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Listener or Speaker Instruction and Emergence of Derivational Responses in Symmetry as Naming in Children with Autism Spectrum Disorders

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The present study examined whether teaching listener or speaker responses to stimuli (symbols/pictures) would induce untaught speaker or listener responses to the same stimuli in children with autism spectrum disorder. Korean Alphabet letters or Greek letters, pictures of rare see animals or construction tool were used as stimuli. English speaking children aged 3- to 4- year old participated in the study. A time-lagged multiple baseline across participants design with multiple probes was used. Participant A and Participant D received instruction on listener responses (auditory-visual stimulus-response relation) in form of selecting printed symbols/pictures upon hearing the corresponding spoken names until they reached to the preset criteria. Then probes for untaught speaker responses (visual-auditory stimulus-response relation) in forms of vocal labeling of the stimuli which were presented in front of the participants were conducted. With Participant B and Participant C, target responses for instruction and probes were counterbalanced with those for Participant A and Participant D. The results showed that participants who received speaker instruction demonstrated untaught listener responses as

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listener Naming and participants who received listener instruction didn't show a clear emergence of untaught speaker responses as speaker Naming. The results were discussed in terms of Naming, derived verbal responses within symmetry relation of stimulus equivalence.

Key words : Naming, derived verbal response, stimulus equivalence

Ⅰ. Introduction

Naming "as a basic unit of verbal behavior, symbolize objects and event in the real world" (Horne & Lowe, 1996, p.185). "It represents or reminds us of the stimulus; refers it; stands for or substitutes for it; specifies or means it" (p. 201). With the Naming, a child can refer to or/and understand references about objects or events without seeing them and enter other realm of "being fully verbal" and "being symbolic." (Horne & Lowe, 1996). Naming is a behavioral developmental capability and cusp which is a bidirectional higher order responses across listener responses and speaker responses (Gilic & Greer, 2011; Greer & Longano, 2010; Greer & Speckman, 2009).

Naming involves multiple verbal capabilities such as observing others speaker behavior, covert or overt echoics, act as a speaker-as-own listener when he/she hears the echoics, joining speaker behavior and listener behavior demonstrating bidirectional responding to a stimulus (Horne & Lowe, 1996). Children with Naming capability acquire both speaker and listener responses to a stimulus by observing the stimulus hearing other's saying the name of the stimulus without direct instruction. For example, a Naming occurs when a child says "fire engine" upon seeing a fire truck due to prior experience observing a fire truck hearing other's saying "fire engine". Naming capability for a child is a tool for "registering events or objects voluntarily" and allow the child to learn new language without direct instruction (Gilic & Greer, 2011) and thus enable them to learn in ways they could not before (Greer & Longano, 2010; Greer & Ross; Greer & Speckman, 2009).

A line of research identified that sources of higher-order verbal responses

including Naming was acquisition of derived responding within relational frames. The acquisition of derived relational responding within the frames is resulted from multiple exemplar experiences for the frames within a verbal environment (Barnes-Holmes, Barnes-Holmes, & Cullinan, 2000; Barnes-Homles, Barnes-Holmes, Roche, & Smeets, 2001b). Within this perspective, Naming itself is a derived relational responding which is resulted from reinforcement histories for bidirectional responding across listener responses and speaker responses (Horne & Lowe, 1996; Greer & Koehan, 2005; Greer & Ross, 2004, 2008; Greer & Specksman, 2009; Greer & Longano, 2010). These reinforcement histories may be one of environmental sources for the rapid growth of language that occurs at about 3 years of age (Gilic & Greer, 2011; Horne & Lowe, 1996). Acquisition of generative responding within a relational frame including Naming is representation of verbal development adding more complexity to the verbal behavior of children (Greer & Speckman, 2009). In this course of expanding verbal capabilities in children, establishing reinforcement histories for responding within specific frames is the key feature.

