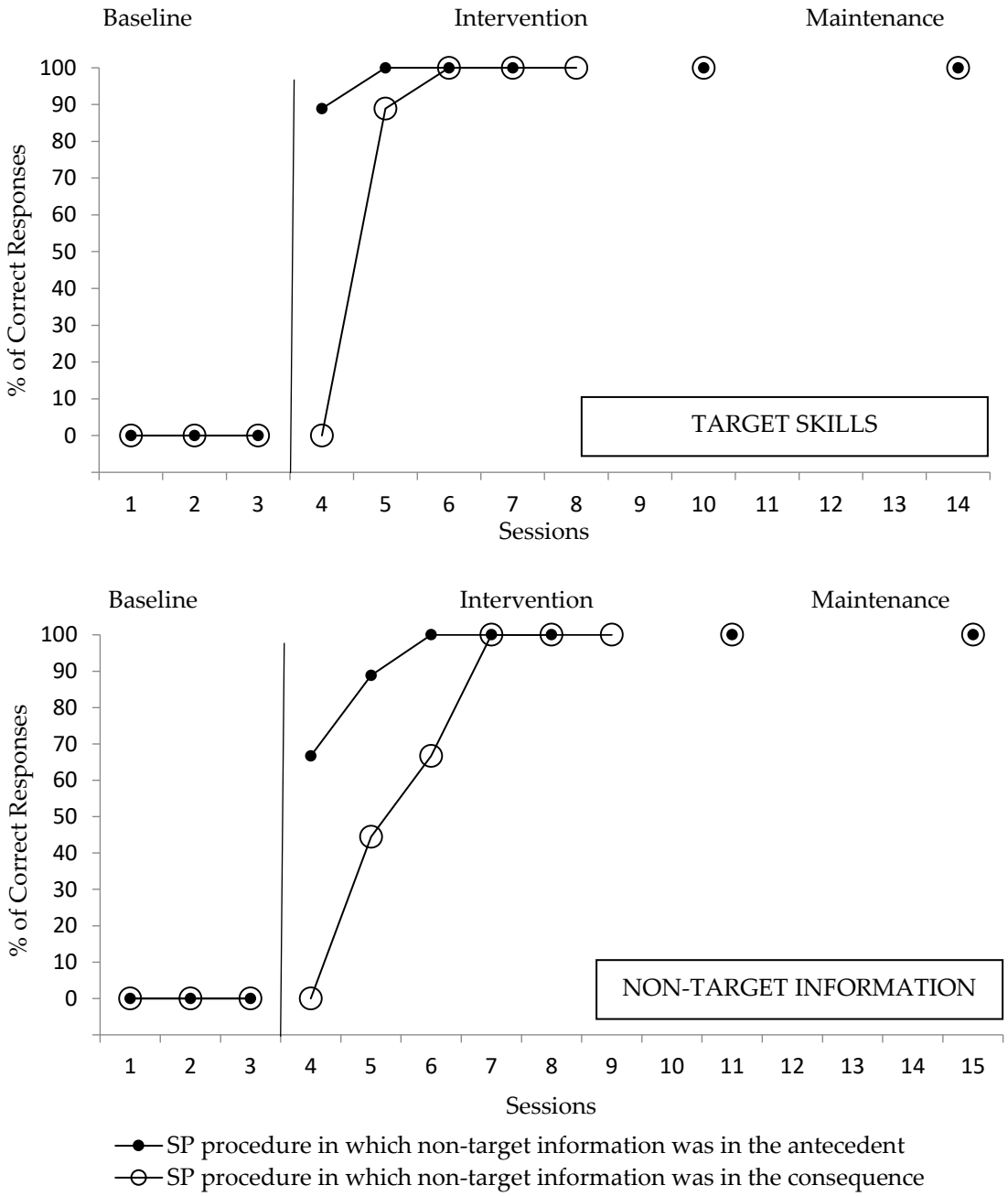

Figure 3. Hasan's Performance on Target Skills and Non-Target Information

Efficiency Findings

In assessing the efficiency of the SP procedures in which the non-target information was in the antecedent or consequence, the following efficiency measures were included: (a) the number of sessions to criterion, (b) the number of trials to criterion, (c) the number of incorrect responses to criterion, and (d) the number of minutes of instruction to criterion, which is presented in Table 4.

