Cumhuriyet International Journal of Education, 12(2): 477-487, 2023
DOI: https://dx.doi.org/10.30703/cije.1221623

Cumhuriyet International Journal of Education

| cije.cumhuriyet.edu.tr | Founded: 2011 Available online, ISSN: 2147-1606 Publisher: Sivas Cumhuriyet Üniversitesi

A Meta-Analysis of Most to Least Prompting Procedure for Individuals with Developmental Disabilities

Metehan Kutlu[1,*]

[1]*Faculty of Education, Van Yuzuncu Yil University, Van, Türkiye*
**Corresponding author*

Research Article

Acknowledgment
I would like to thank Savas Berk for collecting the reliability data of the research.

History
Received: 20/12/2022
Accepted: 05/02/2023

This paper was checked for plagiarism using iThenticate during the preview process and before publication.

ABSTRACT

Most to least prompting (MLP) procedure is one of the teaching interventions used by many practitioners for more than 30 years in educating individuals with developmental disabilities (DD). However, no meta-analysis study has been conducted on MLP. This current study was conducted to identify whether the MLP procedure can be an evidence-based practice for teaching various skills to individuals with DD. Each study was evaluated according to the certainty of evidence (COE) system. This study used descriptive analysis, as well as meta-analysis. Lastly, effect size was analyzed using percentage of non-overlapping data, percentage of data exceeding the mean and Tau-*U*. This study examined a total of 19 studies which used MLP in individuals with DD between 1990 and 2021. Results suggested that MLP was used effectively in teaching communication, safety, academic, self-care, fine motor and leisure skills to individuals with DD from various age. From the results of COE system, the MLP procedure can be considered as evidence based practice for teaching various skills to individuals with DD.

Keywords: Autism, developmental disabilities, meta-analysis, most to least prompting, decreasing assistance

Gelişimsel Yetersizliği Olan Bireylere İşlevsel Becerilerin Öğretiminde İpucunun Giderek Azaltılmasıyla Öğretimin Kullanımına İlişkin Bir Meta-Analiz Çalışması

Bilgi

Süreç
Geliş: 20/12/2022
Kabul: 05/02/2023

Bu çalışma ön inceleme sürecinde ve yayımlanmadan önce iThenticate yazılımı ile taranmıştır.

ÖZ

İpucunun giderek azaltılmasıyla öğretim (İGAÖ) gelişimsel yetersizliği (GY) olan bireylerin eğitiminde 30 yıldan fazla süredir birçok uygulamacı tarafından kullanılan öğretim yöntemlerinden biridir. Ancak bugüne kadar İGAÖ ile ilgili bir meta-analiz çalışması yapılmamıştır. Bu çalışma İGAÖ'nün GY olan bireylere çeşitli becerilerin öğretiminde bilimsel dayanaklı bir uygulama olarak kabul edilip edilemeyeceğini belirlemek için yapılmıştır. Bunu belirleyebilmek için bu çalışmada: (a) bilimsel kesinlik sistemi kullanılmış, (b) betimsel analiz yapılmış, (c) örtüşmeyen veri yüzdesi, ortancayı aşan veri yüzdesi ve Tau-*U* yaklaşımları kullanılmıştır. Bu çalışmada 1990-2021 yılları arasında GY olan bireylere çeşitli becerilerin öğretiminde İGAÖ'nün kullanıldığı toplam 19 çalışma incelenmiştir. Bu meta-analiz çalışmasının bulguları İGAÖ'nün çeşitli yaş gruplarındaki GY olan bireylere iletişim, güvenlik, akademik, öz bakım, küçük kas ve boş zaman değerlendirme becerilerinin öğretiminde etkili bir şekilde kullanılabildiğini göstermektedir. Bu araştırmada yapılan bilimsel kesinlik sistemi ölçütlerine dayalı olarak İGAÖ'nün bilimsel dayanaklı bir uygulama olduğu söylenebilir.

Anahtar Kelimeler: Otizm, gelişimsel yetersizlik, meta-analiz, ipucunun giderek azaltılmasıyla öğretim, yetersizlik

[a] *metkutlu@gmail.com* *https://orcid.org/0000-0003-4468-6094*

How to Cite: Kutlu, M. (2023). A meta-analysis of most to least prompting procedure for individuals with developmental disabilities. *Cumhuriyet International Journal of Education*, *12*(2):477-487

Introduction

Effective and efficient teaching interventions are developed by researchers to be used in teaching various functional skills to individuals with developmental disabilities (DD), and these teaching methods are applied by special education teachers, specialists, and parents in school, home, and different social environments (Storey & Miner, 2011). Functional skills such as self-care skills, communication skills, and academic skills help individuals with DD integrate with their peers and live fully or partially independently in social environments (Benz et al., 2000). One of the interventions used in teaching functional skills to individuals with DD is most to least prompting (MLP).

MLP is defined as eliminating the prompt over time by starting the teaching with the highest level of prompt that enables the individual to respond correctly (Alberto & Troutman, 1995; Billingsley & Romer, 1983; Tekin-Iftar & Kırcaali-Iftar, 2013). For example, the practitioner puts his hands on the individual's hands to guide the individual through the primary intervention sessions. A less intrusive prompt, such as guiding the student at the wrist, is used in subsequent training attempts (Libby et al., 2008).

The recommended steps for the effective implementation of the MLP procedure are as follows: (Tekin-Iftar & Kırcaali-Iftar, 2013; Wolery et al., 1992) (a) determining and defining the target behavior, (b) determining the stimulus to be given for the individual to react, (c) determining the number of prompt levels to be included in the prompt hierarchy, (d) determining the prompt types to be included in the prompt hierarchy, (e) ordering the prompt types from those requiring more control over the individual's behavior to those requiring less control, (f) the response interval time, (g) determining the criterion for transitioning to the prompt that requires less control over the individual behavior, (h) determining the necessary evaluation plan to determine the individual's performance in the teaching sessions where the prompt requiring less control over the individual behavior is presented, (i) determining how the individual will respond to his/her reactions, and (j) determining and applying the data recording method, record keeping and d when necessary based on the individual's performance listed as making changes.