Sidman's stimulus equivalence theory provided another perspective in understanding the sources of derivational verbal responding (Greer & Specksman, 2009) which may be inconsistent to the aforementioned stance. Sidman et al. (1971, 1974, 1982) demonstrated equivalence among physically dissimilar stimuli (a spoken words "cat", a printed word C-A-T, and a picture of a cat) through a match-to-sample procedure and provided a logical basis in which physically dissimilar stimuli can be functionally equivalent. According to Sidman, if a participant matches a spoken word "cat" (sample) to a picture of cat (comparison) by selecting the picture upon hearing the word, and then matches a picture of cat (sample) to the spoken word "cat", (comparison) by saying "cat" upon seeing the picture without further training, the participant is reversing the conditionality "if a, then b" to "if b, then a". Sidman referred this functional sample-comparison reversability as symmetry which is one of properties of stimulus equivalence. Sidman's explanation on symmetry can be associated to stimulus-response relations: an auditory-visual matching as a listener response and a visual-auditory matching as a speaker response. Within this sense, Naming is derivational responding within a symmetry stimulus-response relation across listener responses and speaker responses (Barnes

-Holmes, Barnes-Holmes, Roche, & Smeets, 2001a; Luciano, Becerra, & Valverde, 2007).

With the logics of stimulus equivalence, Sidman and Tailby (1982) argued that derivational responding within a symmetry (reversability from auditory-visual relations to visual-auditory relations or vice versa) is "given" to children, probably typically developing children. In the present study, presence of derived relational responding within symmetry relation in preschooler with ASD was examined. The following questions were examined in the present study: 1) Would teaching listener response to pictures/symbols as auditory-visual stimulus-response relation induce untaught responses within symmetry, speaker response as visual -auditory stimulus-response relations? 2) Would teaching speaker response to pictures/symbols as visual-auditory stimulus-response relation induce untaught responses within symmetry, listener responses as auditory-visual stimulus-response relations?

Ⅱ. Method

1. Participants

The participants were four children with autism ranged 3 to 4 in ages who attended publicly funded special education preschool in a metropolitan area. All of them followed two- or three-step vocal directions, requested desired items with full sentences, and labeled upper and lower case alphabet letters orally. All of the participants were in early stage of vocal reading of sight words. Descriptions of the participants are shown in <Table 1>.

<Table 1> Description of Participants

Participant/Age	Standard Scores	Verbal Behaviors
A/4 Years	Rossetti-infant Toddler Language Scale - 63% delay in Auditory Comprehension - 63% Delay in Vocal Communication	- Follow 3-step Vocal Direction - Request/Label in Full Sentences - Decoding Sight Words - Early Reader

B/4 Years	Rossetti-infant Toddler Language Scale - 33% delay in Auditory Comprehension - 33% Delay in Vocal Communication	- Request/Label in Full Sentences - Decoding Sight Words - Early Reader
C/3 Years	Preschool Language Scale-3 - 33% delay in Auditory Comprehension - 25% Delay in Vocal Communication	- Request/Label in Full Sentences - Decoding Sight Words - Early Reader
D/4 Years	Rossetti-infant Toddler Language Scale - 50% delay in Auditory Comprehension - 50% Delay in Vocal Communication	- Request/Label in Full Sentences - Decoding Sight Words - Early Reader

2. Setting

The study was conducted in a CABAS® (Comprehensive Application of Behavior Analysis in Schooling) preschool which was a publicly funded private school. The school was located in a suburb of a large metropolitan city. Behavior Analysis was applied comprehensively to instruction, behavior management, and staff training in the school. The experimental sessions were conducted in a small tutoring room. Prior to a session, the experimenter set up the experimental materials (i.e., flash cards and an video camera which was for reliability of data collected) in the room. Then the experimenter visited the participants' classroom, pulled the participant out, and took the child to the tutoring room. The session started as soon as the participant sat at a child size table in the room. The size of the room was 3×5 meters and the size of the table was 60×45 centimeters. There were some toys such as Legos® and cars. the participants were given short break during the sessions and the sessions lasted for 40 minutes in average. Only experimenter and the child stayed in the room throughout the sessions except when the second observer was present for interobserver agreements of the data collected during the study. Data was collected as a part of regular instruction in the same way that all other instructions were delivered in the school, hence no special habituation procedure were necessary.