Table 4. Efficiency Findings for the Teaching Procedures

	Number of sessions to criterion		Number of trials to criterion		Number of incorrect responses to criterion (Daily probe sessions)		Number of minutes of instruction to criterion	
	Ant.	**Cons.**	**Ant.**	**Cons.**	**Ant.**	**Cons.**	**Ant.**	**Cons.**
Alp	7	9	63	81	19	33	24:38	22:31
Ata	7	8	63	72	13	21	37:32	44:10
Hasan	4	5	36	45	1	10	22:15	28:43

Note: Ant. = The SP procedure in which the non-target information was in the antecedent, Cons. = The SP procedure in which the non-target information was in the consequence.

Efficiency findings showed that all students reached the mastery criterion in fewer numbers of sessions and trials to criterion in the SP procedure in which the non-target information was in the antecedent exhibiting fewer numbers of incorrect responses in daily probe sessions. Furthermore, Ata and Hasan reached mastery criteria earlier in the SP procedure in which the non-target information was in the antecedent, while Alp did in the SP procedure in which the non-target information was in the consequence.

Social Validity Findings

Social validity data were collected from the participating students regarding target skills, teaching procedures, and their performances after the study was concluded. All students mentioned the target skills and stated that they could use them in their schools and daily lives. Alp remarked, "I saw a radiation area at the hospital. The machines spread radiation. I mean it was a dangerous place." Also, Hasan commented on using acquired skills in his daily life and said, "Now, I can understand when I'm poisoned. I shouldn't listen to loud music. It was nice that I learned all these." All students indicated that the intervention contributed to acquiring target skills; they liked the procedures; and the procedures were fun. Alp remarked, "You asked questions and told me the answers. It was easy!" Ata said, "It was good that it took short. I never got bored." Also, Hasan stated, "The topics were so interesting (He mentioned non-target information). You never pushed us. You told the answers and asked us to repeat them." All indicated that they would like to learn any other skills in the way as in the study. All students liked the study stating, "It helped me understand easily and it was fun." (Alp), "It was fun and informative. The lesson took very short." (Ata), and "The topics were different, which was good. I had got bored with learning same things. It was also good that you told me 'You did great." (Hasan). No students stated any negative aspects of the study. Furthermore, the order of non-target information presentation did not make any difference. Data regarding their performances after the study were also collected. Alp indicated, "I learned very well. I told my teachers at school about what I've learned.", Ata "I got higher scores in the exams.", and Hasan "It was nice to learn new things. My mother is very happy." Finally, all students wished all subjects in high school to be taught them in the way as in the study.

Discussion, Conclusion, and Suggestions

One of the aims of the current study was to identify whether the effectiveness of the SP procedures in which the non-target information was in the antecedent or consequence differs in teaching academic skills to high school students with ASD. The findings showed that the students acquired the target academic skills with 100% accuracy in both teaching procedures. This finding is consistent with those that compare the effects of procedures in which non-target information was in the antecedent and consequence (Vladescu & Kodak, 2013; Wolery et al., 2000). In these studies, the effectiveness of constant and progressive time delay instruction trials presented with non-target information in teaching individuals with intellectual disabilities or those with ASD in early childhood was examined. It is thought that the inclusion of SP procedure in the current study contributes to the literature on SP procedure and the presentation of non-target information. Considering alarmingly fewer studies conducted with the students with ASD attending a high school, the study also contributes to the ASD literature.

All participating students acquired non-target information at a higher level (77%-100%). In addition, Alp acquired non-target information faster than the target skills in both teaching procedures. Unlike previous studies, the acquisition of non-target information was measured through probe sessions on non-target information conducted before each instructional session. Vladescu and Kodak (2013) suggested that conducting probe sessions before each instruction could clearly reveal the performance of participants on non-target information. They also suggested that probe sessions should be conducted continuously, stating that if the non-target information was acquired prior to the target skill, the instruction of new non-target information could be included. Based on these suggestions, the findings of the current study confirmed Vladescu and Kodak (2013). It is also expected that the current study will guide families and practitioners regarding how to increase the efficiency of an instruction. The target skills and non-target information were identified based on the curriculum of the schools where the students attended, and all were able to acquire both target skills and non-target information following systematic instruction. In the literature, it is emphasized that it is necessary to set goals from the general education curriculum to ensure the participation of students with special needs rather than teaching an alternative content for the success of inclusive practices (Collins, 2021). Improvements in performance within inclusive environments may have a preventative effect on dropout rate. In this study, the subjects from the curriculum followed by the students were identified, and the social validity findings revealed that the school success of the participants increased with the help of these skills. Therefore, it is thought that the research contributes to both the literature and future studies in practical settings in terms of the target skills.