MLP procedure is used effectively in teaching safety skills (Batu et al., 2004), academic skills (Davenport & Johnston, 2015), fine/gross motor movements (Cengher et al., 2016), self-care skills (e.g., Cetrez-Iscan et al., 2016), communication skills (e.g., Lerman et al., 2004), expressive/receptive skills (e.g., Leaf et al., 2016b) and leisure skills (e.g., Jerome et al., 2007) to individuals with DD.

Although different researchers have studied the MLP procedure for more than 30 years for its effectiveness in different environments, no meta-analysis study has been found in the literature to date. In a literature study conducted only on prompt-fading procedures, the findings of some comparison studies conducted with MLP were reported descriptively (Cengher et al., 2018). The review study compared the effectiveness and efficiency findings between MLP and other response prompting procedures (e.g., no-no prompting). They reported that the MLP procedure improved communication skills (Reichle et al., 2005), self-care skills (Aykut, 2012), play skills (Libby et al., 2008) and various functional skills (e.g., banking skills) for individuals with DD (McDonnell & Ferguson, 1989). They also reported that the MLP procedure more efficient than stimulus fading and least to most prompting procedure in two studies (McDonnell & Ferguson, 1989; Strand & Morris, 1986).

This current study extended Cengher et al.'s (2018) study in two ways. First, this study included efficacy studies and published comparative studies on MLP. Second, this meta-analysis study was the first to calculate effect sizes for MLP.

This current meta-analysis study was conducted to identify whether the MLP procedure can be an evidence-based practice for teaching various skills (e.g., self-care skills) to individuals with DD. Each study was evaluated according to the certainty of evidence (COE) system (Lang et al., 2011; Schlosser & Sigafoos, 2007; Smith, 1981; Simeonsson & Bailey, 1991). The current study also used descriptive analysis. Lastly, effect size was analyzed using percentage of non-overlapping data (PND), percentage of data exceeding the mean (PEM) and Tau-*U*.

Method

Search Procedures

The searches were conducted using the Academic Search Complete, PsycINFO, Google Scholar, Educational Resources Information Center (ERIC), Education Full Text (EBSCO), JSTOR, Primary Search, and Web of Science databases. The following keywords were used to search for relevant studies: "decreasing assistance," "decreasing prompt," and "most to least prompting."

Inclusion and Exclusion Criteria

Inclusionary criteria of the identified articles included the following: (1) published in a peer-reviewed journal between 1990-2021, (2) used a single-subject design, (3) diagnosed with DD (e.g., autism), (4) if the MLP procedure has been included in an instructional package, should be specified separately on the graph. As a result, 31 studies met the established criteria. Some of these studies were excluded for the following reasons: (a) if the baseline was not shown in the graph, (b) display of data in table rather than graph. As a result, 19 articles were included in this study.

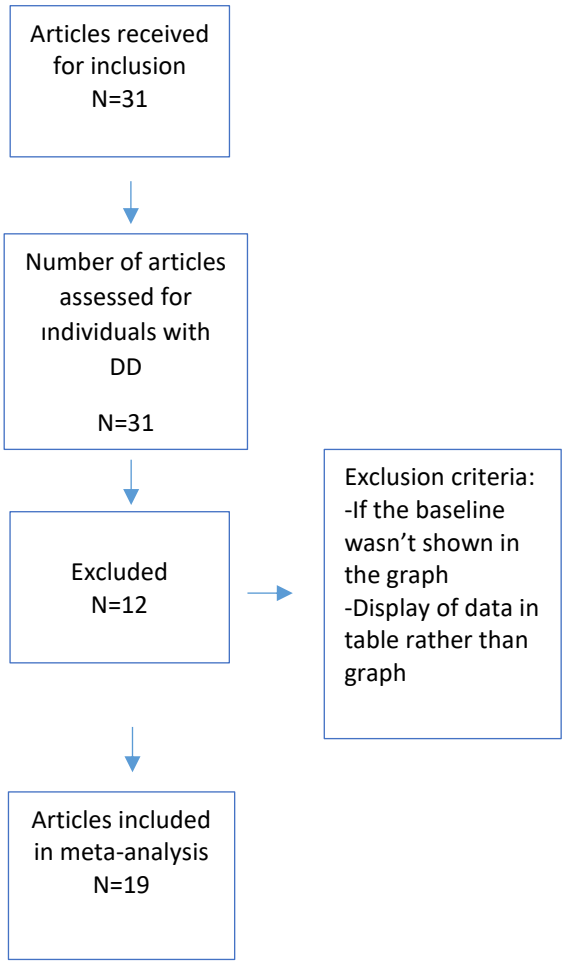

Figure 1. Flow diagram for study selection

Variables Coded

Each study was summarized in terms of the following variables: (a) reference, (b) participant characteristics (age, gender, diagnosis), (c) research design, (d) dependent variable, (e) intervention setting and teaching format, (f) implementer (e.g., researcher), (g) reliability data, (h) generalization and maintenance, (i) social validity, (j) COE.

COE

The COE for each study was classified as ''suggestive'', ''preponderance'', or ''conclusive'' (Lang et al., 2011; Ramdoss et al., 2011; Roth et al., 2014; Simeonsson & Bailey, 1991; Smith, 1981; Wiseman et al., 2017). This classification was conducted to provide information on the evidence certainty of studies (Lang et al., 2011; Schlosser & Sigafoos, 2007). The criteria for the suggestive category included a nonexperimental design (e.g., AB design), no or inadequate treatment fidelity and/or interobserver agreement (less than 20% of observations and/or less than 80% fidelity/agreement), or insufficient information to enable replication (Roth et al., 2014). The second level of certainty was classified as preponderance of evidence. Studies in this classification had four characteristics: (1) experimental designs, (2) adequate inter-observer agreement and treatment fidelity, (3) operationally defined dependent variables, and (4) enough detail to enable replication. However, studies classified at the preponderance level also had substantial limitation(s) in controls against alternative explanations for intervention outcomes (Lang et al., 2011). The third category of certainty was classified as conclusive evidence. Within this category, studies included all of the qualities of the preponderance category but without the considerable limitations previously referred.