3. Stimuli

Two sets of printed symbols (Korean alphabets or Greek letters) and printed

pictures (construction tools) were used as stimuli. Those stimuli were selected due to minimal possibilities of connection to the existing instructional histories of the English speaking participants. Each stimulus was presented on a 15×10 centimeter index card in black and white. The sets of stimuli are shown at <Table 2>.

<Table 2> The sets of stimuli

	Set 1	Set 2	
Visual Stimuli	ㄹ, ㅈ, ㅎ, ㅂ	 Π	 Ω
Spoken Names	Leeul, Jeeup, Heeup, Beeup	snips, Pry, Pi, Omega	

4. Response Definition and Dependent Variables

A speaker response occurred when participants said the name of the stimulus presented in a flash card. Thus a speaker response is matching a visual stimulus to the spoken words (visual-auditory stimulus-response relation). A listener responses occurred when participant pointed to a printed stimulus upon hearing the spoken name of it (auditory-visual stimulus-response relation) presented by the experimenter. Stimulus-response relations trained and probed with each stimulus were symmetry relations of stimulus equivalence. For example, a stimulus-response relations in symmetry was demonstrated when participant showed untaught spoken word for 'ㄹ' after they received listener instruction with 'ㄹ' and vice versa.

The dependent variables were untaught responses in symmetry relations as Naming during post listener- or speaker-instruction probes. The targeted response classes with the visual stimuli (printed pictures/symbols) during the probes were: 1) untaught auditory-visual stimulus-relation in symmetry to trained speaker response (visual-auditory) as a listener Naming, 2) untaught visual-auditory relation in symmetry to trained listener responses (auditory-visual) as speaker Naming.

5. Independent Variables

One of the independent variables was instruction on either listener or speaker responses to the stimuli. The purpose of the instruction was to determine whether the instructions on either listener responses or speaker responses with the stimuli induced Naming as untaught responses within in symmetry relations with the same sets of stimuli. Instruction as independent variables was delivered in a discrete-trial-training format where potential three-term contingencies (i.e., an antecedent, a response, and a consequence) were presented (Greer, 2002).

6. Data Collection

1) Instruction Sessions

During instruction sessions, 20 discrete trials were presented. Discrete trials instruction for the listener responses were presented with pictures/symbols printed on flash cards: The experimenter presented one exemplar and on non-exemplar in front of the participants along with a vocal antecedent, "point to ___" and waited for 3 seconds for the participant to respond. If the participant pointed to the target exemplar within 3 seconds, the experimenter delivered reinforcers and praise immediately and recorded "+" in the data sheet. If the participant pointed to the non-exemplar or didn't respond within 3 seconds, a correction was provided. First, the experimenter repeated the vocal antecedent and guided the participant to point the target exemplar with a gesture to the target. If the participant pointed to the target with the gestural prompt, the experimenter presented next discrete trials after a brief pause. If the participant didn't point to the target with the gestural prompt, the experimenter guided the participant to point to the target with hand-over-hand guidance.

During the instruction for speaker responses, the experimenter presented one of the flash cards in front of the participants. The participants were required to emit a vocal response to the printed word correctly within 3 seconds. if the participants emitted the target vocal responses within 3 seconds, the experimenter praised immediately and recorded "+". If the participants didn't emit the target vocal response within 3 seconds, the experimenter provided an echoic

and waited for 3 second for them to respond. The experimenter provided one more echoic if the participant didn't emit the vocal response. the experimenter provided next discrete trial after a brief pause. Mastery criterion during instruction was over 90% of accuracy for two consecutive sessions.

2) Probe sessions

When probe trials were presented, consequences for correct or incorrect responses were not delivered. All other aspects of the procedures for probes for matching spoken words to printed symbols as listener responses, matching printed symbols to spoken words as the speaker responses were same as those during the instruction.

7. Design and Procedure

Data were collected within a time lagged multiple baseline across participants design with multiple probes. First Participant A and Participant D received listener instruction and probes for untaught speaker response. Participant B and Participant C received speaker instruction and probes for untaught listener response. Then the participants received instruction and probe sessions with another set of stimuli, Set 2 to examine whether the targeted derivational responding within symmetry was generalized to a novel set of stimuli. Onset of each experimental condition delayed stepwise across participants.