Another research question in the study was whether the effectiveness of the SP procedures in which the non-target information was in the antecedent or consequence for maintenance and generalization would differ. All students maintained the target academic skills and non-target information in both teaching procedures at 100% one and four weeks after the intervention. The generalization findings showed that all participants except Alp generalized the target skills and non-target information across different people with 100% accuracy; Alp generalized the non-target information in the SP procedure in which the non-target information was in the antecedent averaging 77%. Based on these findings, it can be said that both teaching procedures in which the non-target information is in the antecedent and consequence resulted in difference only in Alp's generalization performance regarding non-target information. Although Alp acquired target skills and non-target information at 100%, he could not correctly answer only one question in the generalization session. Alp stated that he could not remember the answer by saying "I know it, but I cannot remember it". Another finding that should be noted in terms of maintenance and generalization is Ata's performance. As a result of the procedure in which the non-target information was in the consequence, Ata acquired the non-target information averaging 77% while performing at 100% in maintenance and generalization

sessions. Ata gave a correct response in the maintenance and generalization sessions regarding a question he had difficulty in remembering during the probe sessions. These differences in the performances of Alp and Ata may be related to their diagnosis. Both participants had a diagnosis of intellectual disabilities in addition to ASD. Individuals with intellectual disabilities may experience difficulties in remembering new information and skills during the learning process (Smith, 2007). This may have affected the performances of Alp and Ata. In the literature, the studies comparing the effectiveness of the SP procedures in which the non-target information was in the antecedent or consequence (Vladescu & Kodak, 2013; Wolery et al., 2000) did not collect data regarding whether the participants maintained the non-target information, and whether they generalized them across different people, settings, and contexts. Therefore, the results of the current study cannot be discussed in light of previous literature. However, it can be said that the current study advances the literature of effective and efficient instruction in this respect.

The study also examined whether the efficiency of the SP procedures in which the non-target information was in the antecedent or consequence differed in teaching academic skills to high school students with ASD. For this purpose, data on (a) the number of sessions to criterion, (b) the number of trials to criterion, (c) the number of incorrect responses to criterion, and (d) the number of minutes of instruction to criterion were collected and analyzed. The findings showed that the SP procedure in which the non-target information was in the antecedent was more efficient than the other teaching procedure for all parameters except the number of minutes of instruction to criterion. In fact, the duration in the SP procedure in which the non-target information was in the consequence was shorter only for Alp. In the SP procedure in which the non-target information was in the antecedent, immediately after the attention of the participants was drawn, the non-target information was presented, then the target skill was taught. It is thought that the successive presentation of the non-target information as soon as participants' attention was secured affects the findings related to efficiency. This finding is also similar to that of Wolery et al. (2000). Wolery et al. (2000) examined the effects of constant time delay presented with the inclusion of non-target information either to the antecedent or consequence for future learning. As a result, the authors found that there were no significant differences. They also found that the antecedent condition was more efficient in facilitating future learning. Since there are no studies comparing the efficiency of SP procedures in which the non-target information is in the antecedent and consequence among high school students with ASD, the study findings contribute to effective and efficient instructional literature in terms of participant and teaching procedures. In addition, the findings suggest practitioners an alternative that the non-target information can be presented by adding them to the antecedent. In this respect, the current study guides the practitioners in that they can present non-target information in different ways, taking into account the teaching procedures, the skills they aim to teach, and the characteristics of the students.