Effect Size Calculation

PND, PEM and Tau-*U* scores were calculated to determine the effect size for all studies included in this study (Table 3). PND is the numerical determination of the visual difference between the baseline and intervention phase (Mastropieri & Scruggs, 1985-1986; Scruggs & Mastropieri, 2001). PND score ranges are interpreted as follows: at or above 90% as "highly effective," between 70% and 90% as "moderate (or fair) effective," between 50% and 70% as "mild or questionable effect" and below 50% as "ineffective treatment" (Scruggs & Mastropieri, 2001).

One of the approaches used to determine the effectiveness of the MLP procedure is PND. However, PND approach has some limitations: (a) it may not be sufficient to results accurately, (b) does not take into account changes during visual analysis, (c) controversy continues regarding the reliability of PND (Allison & Gorman, 1993; Test et al., 2011).

To overcome these limitations, Ma (2006) suggested PEM approach. PEM is a method calculated by drawing a line parallel to the horizontal axis from the median point in the baseline to the intervention phase. Then, the percentage of those above this line for the behaviors to be increased and below this line for the behaviors to be reduced are determined (Ma, 2006). PEM scores at or above 90% as "highly effective," between 70% and 90% as "moderately effective," and less than 70% as "questionable effect or not effective treatment". Another effect size measurement used in this meta-analysis study was Tau-*U*. Effect sizes can be interpreted according to the following range of Tau-*U* scores: weak or small effect: 0%–65%; medium to high effect: 66%–92%; large or strong effects: 93%–100% (Parker et al., 2011).

Reliability

We conducted three reliability analyses in the study that included (a) COE, (b) descriptive analysis, (c) PND, PEM and Tau-*U* calculation. All findings in the articles were recorded in a coding key by the author and research assistant. Later, the researchers came together and compared their coding. Reliability analysis by the first author and research assistant included 32% (n=6) of the articles. We used a point-by-point method, dividing the number of agreements by the number of agreements plus the number of disagreements and multiplying by 100

(Kazdin, 1982). Inter-rater reliability was 100% for 6 articles.

Results

Table 1 summarizes the following: (a) reference, (b) participant characteristics (age, gender, diagnosis), (c) research design, (d) dependent variable, (e) intervention setting and teaching format, (f) implementer (e.g., researcher), (g) reliability data, (h) generalization and maintenance, (i) social validity, (j) COE.

Participant Characteristics

The examined studies included a total of 60 participants, 63% (n = 38) were male, 27% (n=16) were female, and 10% (n = 6) were not reported. The age ranges of the participants in the studies varied: 43% (n = 26) were between the ages of 0 and 6, 35% (n = 21) were between the ages of 7 and 17, 17% (n = 10) were between the ages of 18 – 35, and 5% (n = 3) were between the ages of 36 and 55. In studies examining the effect of MLP, most participants were diagnosed with autism (68%) (e.g., Reichle et al., 2008). In addition, some studies included individuals diagnosed with intellectual disabilities (27%) (e.g., Batu, 2004). One study included individuals diagnosed with developmental delay (5%). (Davenport & Johnston, 2015).

Research Designs

Multiple probe design 37% (n=7), multiple baseline design 32% (n=6), adaptive alternating treatments design 21% (n=4), parallel treatments design 5% (n=1), and alternating treatments design 5% (n=1) were used in the studies on MLP. Among the multiple probe models used in the studies, five were conducted across participants (e.g., Batu et al., 2004), while two of them were multiple probe designs conducted across behaviors (e.g., Vuran, 2008). All of the studies that utilized the multiple baseline design employed the multiple baseline design across participants (e.g., Jerome et al., 2007).

Targeted Behaviors

In the study, the following percentages were determined as target behaviors: communication 43% (n=8) (e.g., Reichle et al., 2005), self-care 21% (n=4) (e.g., Ozen et al., 2002), leisure 21% (n=4) (e.g., Kurt & Cuhadar, 2018), safety 5% (n=1) (Batu et al., 2004), academic 5% (n=1) (Davenport & Johnston, 2015), and fine motor skills 5% (n=1) (Cengher et al., 2016).

Follow-up and Generalization

Maintenance data was collected in 84% (n=16) of the studies (e.g., Fentress & Lerman, 2012), 16% (n=3) were not reported. The researchers reported that the participants were able to exhibit the target behaviors they learned during the follow-up phase. In addition, the participants were able to generalize their acquired skills to different environments, people, or materials.

Social Validity

Social validity data were collected in 37% (n=7) of the studies. In the studies where social validity data were collected, the data were obtained from the parents or teachers of the participants. In two studies, social validity data were collected from both parents and teachers of the participants (Kurt & Cuhadar, 2018; Vuran, 2008).

COE

Five studies were classified at the suggestive level of evidence, one at the preponderance level, and 13 at the conclusive level. It is important to note that a significant number of studies were placed in the conclusive category due to their implementation of an experimental design (e.g., multiple baseline design), ensuring sufficient procedural reliability and interobserver agreement. These studies also provided a functional description of dependent variables and included enough detail for replication. The classifications according to the Criteria of Evidence (COE) are presented in Table 2.

Settings and Teaching Format

In all the studies, probe and intervention sessions were conducted at various locations, including schools, private centers, universities, research centers, homes, and institutions. When examining the studies based on settings, 37% (n = 7) were conducted at schools (e.g., Lerman et al., 2004), 26% (n = 5) at private centers (e.g., Leaf et al., 2016a), 10% (n = 2) at universities (Kurt & Cuhadar, 2018; Yilmaz et al., 2010), 10% (n = 2) at institutions (Cetrez-Iscan et al., Ozen et al., 2002), 10% (n = 2) at homes (Reichle et al., 2005; 2008), and 4% (n = 1) at research centers (Nepo et al., 2017).