1) Pre-Experimental Probe

Probes were conducted with all of the stimuli (two sets of printed pictures /symbols) across listener responses and speaker responses.

2) Listener or Speaker Instruction and Post-Instruction Probes for Untaught Speaker or Listener Responses as Naming with Set 1

Participant A and Participant D received listener instruction and probes for untaught speaker response. Participant B and Participant C received speaker instruction and probes for untaught listener responses.

3) Instruction on either Listener or Speaker Responses and probes for Generalization of the Untaught Responding with a Set of New Stimuli, Set 2

Generalization of untaught responding across listener and speaker responses demonstrated with Set 1 was examined with another set, Set 2. The response classes instructed and probes were counterbalanced within a participant except Participant A during this phase. For example, Participant B and Participant C who received speaker instruction and listener probes received listener instruction and speaker probes with Set 2.

8. Interobserver Agreement

Interobserver agreements (IOA) were obtained by the second observers who collected data independently while the experimenter worked with the participants. The second observer was a teacher assistant in the classroom. The percentage of interobserver agreement was calculated for both of the instructional sessions and probe sessions by dividing the number of point-by-point agreements by the total number of agreement and disagreements and multiplying by 100. IOA was obtained during the 100% of probe sessions and during 25.6% of instruction sessions for Participant A. The IOA for probe session was 100% and the mean IOA for instruction sessions was 97.0%, with a range from 90% to 100%. For Participant B, IOA was obtained during 100% of the probe session and during 26.6% of instruction sessions. The IOA for probe session was 100% and the mean for instruction sessions was 96.3% with a range from 76% to 100%. For Participant c, IOA was obtained during 100% of the probe session and during 26.1% of instruction sessions. The IOA for probe session was 100% and the mean for instruction sessions was 97.7% with a range from 90% to 100%. For Participant D, IOA was obtained during 100% of the probe session and during 25.5% of instruction sessions. The IOA for probe session was 100% and the mean for instruction sessions was 97.6% with a range from 90% to 100%.