Finally, social validity data were collected by receiving the opinions of high school students with ASD about the teaching procedures in which the non-target information is in the antecedent and consequence. It was seen that the students' views on target skills, non-target information, SP procedures, and their performances following the instruction were positive. This finding is similar to research findings in which the effectiveness of SP procedure in teaching academic skills to students with ASD was examined and social validity data were collected from the participants themselves (Tekin-İftar & Olcay-Gül, 2016; Tekin-İftar et al., 2017). Vladescu and Kodak (2013) revealed that there was no significant difference between the teaching procedures in which non-target information was in the antecedent or consequence in terms of effectiveness and efficiency. They stated that the participant opinions need to be evaluated in determining which procedure should be used. In this study, the participants were asked which procedure they preferred. They responded that whether the non-target information was presented before or after did not result in a difference for them. In general, they favored that the answer (the presentation of the controlling cue) was given immediately after the question (target stimulus) and stated that it was easier for them to learn this way.

In addition to the positive characteristics of the study, there are limitations worth to note. This study is limited to (a) including three adolescent participants with ASD and (b) examining the effectiveness and efficiency of SP procedure in which non-target information was in the antecedent and consequence on the specified target academic skills.

Suggestions for further research and practices can be made based on the positive characteristics and limitations of the study. In future studies, the effectiveness and efficiency of different teaching procedures with non-target information embedded in antecedent or consequence can be examined for individuals with only ASD or intellectual disability; the effectiveness of instruction with non-target information embedded in different teaching procedures on teaching various skills can be examined; participants with different diagnoses and characteristics can be included; the effectiveness and efficiency of teaching practices in which non-target information is presented at different stages of instruction trials can be compared. It can be suggested to families, specialists, and teachers to increase the efficiency of their instruction by including the presentation of non-target information in teaching different skills to their children and students, and even by including the presentation of more than one non-target information when appropriate.

Acknowledgements

This study was supported by Scientific Research Projects Committee of Hacettepe University (Project No: SBA-2017-12050). The authors thank to Scientific Research Projects Committee of Hacettepe University for supporting this research.

References

Albarran, S. A., & Sandbank, M. P. (2019). Teaching non-target information to children with disabilities: An examination of instructive feedback literature. *Journal of Behavior Education, 28*, 107-140. doi:10.1007/s10864-018-9301-3

Alig-Cybriwsky, C. A., Wolery, M., & Gast, D. L. (1990). Use of a constant time delay procedure in teaching preschoolers in a group format. *Journal of Early Intervention, 14*(2), 99-116. doi:10.1177/105381519001400201

Atas, B., Ozsandikci, İ., Olcay, S., & Saral, D. (2023). Opinions about evidence-based practices among special education teachers. *Journal of Evidence-Based Social Work, 20*(1), 145-157. doi:10.1080/26408066.2022.2133981

Collins, B. C. (2021). *Systematic instruction for students with moderate and severe disabilities*. Baltimore, MD: Brookes.

Dass, T. K., Kisamore, A. N., Vladescu, J. C., Reeve, K. F., Reeve, S. A., & Taylor-Santa, C. (2018). Teaching children with autism spectrum disorder to tact olfactory stimuli. *Journal of Applied Behavior Analysis, 51*, 538-552. doi:10.1002/jaba.470

Ferguson, J. L., Majeski, M. J., McEachin, J., Leaf, R., Cihon, J. H., & Leaf, J. B. (2020). Evaluating discrete trial teaching with instructive feedback delivered in a dyad arrangement via telehealth. *Journal of Applied Behavior Analysis, 53*, 1876-1888. doi:10.1002/jaba.773

Fidan, A., & Tekin-İftar, E. (2022). Effects of hybrid coaching on middle school teachers' teaching skills and students' academic outcomes in general education settings. *Education and Treatment of Children, 45*, 193-210. doi:10.1007/s43494-021-00069-9

Grow, L. L., Kodak, T., & Clements, A. (2017). An evaluation of instructive feedback to teach play behavior to a child with autism spectrum disorder. *Behavior Analysis Practice, 10*(3), 313-317. doi:10.1007/s40617-016-0153-9

Hamrick, J., Cerda, M., O'Toole, C., & Hagen-Collins, K. (2021). Educator knowledge and preparedness for educating students with autism in public schools. *Focus on Autism and Other Developmental Disabilities, 36*(4), 213-224. doi:10.1177/10883576219893101