In all of the studies, intervention sessions were conducted using one-on-one teaching. In 69% (n = 13) of the studies, teaching was carried out by researchers (e.g., Jerome et al., 2007), 16% (n = 3) by teachers (e.g., Cetrez-Iscan et al., 2016), 5% (n = 1) by a therapist (Fentress & Lerman, 2012), 5% (n = 1) by an interventionist (Reichle et al., 2005), and 5% (n = 1) by a therapist and paraprofessional (Reichle et al., 2008).

Table 1. Summary of studies using MLP procedure

Author (s)	Participants:Age, gender, label	Setting/Teaching format	Instructor	Skills	Design	Follow-up/ Generalization/ Social Validity
Aykut & Varol (2010)	12-13; 2M; ID	School; 1:1	R	Self-care	AAT	Y/Y/Y
Aykut (2012)	13-14; 2M; ID	School; 1:1	R	Self-care	AAT	Y/Y/Y
Batu et al., (2004)	7-15; 5M; ID	School; 1:1	R	Safety	MP	Y/Y/Y
Cengher et al., (2016)	5; 3E; A	School; 1:1	R	Fine motor	AAT	Y/N/N
Cetrez-Iscan et al., (2016)	8-11; 3M; A	Institution; 1:1	T	Self-care	MP	N/Y/N
Davenport & Johnston (2015)	4-5; 2F, 1M; DD	School; 1:1	R	Academic	MP	Y/Y/Y
Fentress & Lerman (2012)	5-7; 3M, 1F; A	School; 1:1	Th	Communication	AAT	Y/N/N
Jerome et al., (2007)	25-32; 3M; A	Private; 1:1	R	Leisure	MB	Y/Y/N
Kurt & Cuhadar (2018)	34-37; 4F; ID	University; 1:1	R	Leisure	MB	Y/Y/Y
Leaf et al., (2014)	3-5; 2M; A	Private; 1:1	R	Communication	AT	Y/N/N
Leaf et al., (2016a)	6-7; 3M, 1F; A	Private; 1:1	R	Communication	PT	Y/N/N
Leaf et al., (2016b)	4-9; 4M, 2F; A	Private; 1:1	R	Communication	MB	Y/N/N
Lerman et al., (2004)	3-6; 6 children; A	School; 1:1	T	Communication	MB	Y/Y/N
Nepo et al., (2017)	31-44; 2M-1F; A	Research center; 1:1	R	Communication	MB	N/Y/N
Ozen et al., (2002)	4-7; 2F, 1M; ID	Research institute; 1:1	R	Self-care	MP	Y/N/N
Reichle et al., (2005)	40; 1M; A	Home; 1:1	I	Communication	MP	N/N/N
Reichle et al., (2008)	5; 1M; A	Home; 1:1	Th	Communication	MP	Y/Y/Y
Vuran (2008)	21-23; 2M; A	Private; 1:1	T	Leisure	MP	Y/N/Y
Yilmaz et al., (2010)	9; 3M; autism	University; 1:1	R	Leisure	MB	Y/Y/N

Note. ID=intellectual disability; A=autism; M= male; F= female; MB=multiple baseline; MP=multiple probe; R=researcher; AAT=adapted alternating treatments; AT=alternating treatments; PT=parallel treatments; Th=therapist; T=teacher; Interventionist=I; Y=yes; N=no

Table 2. Summary of COE

Author (s)	Baseline stability and number of points	Adequate details presented for replication (description of procedure and design)	Reliability (IOA/TI)	Dependent variable functionally defined	Category of certainty
Aykut & Varol, (2010)	S	Y	Only TI	Y	Suggestive (no data on IOA
Aykut, (2012)	S	Y	Y	Y	Suggestive (AATD)
Batu et al., (2004)	S	Y	Y	Y	Conclusive
Cengher et al., (2016)	S for P2 and P3, some variable for P1	Y	Y	Y	Suggestive (AATD)
Cetrez-Iscan et al., (2016)	S	Y	Y	Y	Conclusive
Davenport & Johnston, (2015)	S	Y	Y	Y	Conclusive
Fentress & Lerman, (2012)	S	Y	Only IOA	Y	Suggestive (no data on TF)
Jerome et al., (2007)	S	Y	Only IOA	Y	Suggestive (no data on TF)
Kurt & Cuhadar, (2018)	S	Y	Y	Y	Conclusive
Leaf et al. (2014)	S	Y	Y	Y	Conclusive
Leaf et al., (2016a)	S	Y	Y	Y	Conclusive
Leaf et al., (2016b)	S	Y	Y	Y	Conclusive
Lerman et al., (2004)	S for P1 and P3, Variable for P2, P4 and P5	Y	Y	Y	Preponderance (variable baseline)
Nepo et al., (2017)	S	Y	Y	Y	Conclusive
Ozen et al., (2002)	S	Y	Y	Y	Conclusive
Reichle et al., (2005)	S	Y	Y	Y	Conclusive
Reichle et al., (2008)	S	Y	Y	Y	Conclusive
Vuran, (2008)	S	Y	Y	Y	Conclusive
Yılmaz et al., (2010)	S	Y	Y	Y	Conclusive

Note. IOA= inter-observer agreement; TI= treatment integrity; P= participant; AATD= adapted alternating treatments design; Y= yes; S= stable

Table 3. PND, PEM and Tau-*U* Calculations for MLP

Study	Intervention		
	PND	PEM	Tau-*U*
Aykut & Varol (2010)	67.5%	75%	52.80%
Aykut (2012)	81.5%	81.5%	81.70%
Batu et al., (2004)	92.7%	91.1%	92.17%
Cengher et al., (2016)	90.1%	90.1%	85.0 %
Cetrez-Iscan et al., (2016)	90.0%	100%	95.0%
Davenport & Johnston (2015)	97.0%	98.3%	99.0%
Fentress & Lerman (2012)	68,25%	72%	71%
Jerome et al., (2007)	97%	100%	97%
Kurt & Cuhadar (2018)	98,6%	100%	99%
Leaf et al., (2014)	84%	84%	84%
Leaf et al., (2016a)	97%	97%	93%
Leaf et al., (2016b)	78%	93%	82%
Lerman et al., (2004)	100%	100%	100%
Nepo et al., (2017)	100%	100%	100%
Ozen et al., (2002)	83%	87%	81%
Reichle et al., (2005)	76%	76%	81%
Reichle et al., (2008)	89%	89%	69%
Vuran (2008)	81%	100%	83%
Yilmaz et al., (2010)	100%	100%	100%