Ⅲ. Results

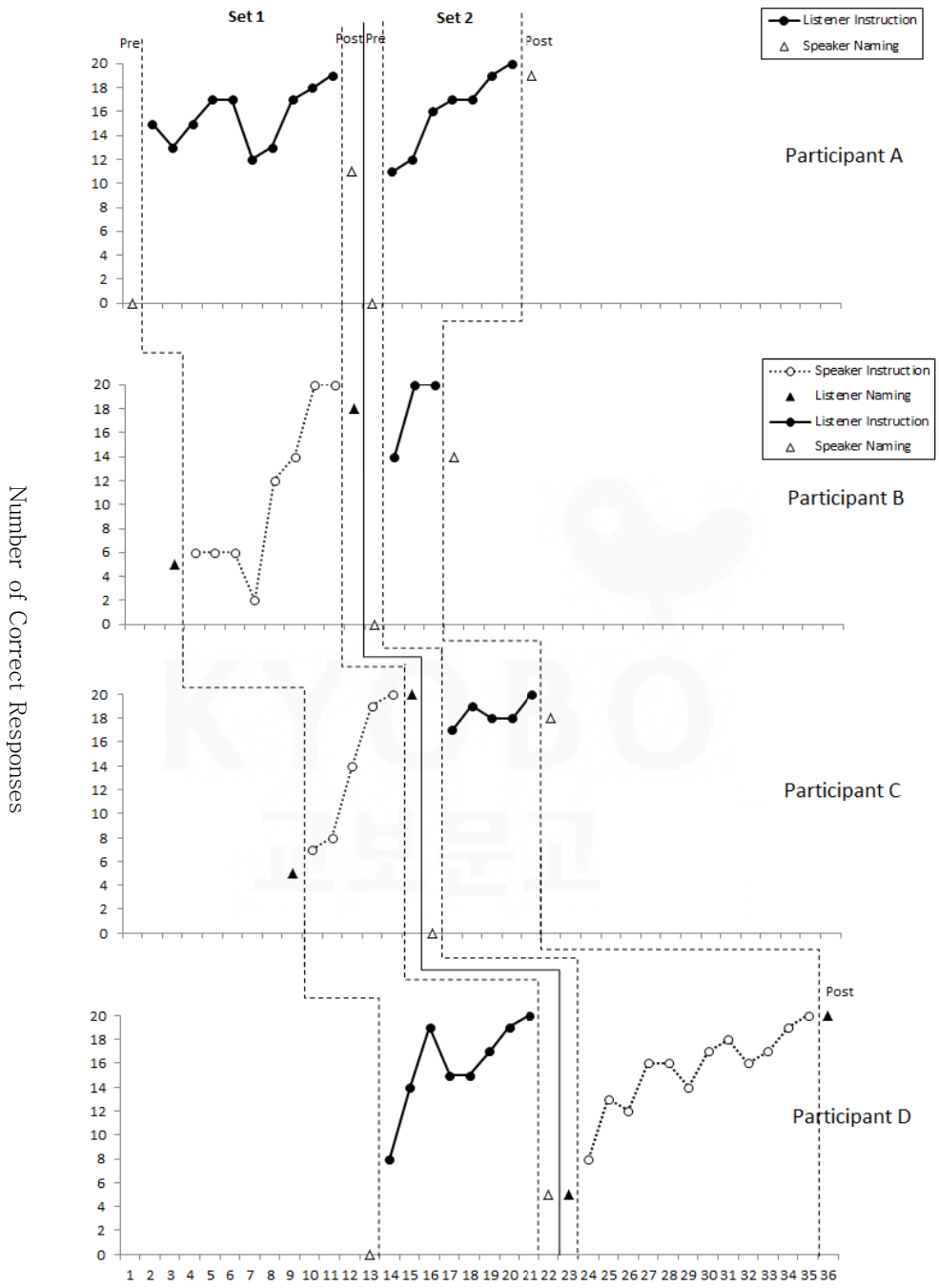
The sequences of instruction and probe phases along with the performance of the participants during the phases are shown in [Figure 1]. Participant A showed 11 correct untaught speaker responses during the post listener-instruction probe session. He failed to demonstrate a clear transformation of function from listener responses to speaker responses as speaker Naming during the probe. Participant A showed 17 correct untaught speaker responses out of 20 probe trials with Set 2.

Participant B and Participant C who received instruction on the speaker responses showed clear listener Naming with Set 1. Participant B showed 18 correct untaught listener responses to the presented stimuli during the post speaker -instruction probe. Participant C showed 20 correct untaught listener responses to the stimuli during the probes. Participant B showed 14 correct untaught speaker responses to the stimuli of Set 2 and Participant C, 17 correct derived speaker responses during post listener-instruction probes with Set 2. Participant D showed 5 correct emergent speaker Naming with the stimuli during the post listener-instruction probes and this failed to show a clear speaker Naming with the printed words. Participant D showed 20 correct listener Naming during the probes with Set 2.

<Table 3> Number of Untaught Responses out of 20 Trials during Probe Sessions

Probe Phase Set	Response Probed	A Pre/Post	B Pre/Post	C Pre/Post	D Pre/Post
Pre-/Post-Instruction Set 1	Listener		5/18	5/20	
	Speaker	0/11			0/5
Pre-/post-Instruction Set 3	Listener				5/20
	Speaker	0/17	0/14	0/17	

Note. Response classes taught and probed were not counterbalanced across sets of stimuli with Participant A.



[Figure 1] Number of Correct Responses during Instruction Sessions and Probe Sessions

Ⅳ. Discussion

In the present study, participants were taught one stimulus-response relations (speaker or listener) to a set of stimuli and tested for derived responses within symmetry relation of stimulus equivalence as Naming. Results of the study indicated inconsistent findings: Participant B and Participant C who received instructions on listener relations failed to show clear emergence of speaker Naming and the participants who received speaker instruction demonstrated a clear emergence of listener Naming. Naming capability considered to be exist when a child incidentally expands his/her language skills by observing stimuli (objects or events) while hearing someone commenting about the stimuli (Feliciano, 2006; Fiorile & Greer, 2007; Gilic & Greer, 2011; Greer & Ross, 2008; Greer & Speckman, 2009; Greer & Longano, 2010; Horne & Lowe, 1996). The results of the present study supported the finding of the previous study. The findings indicated that Sidman's logical stance about the derivational language phenomenon based on stimulus equivalence was not sufficient to explain the inconsistencies among the results of relevant research.