Hudson, T. M., Hinkson-Lee, K., & Collins, B. (2013). Teaching paragraph composition to students with emotional/behavioral disorders using the simultaneous prompting procedure. *Journal of Behavioral Education,* 22, 139-156. doi:10.1007/s10864-012-9167-8

Jones, G. Y., & Collins, B. C. (1997). Teaching microwave skills to adults with disabilities: Acquisition of nutrition and safety facts presented as non-targeted information. *Journal of Developmental and Physical Disabilities, 9*, 59-78. doi:10.1023/A:1024944811896

Kiyak, Ü. E., & Toper, Ö. (2022). Teaching science facts to students with autism spectrum disorders via telehealth. *Journal of Behavior Education,* 32, 605-615. doi:10.1007/s10864-022-09497-y

Knight, V. F., Huber, H. B., Kuntz, E. M., Carter, E. W., & Juarez, A. P. (2018). Instructional practices, priorities, and preparedness for educating students with autism and intellectual disability. *Focus on Autism and Other Developmental Disabilities, 34*(1), 3-14. doi:10.1177/1088357618755694

Ledford, J. R., Gast, D. L., Luscre, D., & Ayres, K. M. (2008). Observational and incidental learning by children with autism during small group instruction. *Journal of Autism and Developmental Disorders, 38*(1), 86-103. doi:10.1007/s10803-007-0363-7

Mastropieri, M. A., & Scruggs, T. E. (2010). *The inclusive classroom: Strategies for effective instruction* (4th ed.). Upper Saddle River, NJ: Prentice Hall.

Matthew, J. M., Zachary, W., Ashley, R. W., Esther, A., Amanda, V. B., Deborah, A. B., … Kelly, A. S. (2023). Prevalence and characteristics of autism spectrum disorder among children aged 8 years-autism and developmental disabilities monitoring network, 11 Sites, United States, 2020. *MMWR Surveillance Summaries, 72*(2), 1-14. doi:10.15585/mmwr.ss7202a1

Ministry of National Education. (2010). *Stanford Binet Zeka Testi L formunun yönerge ve değerlendirilmesi*. Ankara: Özel Eğitim ve Rehberlik Hizmetleri Genel Müdürlüğü.

Ministry of National Education. (2022). Milli Eğitim istatistikleri: Örgün eğitim 2021-2022. Retrieved from http://sgb.meb.gov.tr

Morse, T. E. (2022). Simultaneous prompting and students with autism: Procedural guidance for teachers from review of the literature. *Education and Training in Autism and Developmental Disabilities, 57*(1), 44-66.

National Autism Center. (2015). National standards report. Retrieved from http://www.nationalautismcenter.org

National Center for Education Statistics. (2020). Status dropout rates. Retrieved from https://nces.ed.gov/programs/coe/indicator/coj

National Professional Development Center on Autism Spectrum Disorder. (2014). Evidence-based practices. Retrieved from http://autismpdc.fpg.unc.edu/evidence-based-practices

Nottingham, C. L., Vladescu, J. C., DeBar, R. M., Deshais, M., & DeQuinzio, J. (2020). The influence of instructive feedback presentation schedule: A replication with children with autism spectrum disorder. *Journal of Applied Behavior Analysis, 53*, 2287-2302. doi:10.1002/jaba.706

Olcay, S., Karabulut, E., & Saral, D. (2023). Zoom in screen with simultaneous prompting to teach young children with autism. *International Journal of Developmental Disabilities*. doi:10.1080/20473869.2023.2190988

Reichow, B., & Wolery, M. (2011). Comparison of progressive prompt delay with and without instructive feedback. *Journal of Applied Behavior Analysis, 44*, 327-340. doi:10.1901/jaba.2011.44-327

Savaşır, I., & Şahin, N. (1995). *Wechsler Çocuklar için Zeka Ölçeği (WISC-R) uygulama kitapçığı*. Ankara: Türk Psikologlar Derneği Yayınları.

Schnell, L. K., Vladescu, J. C., Kodak, T., & Nottingham, C. L. (2018). Comparing procedures on the acquisition and generalization of tacts for children with autism spectrum disorder. *Journal of Applied Behavior Analysis, 51*, 769-783. doi:10.1002/jaba.480

Smith, B. R., Schuster, R., Collins, B. C., & Kleinert, H. (2011). Using simultaneous prompting to teach restaurant words and classifications as non-target information to secondary students with moderate to severe disabilities. *Education and Training in Autism and Developmental Disabilities, 46*, 251-266.