Effects of MLP Procedure

For this meta-analysis study, the effects of the MLP procedure were determined using PND, PEM, and Tau-*U*. Table 3 shows the PND, PEM and Tau-*U* scores calculated across the 19 studies. PND scores suggested that the MLP procedure was "very effective" in nine studies (e.g., Batu et al., 2004), "fair effective" in eight studies (e.g., Leaf et al., 2014) and "questionable" in two studies. PEM scores suggested that the MLP procedure was "highly effective" in 12 studies (e.g., Batu et al., 2004), "moderately effective in seven studies (e.g., Aykut & Varol, 2010). Tau-*U* scores suggested that the MLP procedure had a "strong effect" in eight studies (e.g., Davenport & Johnson), "medium to high effect" in 10 studies (e.g., Ozen et al., 2002) and "small or weak effect" in one study (Aykut & Varol, 2010).

Discussion

This meta-analysis study included 19 studies using MLP. The COE system used in this research showed that MLP procedure was an evidence-based practice in teaching various skills to individuals with DD. In addition, a meta-analysis using PND found that MLP was generally "very effective" or "effective", a meta-analysis using PEM found MLP to be "highly effective" or "moderately effective" and a meta-analysis using Tau-*U* showed that MLP generally had a "strong effect" or "medium to high effect". The average PND score obtained from all studies was 87.9%, the average PEM score obtained from all studies was 91.2% and the average Tau-*U* score obtained from all studies was 86.6%. Based on these results, it can be said that MLP is an effective intervention. As a result of the descriptive analysis of this research, the reseaercher believes that it is important to discuss some issues related to research and practice.

Participant Characteristics

Almost all of the participants in the studies were primary school children and adults. Further studies can be planned to determine the effectiveness of MLP in individuals in the secondary school age range (14 years and above) in teaching various skills. The disability types of the participants in the studies indicated that the studies worked with individuals with ASD or ID (e.g., Cengher et al., 2016). In order to generalize the findings about MLP to a larger sample group, research can be planned to test the effects of MLP in teaching various skills to other individuals with DD (e.g., learning disabilities). The results obtained in the study in terms of the instructors

highlighted that the people who provided education were teachers, therapists or researchers. Further research can be conducted on teaching the use of MLP with parents/siblings and peers and testing its effectiveness in terms of use by these people.

Target behaviors

Communication skills, self-care skills, and leisure skills (84%) (n=16) stood out among the skills aimed to be taught to the participants in the studies. Research findings showed that participants with ID or ASD can learn target skills. Therefore, practitioners may be advised to use MLP to help individuals with ID or ASD acquire communication, self-care, or leisure skills.

Settings

The evaluations made about the settings in which the examined researches were conducted indicated that the research settings were home, school, research institute, private center and university. In general, individuals with DD showed inability to generalize and maintain the skills they learned to other situations (person, material, setting). It is important to teach target behaviors in social environments in order to provide generalization. In studies, practitioners worked with participants in structured rather than social environments. It can be considered that conducting studies that test the effectiveness of MLP in social environments in future studies have critical importance.

Research Designs

Multiple baseline and multiple probe designs were used in 69% (n = 13) of the studies. In all of these designs used, across-behaviors or across participants were preferred. The findings showed that these designs were predominantly preferred in studies where MLP was effective. The reason for preference can be listed as that experimental control can be established strongly in these designs and allows teaching for multiple situations. However, testing effectiveness with different research designs and methodologies may also be significant.

Generalization/Follow-up/Social Validity

Generalization data were collected in 58% (n = 11) of the studies on MLP, and it was not collected or reported in 42% (n = 8). The fact that generalization data were not collected or reported in a significant part of the studies conducted with MLP constituted a limitation for these studies. Follow-up data were collected in 84% (n = 16) of the studies. The fact that participants maintained the behaviors they learned in the follow-up sessions is vital to research with MLP. The collection of social validity data in only 37% (n = 7) of the studies underlined an important limitation of the studies on this subject. When the social validity findings were examined, in many studies, the participants' parents stated a high level of satisfaction with the research's aims, process, and application results. However, in all studies, social validity data were collected after implementation. Social validity is generally considered a result that emerges after research or application. However, there are also opinions in the literature stating that it is the right approach to consider social validity as a process rather than a result (Foster & Mash, 1999). In line with this view, it can be suggested to researchers that social validity data should be collected in future studies before the application starts, while the application is in progress, and after the application, in short, throughout the whole process. In all of the studies examined, social validity data were obtained from the first-degree relatives of the participants. However, it is not wrong to say that those around the individual who is not directly involved in the research may also be affected by the study process or its results. These people may be the parents, classroom teachers, school administrators, caregivers, or siblings of other students at the school where the participants attend. From this point of view, the researcher suggests for future research to collect data from the researcher's first-degree relatives of the participants in the study, as well as from other people who may be related to the study.

Limitations

First, this meta-analysis is limited to studies involving individuals with DD. Further research can also include studies examining the effects of MLP on teaching various skills to individuals with special needs other than DD. Secondly, the effect size calculation methods used in this study are limited to PND, PEM and Tau-*U*. In further studies, the use of other methods (e.g., percentage of all non-overlapping data) can be included in the calculation of the effect size of MLP.

Conclusion

This meta-analysis study included 19 studies in which MLP was used in teaching various skills to individuals with DD between 1990-2021. Single-subject research designs were used in all studies included in this meta-analysis study. Results suggested that MLP was used effectively in teaching communication, safety, academic, self-care, fine motor and leisure skills to individuals with DD from various age. From the results of COE system, the MLP procedure can be considered as evidence based practice for teaching various skills to individuals with DD.