In the experiment of the present study, the simulated natural conditions where incidental learning occurred was provided within discrete-trial formats. For example, observational experiences was provided in which the participant heard the experimenter say names for the stimuli while they learned to respond visually through Match-To-Sample procedure. For Participant A and Participant D, reinforcement histories of responding within auditory-visual relations in abovementioned structured instructional settings didn't induced derived relational responding with symmetry, visual-auditory relations, thus failed to show speaker Naming as transformation of the stimulus function from speaker responses to listener responses. On the contrary, Participant B and Participant B who mastered speaker responding to the same set of stimuli demonstrated the derived symmetry relation. These results imply that auditory comprehension in which a child attends to an item when she/he hears the name of the item likely comes before the child learns oral naming (Sidman, 1994; Lowe, Harris, & Randle, 2002). These data also provided empirical evidences for the suggestion that untaught listener responses might be

evoked for typically developing children once vocal labeling acquired (Greer, Stolfi, Chavez-Brown, & Rivera-Valdes, 2005).

Participant A failed to show a clear speaker Naming, a derived relational responding in symmetry with listener response mastered with instruction with Set 1: He emitted 11 correct responses during the post listener-instruction probe session. However, he showed 19 correct speaker Naming out of 20 probe trials with Set 2. The multiple exemplar experience of symmetry responding across listener and speaker responses which he had with Set 1 might be responsible for the differences in the relational responding with Set 1 and Set 2.

Similarly, comparing the levels of the correct speaker Naming responses emitted by Participant A and Participant D (11 and 5 out of 20 trials respectively) during the first post-instruction probe session with Set 1 and those emitted by Participant B and Participant C during the second post-instruction probes with Set 2 (14 and 17 out of 20 trials respectively), the levels of emergent speaker responding with Set 2 were higher than those with Set 1. Again, this might be explained in terms of multiple exemplar experience within a specific frame of verbal responding. The reinforcement histories of responding within symmetry relations across listener responses (auditory-visual) and speaker responses (visual-auditory) was established during the instruction and probe sessions with Set 1. Once the reinforcement history was established with a specific frame of responding, the participants demonstrated higher level of emergent responding within the symmetry relation (Greer & Speckman, 2009; Greer, Stolfi et al., 2005). These results have implication on possible utilities of multiple exemplar instruction in symmetry as an intervention procedure for inducing Naming in children with ASD. Research has reported effects of multiple exemplar experience on aquisition of different type of relational frames (Barnes-Holmes, Barnes-Holmes, & Cullinan, 2000; Barnes-Homles, Barnes-Holmes, Roche, & Smeets, 2001; Greer, Yuan, & Gautreaux, 2005; Nuzzolo-Gomez & Greer, 2004). A systematic investigation is needed to examine effects of multiple exemplar experience on acquisition of bidirectional responding across listener and speaker responses.

Gilic and Greer (2011) tested emergence of Naming with three-dimensional objects in typically developing children. They found that all nine 3-year olds showed Naming but only two out of 10 2-year olds showed Naming. In Sprinkle and

Miguel's (2012) study, all of four participants aged between 5 to 7 years demonstrated relational responding in symmetry of stimulus equivalence among pictures, printed words for the pictures, and spoken names for the pictures. The 3- to 4-year old children with ASD showed inconsistent findings with 2- dimensional pictures or symbols in the present study. Participant B required 5 sessions of 20 discrete trials in order to master speaker responses to Set 1 and demonstrated a clear derived listener symmetry (20 out of 20 trials). She required 3 sessions for mastering listener responses to Set 2 and emitted 14 correct speaker Naming. She failed to demonstrate transformation of stimulus function from listener to speaker function with one specific stimulus "omega". This might be due to her unknown instructional history with the stimulus. Variables which affect emergence of derived verbal responses such of age levels, required instructional trials with reinforcement opportunities need systematic investigations in the future studies.