Smith, D. D. (2007). *Introduction to special education: Making a difference*. New Jersey, NJ: Pearson Merrill Prentice Hall.

Smith, T. E. C., Polloway, E. A., Patton, J. R., & Dowdy, C. A. (2006). *Teaching students with special needs in inclusive settings (revised IDEA edition)*. Boston: Allyn & Bacon.

Steinbrenner, J. R., Hume, K., Odom, S. L., Morin, K. L., Nowell, S. W., Tomaszewski, B., … Savage, M. N. (2020). *Evidence-based practices for children, youth, and young adults with Autism*. The University of North Carolina at Chapel Hill, Frank Porter Graham Child Development Institute, National Clearinghouse on Autism Evidence and Practice Review Team.

Tawney, J. W., & Gast, D. L. (1984). Single subject research in special education. Columbus, OH: Charles E. Merrill.

Tekin-İftar, E., & Değirmenci, H. D. (2018). Otizm spektrum bozukluğu olan çocukların öğretimi. In E. Tekin-İftar (Ed.), *Otizm spektrum bozukluğu olan çocuklar ve eğitimleri* (pp. 265-319). Ankara: Vize Akademik.

Tekin-İftar, E., & Olcay-Gül, S. (2016). Increasing instructional efficiency when using simultaneous prompting procedure in teaching academic skills to students with autism spectrum disorders. *International Electronic Journal of Elementary Education, 9*(2), 451-472.

Tekin-İftar, E., Collins, B. C., Spooner, F., & Olcay-Gul, S. (2017). Coaching teachers to use a simultaneous prompting procedure to teach core content to students with autism. *Teacher Education and Special Education, 40*(3), 225-245. doi:10.1177/0888406417703751

Tekin-İftar, E., Olcay-Gul, S., & Collins, B. (2019). Descriptive analysis and meta-analysis of studies investigating the effectiveness of the simultaneous prompting procedure. *Exceptional Children, 85*(3), 309-328. doi:10.1177/0014402918795702

Travers, J. C. (2017). Evaluating claims to avoid pseudoscientific and unproven practices in special education. *Intervention in School and Clinic, 52*(4), 195-203. doi:10.1177/1053451216659466

Tunc-Paftali, A., & Tekin-İftar, E. (2021). E-coaching preschool teachers to use simultaneous prompting to teach children with autism spectrum disorder. *Teacher Education and Special Education, 44*(3), 255-273. doi:10.1177/0888406420925014

Vladescu, J. C., & Kodak, T. M. (2013). Increasing instructional efficiency by presenting additional stimuli in learning trials for children with autism spectrum disorders. *Journal of Applied Behavior Analysis, 46*(4), 805-816. doi:10.1002/jaba.70

Walker, V. L., Douglas, K. H., Douglas, S. N., & D'Agostino, S. R. (2020). Paraprofessional-implemented systematic instruction for students with disabilities: A systematic literature review. *Education and Training in Autism and Developmental Disabilities, 55*(3), 303-317.

Werts, M. G., Hoffman, E. M., & Darcy, C. (2011). Acquisition of instructive feedback: Relation to target stimulus. *Education and Training in Autism and Developmental Disabilities, 46*(1), 134-149.

Wolery, M., Doyle, P. M., Ault, M. J., Gast, D. L., Meyer, S., & Stinson, D. (1991). Effects of presenting incidental information in consequent events on future learning. *Journal of Behavioral Education, 1*(1), 79-104. doi:10.1007/BF00956755

Wolery, T. D., Schuster, J. W., & Collins, B. C. (2000). Effects on future learning of presenting non-target stimuli in antecedent and consequent conditions. *Journal of Behavioral Education, 10*(2/3), 77-94. doi:10.1023/A:1016679928480

Wong, C., Odom, S. L., Hume, K. A., Cox, A. W., Fettig, A., Kucharczyk, S., … Schultz, T. R. (2015). Evidence-based practices for children, youth, and young adults with autism spectrum disorder: A comprehensive review. *Journal of Autism and Developmental Disorders, 45*(7), 1951-1966. doi:10.1007/s10803-014-2351-z