Genişletilmiş Özet

Giriş

İpucunun giderek azaltılmasıyla öğretim (İGAÖ) bireyin doğru tepkide bulunmasını sağlayan en yüksek düzeyde ipucu sunulmasıyla öğretime başlanarak, zamanla ipucunun ortadan kaldırılması olarak tanımlanır (Alberto & Troutman, 1995; Billingsley & Romer, 1983; Tekin-Iftar & Kırcaali-Iftar, 2013). Örneğin, uygulamacı ilk öğretim oturumlarında ellerini bireyin ellerinin üzerine koyarak tam fiziksel ipucu kullanır. Sonraki öğretim oturumlarında öğrencinin bileğinden tutarak yardım sağlar ve daha az kontrol edici bir ipucu kullanılır (Libby et al., 2008). Bu şekilde uygulamacı ipucunun azaltmış olur.

Bu meta-analiz çalışması, İGAÖ 'ın gelişimsel yetersizliği (GY) olan bireylere çeşitli becerilerin öğretilmesinde bilimsel dayanaklı bir uygulama olup olamayacağını belirlemek için yapılmıştır. Bunu belirleyebilmek için bu çalışmada: (a) bilimsel kesinlik sistemi kullanılmış, (b) İGAÖ kullanılarak yapılan çalışmaların betimsel analizi gerçekleştirilmiş ve son olarak, (c) örtüşmeyen veri yüzdesi, ortancayı aşan veri yüzdesi ve Tau-*U* yaklaşımları kullanılmıştır. Bu çalışmada 1990-2021 yılları arasında GY olan bireylerde İGAÖ'nün kullanıldığı toplam 19 çalışma incelenmiştir.

Yöntem

Bu çalışmada incelenen çalışmalara ilişkin betimsel analiz ve meta-analiz yapılmıştır. Bu araştırmaya dahil edilen araştırmalara ulaşmak için Academic Search Complete, PsycINFO, Google Scholar, Educational Resources Information Center (ERIC), Education Full Text (EBSCO), JSTOR, Primary Search and Web of Science veritabanları taranmıştır. Elektronik ortamda gelişmiş arama için "decreasing assistance", "decreasing prompt", "Most to least prompting" anahtar sözcükleri kullanılmıştır.

Dahil Etme ve Hariç Tutma Ölçütleri

Araştırmaların bu meta-analiz çalışmasına dahil edilebilmesi için belirlenen ölçütler şu şekildedir: (a) araştırmanın 1990-2021 yılları arasında hakemli bir dergide yayımlanmış olması (b) çalışmada tek denekli bir araştırma modeli kullanılmış olması, (c) katılımcıların GY tanısı almış olması (otizm, v.b.), (d) İGAÖ bir öğretim paketine dahil edilmişse, grafikte ayrıca belirtilmiş olması gerekmektedir. Sonuç olarak, 31 çalışma belirlenen kriterleri karşılamıştır. Bu çalışmalardan bazıları aşağıdaki nedenlerden dolayı hariç tutulmuştur: (a) başlama düzeyi oturumları grafikte gösterilmiyorsa, (b) araştırma vaka çalışması olarak tanımlanmışsa. Sonuç olarak 19 araştırma bu çalışmaya dahil edilmiştir.

Kodlanmış Değişkenler

Her çalışma çeşitli değişkenler açısından değerlendirilmiştir: (a) kaynakça, (b) katılımcı özellikleri (yaş, cinsiyet, tanı), (c) araştırma modeli, (d) bağımlı değişken, (e) ortam ve öğretim formatı, (f) uygulayıcı (örneğin, araştırmacı), (g) güvenilirlik verileri, (h) genelleme ve izleme, (i) sosyal geçerlik, (j) bilimsel kesinlik sistemi.

Etki Büyüklüğü Hesaplaması

Bu çalışmaya dahil edilen tüm çalışmalar için PND, PEM ve Tau-*U* etki büyüklüğü hesaplamaları yapılmıştır (Table 3).

Bulgular

Bu araştırmada hesaplanan etki büyüklüğü hesaplamalarından PND'nin ortalama değeri %87.9 bulunmuştur ve İGAÖ, PND sonuçlarına göre artırılmak istenen davranışlarda orta düzeyde etkilidir. PEM'nin ortalama değeri %91.2 bulunmuştur ve İGAÖ, PEM sonuçlarına göre artırılmak istenen davranışlarda çok etkilidir. Tau-*U*'nun ortlama değeri %86.6 bulunmuştur ve İGAÖ artırılmak istenen davranışlarda Tau-*U* sonuçlarına göre orta ile yüksek düzeyde etkilidir.

Tartışma

Bu meta-analiz çalışmasına GY olan bireylere çeşitli becerilerin öğretiminde İGAÖ'nün uygulandığı 19 çalışma dahil edilmiştir. Bu araştırmada yapılan bilimsel kesinlik sistemi ölçütlerine dayalı olarak İGAÖ'nün bilimsel dayanaklı bir uygulama olduğu söylenebilir. Bu araştırmanın betimsel analizi sonucunda araştırma ve uygulama ile ilgili bazı konuların tartışılmasının önemli olduğu düşünülmektedir.

Sınırlılıklar

Bu araştırma GY olan bireyleri içeren çalışmalarla sınırlıdır. İleri araştırmalarda, İGAÖ'nün GY dışında özel gereksinimli olan bireylere çeşitli becerilerin öğretilmesi üzerindeki etkilerini inceleyen çalışmalar planlanabilir. İkinci olarak, bu çalışmada kullanılan etki büyüklüğü hesaplama yöntemleri PND, PEM ve Tau-*U* ile sınırlıdır. İleri çalışmalarda, İGAÖ'nün etki büyüklüğünün hesaplanmasında diğer yöntemlerin kullanımına yer verilebilir (örneğin, örtüşmeyen tüm veri yüzdesi).

Araştırmanın Etik Taahhüt Metni

Yapılan bu çalışmada bilimsel, etik ve alıntı kurallarına uyulduğu; toplanan veriler üzerinde herhangi bir tahrifatın yapılmadığı, karşılaşılacak tüm etik ihlallerde "Cumhuriyet Uluslararası Eğitim Dergisi ve Editörünün" hiçbir sorumluluğunun olmadığı, tüm sorumluluğun sorumlu yazara ait olduğu ve bu çalışmanın herhangi başka bir akademik yayın ortamına değerlendirme için gönderilmemiş olduğu sorumlu yazar tarafından taahhüt edilmiştir.