One of the limitations of the present study is that data for speaker Naming or listener Naming for each participant were collected with only one set of stimuli and was not sufficient to explain phenomena relevant to derivational verbal responding as Naming. Limited number of participants to examine emergence of listener or speaker Naming is another limitation of the study.

Greer and O'sullivan (2007) found that 48 of 52 first graders were missing Naming for 2-dimensional stimuli at the onset of the first year of school which would affect educational prognosis negatively. Naming is a source for children to acquire language incidentally without direct instruction. Considering that Naming capability emerges around 2- to 3-year old in typically developing children, missing the capability would impact in learning during early stage of their life and later how they learn best at school (Greer, Corwin, & Buttigieg, 2011). Observing visual stimuli hearing what others say and acquiring speaker and listener behaviors to the stimuli is a main component in Naming. In that sense, Naming might be closely tied to observational learning (Greer & Speckman, 2009). Finding out how presence or absence of those two capabilities affects courses of language development of children is needed. There are other questions relevant to the Naming phenomenon to be answered. Are there differences in emergence between Naming 3-dimensional stimulus and 2-dimensional stimulus? Will acquisition of Naming with symbols or pictures be affected by presence of Naming with textual counterparts to the symbols

or pictures or vice versa. Future research to find answers to abovementioned questions is warranted considering that Naming is a major developmental cusps in the trajectories of verbal developments which affects later development of verbal behaviors of the child (Greer & Keohane, 2006; Greer & Longano, 2010; Greer & Ross, 2008; Greer & Longano, 2010) and the presence of Naming affects the way how children develop their language.

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한글요약

자폐성 장애 아동이 보이는 청자 혹은 화자교수와 대칭관계의 파생적 언어행동인 네이밍의 출현과의 관련성

박 혜 숙

본 연구는 자폐성 장애 아동들이 상징/그림과 같은 자극을 가지고 청자 혹은 화자 교수를 받은 후 같은 자극에 대해 교수 받지 않은 화자 혹은 청자 반응을 보이는 지를 점검하였다. 영어권에서 거주하는 4명의 3~4세 사이의 아동이 본 연구에 참가하였다. 사용한 자극은 인쇄된 한국어 자음과 그리스 문자, 그리고 희귀한 바다동물이나 건설 현장에서 쓰이는 도구의 그림카드였다. 본 연구에는 대상자간 지연된 중다 기초선 계획이 사용되었다. 실험 단계에 걸쳐 교수되고 그 능력의 존재 유무가 테스트 된 반응은 두 가지 자극-반응 관계에 기반 하였다. 그 하나는 청각-시각 관계로 청자반응이 이에 해당된다. 나머지 하나는 시각-청각 관계인 화자반응이었다. 청자반응은 실험자가 말한 자극의 이름(청각자극)을 듣고 해당하는 그림카드를 가리키는 형태(시각적 반응)로 정의되었고, 화자 반응은 제시된 그림카드(시각자극)를 보고 그 이름을 말하는 형태(청각적 반응)으로 정의되었다. 대상자 A와 대상자 D는 첫 번째 자극 셋트로 청자반응을 교수 받은 후 직접적인 교수이력이 없는 화자 반응의 출현을 테스트 받았고 대상자 B와 대상자 C에게는 실험 절차가 위 두 아동과 역으로 실시되었다. 그 후 두 번째 자극 셋트로 같은 절차가 반복되었는데, 이 때 교수된 반응과 테스트 시에 목표된 반응이 대상자 안에서 카운터 발란스 되었다. 실험 결과에 의하면 화자 반응을 교수 받은 대상자들은 안정적으로 파생적 청자반응을 보였지만 청자반응을 교수 받은 대상자들은 안정적으로 파생적 화자반응을 보이는데 실패 하였다. 본 실험 결과는 네이밍, 반응등가(stimulus equivalence)의 대칭적 관계 안에서의 파생적 반응과 관련되어 토론되었다.

주제어 : 네이밍, 파생적 언어반응, 반응등가

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