References

Alberto, A. A., & Troutman, A. C. (1995). *Applied behavior analysis for teachers*. Prenctice Hall.

Allison, D. B., & Gorman, B. S. (1993). Calculating effect sizes for meta-analysis: The case of the single case. *Behaviour Research and Therapy, 31*(6), 621–631. https://doi.org/10.1016/0005-7967(93)90115-B

Aykut, C., & Varol, N. (2010). Zihinsel yetersizlikten etkilenmis ogrencilere günlük yasam becerilerinin kazandirilmasinda sabit bekleme sureli ve ipucunun sistematik olarak geri cekilmesi islem sureci ile yapilan ogretimin etkililik ve verimliliklerinin karsilastirilmasi [Comparison of effectiveness and efficiency of constant-time delay and most to least prompts in teaching of daily living skills for children with mental retardation]. *Turk Egitim Bilimleri Dergisi* [Turkish Journal of Educational Sciences]*, 8*(1) , 227-261.

Aykut, C. (2012). Effectiveness and efficiency of constant-time delay and most-to-least prompt procedures in teaching daily living skills to children with intellectual disabilities. *Educational Sciences: Theory and Practice, 12*(1), 366–373.

Batu, S., Ergenekon, Y., Erbas, D., & Akmanoglu, N. (2004). Teaching pedestrian skills to individuals with developmental disabilities. *Journal of Behavioral Education, 13*(3), 147-164. https://doi.org/10.1023/B:JOBE.0000037626.13530.96

Benz, M. R., Lindstrom, L. E., & Yanvanoff, P. (2000). Improving graduation and employment outcomes of students with disabilities: *Predictive factors and student perspectives. Exceptional Children, 66*(4), 509–529. https://doi.org/10.1177/001440290006600405

Billingsley, F. F., & Romer, L. T. (1983). Response prompting and the transfer of stimulus control: Methods, research, and a conceptual framework. *Journal of the Association for the Severely Handicapped, 8*(2), 3–12. https://doi.org/10.1177/154079698300800201

Cengher, M., Shamoun, K., Moss, P., Roll, D., Feliciano, G., & Fienup, D. M. (2016). A comparison of the effects of two prompt-fading strategies on skill acquisition in children with autism spectrum disorders. *Behavior Analysis in Practice, 9*(2), 115–125. https://doi.org/10.1007/s40617-015-0096-6

Cengher, M., Budd, A.F., Farrell, N.C., & Fienup, D.M. (2018). A review of prompt-fading procedures: Implications for effective and efficient skill acquisition. *Journal of Developmental and Physical Disabilities, 30,* 155-173. https://doi.org/10.1007/s10882-017-9575-8

Cetrez-Iscan, G., Nurcin, E., & Fazlioglu, Y. (2016). Effect of most-to-least prompting procedure on dressing skill of students with autism. *Educational Research Review, 11,* 1766-1774.

Davenport, L. A., & Johnston, S. S. (2015). Using most-to-least prompting and contingent consequences to teach numeracy in ınclusive early childhood classrooms. *Topics in Early Childhood Special Education, 34*(4), 250–261. https://doi.org/10.1177/0271121413518824

Fentress, G. M., & Lerman, D. C. (2012). A comparison of two prompting procedures for teaching basic skills to children with autism. *Research in Autism Spectrum Disorders, 6*(3), 1083–1090. https://doi.org/10.1016/j.rasd.2012.02.006

Foster, S. L., & Mash, E. J. (1999). Assessing social validity in clinical treatment research issues and procedures. *Journal of Consulting and Clinical Psychology, 67*(3), 308-319.https://doi.org/10.1037//0022006x.67.3.308

Jerome, J., Frantino, E. P., & Sturmey, P. (2007). The effects of errorless learning and backward chaining on the acquisition of Internet skills in adults with developmental disabilities. *Journal of Applied Behavior Analysis, 40*(1), 185–189. https://doi.org/10.1901/jaba.2007.41-06

Kazdin, A. E. (1982). *Single case research designs: Method for clinical and applied settings*. Oxford University Press.

Kurt, O., & Cuhadar, S. (2018). Effects of most to least prompting procedure on teaching exercise for adults with intellectual disabilities. *Journal of Education and Training Studies*, *6*(9a). https://doi.org/10.11114/jets.v6i9a.3485

Lang, R., Mulloy, A., Giesbers, S., Pfeiffer, B., Delaune, E., Didden, R., Sigafoos, J., Lancioni, G., & O'Reilly, M. (2011). Behavioral interventions for rumination and operant vomiting in individuals with intellectual disabilities: a systematic review. *Research in Developmental Disabilities, 32*(6), 2193–2205. https://doi.org/10.1016/j.ridd.2011.06.011

Leaf, J. B., Leaf, J. A., Alcalay, A., Dale, S., Kassardjian, A., Tsuji, K., Leaf, R., Taubman, M., & McEachin, J. (2014). Comparison of most-to-least to error correction to teach tacting to two children diagnosed with autism. *Evidence-Based Communication Assessment and Intervention, 7* (3), 124–133. https://doi.org/10.1080/17489539.2014.884988

Leaf, J. B., Leaf, J. A., Alcalay, A., Kassardjian, A., Tsuji, K., Dale, S., Ravid, D., Taubman, M., McEachin, J., & Leaf, R. (2016a). Comparison of most-to-least prompting to flexible prompt fading for children with autism spectrum disorder. *Exceptionality, 24*(2), 109-122, https://doi.org/10.1080/09362835.2015.1064419

Leaf, J. B., Cihon, J. H., Townley-Cochran, D., Miller, K., Leaf, R., McEachin, J., & Taubman, M. (2016b). An evaluation of positional prompts for teaching receptive identification to individuals diagnosed with autism spectrum disorder. *Behavior Analysis in Practice, 9*(4), 349–363. https://doi.org/10.1007/s40617-016-0146-8

Lerman, C. D., Vorndran, M. C., Addison, L., & Kuhn, C. S. (2004). Preparing teachers in evidence-based practices for young children with autism. *School Psychology Review, 33,* 510–526. https://doi.org/10.1080/02796015.2004.12086265

Libby, M. E., Weiss, J. S., Bancroft, S., & Ahearn, W. H. (2008). A comparison of most-to-least and least-to-most prompting on the acquisition of solitary play skills. *Behavior Analysis in Practice, 1*(1), 37–43. https://doi.org/10.1007/BF03391719

Ma, H. H. (2006). An alternative method for quantitative synthesis of single-subject researches: percentage of data points exceeding the median. *Behavior Modification, 30*(5), 598–617. https://doi.org/10.1177/0145445504272974

Mastropieri, M. A., & Scruggs, T. E. (1985–1986). Early intervention for socially withdrawn children. *Journal of Special Education, 19*(4), 429–441.

McDonnell, J., & Ferguson, B. (1989). A comparison of time delay and decreasing prompt hierarchy strategies in teaching banking skills to students with moderate handicaps. *Journal of Applied Behavior Analysis, 22*(1), 85–91. https://doi.org/10.1901/jaba.1989.22-85

Nepo, K., Tincani, M., Axelrod, S., & Meszaros, L. (2017). iPod touch® to ıncrease functional communication of adults with autism spectrum disorder and significant ıntellectual disability. *Focus on Autism and Other Developmental Disabilities, 32*(3), 209–217. https://doi.org/10.1177/1088357615612752

Ozen, A., Acar, C., Tavlar, O, & Cetin, O. (2002). Ozbakim becerilerinin ogretiminde ipucunun giderek azaltilmasiyla ogretim yonteminin etkililiği [Effectiveness of the most to least prompting procedure on teaching chained self-care skills to students with developmental disabilities]. *Anadolu Universitesi Sosyal Bilimler Dergisi* [Anadolu University Journal of Social Sciences]*, 2*(2), 147 - 167.

Parker, R. I., Vannest, J. K., & Davis, J. L. (2011). Effect size in single-case research: A review of nine nonoverlap techniques. *Behavior Modification, 35,* 303–322. https://doi:10.1177/0145445511399147

Ramdoss, S., Lang, R., Mulloy, A., Franco, J., O'Reilly, M., Didden, R., & Lancioni, G. (2011). Use of computer-based ınterventions to teach communication skills to children with autism spectrum disorders: *A systematic review. Journal of Behavioral Education, 20*(1), 55-76. https://doi.org/10.1007/s10864-010-9112-7

Reichle, J., McComas, J., Dahl, N., Solberg, G., Pierce S., & Smith, D. (2005). Teaching an individual with severe intellectual delay to request assistance conditionally. *Educational Psychology, 25*(2-3), 275–286. https://doi.org/10.1080/0144341042000301201

Reichle, J., Dropik, P. L., Alden-Anderson, E., & Haley, T. (2008). Teaching a young child with autism to request assistance conditionally: A preliminary study. *American Journal of Speech-Language Pathology, 17*(3), 231-240. https://doi.org/10.1044/1058-0360(2008/022)

Roth, M. E., Gillis, J. M., & DiGennaro Reed, F. D. (2014). A meta-analysis of behavioral interventions for adolescents and adults with autism spectrum disorders. *Journal of Behavioral*

Education, 23(2), 258–286. https://doi.org/10.1007/s10864-013-9189-x

Schlosser, R., & Sigafoos, J. (2007). Editorial: Moving evidence-based practice forward. *Evidence-Based Communication Assessment and Intervention, 1*, 1–3. https://doi.org/10.1080/17489530701317620

Scruggs, T. E., & Mastropieri, M. A. (2001). How to summarize-participant research: Ideas and applications. *Exceptionality, 9*(4), 227–244. https://doi.org/10.1207/S15327035EX0904_5

Simeonsson, R., & Bailey, D. (1991). Evaluating programme impact: *Levels of certainty*. In D. Mitchell & R. Brown (Eds.), Early intervention studies for young children with special needs (pp.280-296). Chapman and Hall.

Smith, N. (1981). The certainty of evidence in health evaluations. *Evaluation and Program Planning, 4*, 273–278. https://doi.org/10.1016/0149-7189(81)90028-8

Storey, K., & Miner, C. (2011). *Systematic instruction of functional skills for students and adults with disabilities*. Charles C. Thomas.

Strand, S. C., & Morris, R. C. (1986). Programmed training of visual discriminations: A comparison of techniques. *Applied Research in Mental Retardation, 7(*2), 165–181. https://doi.org/10.1016/0270-3092(86)90003-2

Tekin-Iftar, E., & Kırcaali-Iftar, G. (2013). *Ozel egitimde yanlissiz ogretim yontemleri* [Errorless teaching methods in special education]. Vize Akademik [Vize Academic].

Test, D. W., Richter, S., Knight, V., & Spooner, F. (2011). A comprehensive review and meta-analysis of the social stories literature. *Focus on Autism and Other Developmental Disabilities, 26*(1), 49–62. https://doi.org/10.1177/1088357609351573

Vuran, S. (2008). Empowering leisure skills in adults wıth autism: An experimental investigation through the most to least prompting procedure. *International Journal of Special Education, 23*(1), 174-181.

Wiseman, K.V., McArdell, L.E., Bottini, S.B., & Gillis, J. M. (2017). A meta-analysis of safety skill ınterventions for children, adolescents, and young adults with autism spectrum disorder. *Review Journal of Autism and Developmental Disorders,* 4, 39–49 (2017). https://doi.org/10.1007/s40489-016-0096-7

Wolery, M., Ault, M. J., & Doyle, P. M. (1992). *Teaching students with moderate to severe disabilities: Use of response prompting strategies*. Longman.

Yilmaz, I., Konukman, F., Birkan, B., & Yanardag, M. (2010). Effects of most to least prompting on teaching simple progression swimming skill for children with autism. *Education and Training in Autism and Developmental Disabilities, 45(3)*, 440-448.