This is the peer reviewed version of the following article: Cengher, M., Bowman, M. D., Shawler, L. A., & Ceribo-Singh, M. S. M. (2022). A systematic review of mands for information. Behavioral Interventions, 1– 23. https://doi.org/10.1002/bin.1893, which has been published in final form at https://doi.org/10.1002/bin.1893. This article may be used for non-commercial purposes in accordance with Wiley Terms and Conditions for Use of Self-Archived Versions. This article may not be enhanced, enriched or otherwise transformed into a derivative work, without express permission from Wiley or by statutory rights under applicable legislation. Copyright notices must not be removed, obscured or modified. The article must be linked to Wiley's version of record on Wiley Online Library and any embedding, framing or otherwise making available the article or pages thereof by third parties from platforms, services and websites other than Wiley Online Library must be prohibited.

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A Systematic Review of Mands for Information

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We thank Caio Miguel for his valuable feedback provided on an early version of this manuscript. We declare that we did not have any conflict of interest in the development and dissemination of this project. We did not have funding for the development of this project. The data that support the findings of this systematic literature review are available from the corresponding author upon reasonable request.

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Abstract

The purpose of this paper was to conduct a systematic review of studies on mands for information. We used a combination of keywords to search for articles through PsycINFO® and then conducted reference and citation searches for all articles that met our inclusion criteria. In total, we identified 32 studies with 35 experiments. The most commonly investigated autoclitic frames were *where* and *who*, and the least investigated were *why* and *how*. Over half of the studies included an evocative scenario that served as a test condition, but did not include a control condition; however, there was an overall increasing trend toward including both conditions starting in 2007. The authors of the published studies reported that participants received information, which led to other reinforcers. We make recommendations for clinical practice, as well as discuss directions for future research.

Keywords: abolishing operations, conditioned motivating operations, establishing operations, question, mands for information, request

A Systematic Review of Mands for Information

Neurotypical children begin to behave as speakers and acquire the basic verbal operants beginning at 12 months (Horne & Lowe, 1996; Tager-Flusberg et al., 2005). The mand is a verbal operant and its form is controlled by motivating operations (MOs) and specific reinforcement (Skinner, 1957). The mand is the first verbal operant that children learn, possibly because it is the most beneficial to the speaker (Skinner, 1957; Sundberg & Michael, 2001). Indeed, much of young children's verbal behavior consists of mands for specific items, which may function as reinforcers, such as foods, drinks, or toys (Sundberg & Michael, 2001). In time, more complex mands (e.g., mands for actions and information) develop, and a comprehensive mand-for-information repertoire begins to emerge by 36 months (Nelson, 1978; Sundberg, 2008).

An established mands-for-information repertoire has benefits beyond accessing the information itself—research shows that it can support the development of other verbal operants (Lechago et al., 2010), help meet educational goals (Sundberg et al., 2001), is correlated with a reduction in problem behavior (Ingvarsson & Hollobaugh, 2010), promotes problem-solving (Shillingsburg & Valentino, 2011), and assists in navigating social situations (Landa et al., 2020). In this respect, mands for information can function as behavioral cusps, by allowing children to experience new contingencies of reinforcement with far-reaching ramifications (Rosales-Ruiz & Baer, 1997).

Generally, the verbal behavior development of children with autism spectrum disorder (ASD) and other developmental disabilities does not mirror the trajectory of neurotypical children (Wetherby & Prutting, 1984). For example, some children with ASD have verbal

behavior repertoires that largely consist of mands for specific items or mands to escape from specific items or activities (e.g., “All done”), with few, if any, mands for information (Eigsti et al., 2007). Often, mands for information need to be explicitly taught to this population. As such, teaching mands for information represents a priority in several assessments such as the Assessment of Basic Language and Learning Skills (ABLLS; Partington, 2006) and the Verbal Behavior Milestones Assessment and Placement Program (VB-MAPP; Sundberg, 2008).

There are several hypotheses to explain why children may not acquire mands for information. First, they may not have developed the listener repertoire necessary to respond to the information to access the reinforcer(s). For example, information about the location of a preferred object is only useful if the respective information functions as a discriminative stimulus for responding (e.g., finding the item). Second, some children may demonstrate the necessary skills to respond as listeners; however, information may not be sufficiently reinforcing to evoke responding. For example, a cup in and of itself may not be sufficiently reinforcing to support the acquisition of mands for information about its location. Third, and relatedly, some information may not be immediately relevant (i.e., delay to reinforcement), may be relevant only sometimes (i.e., intermittent schedule of reinforcement), or may be punishing. For example, the answer to “When can I take a break?” may be now, in 1 hr, or 3 hrs. The longer the delay to the break, the less likely it is that the information functions as a reinforcer (see Chung & Herrnstein, 1967). Thus, a delay to reinforcement, a thin schedule of reinforcement, or information that is punishing may preclude the acquisition of mands for information. All of these different hypotheses require different interventions to teach mands for information.

Most researchers assessed the presence of potential prerequisite skills before teaching mands for information, and they developed procedures that programmed immediate and frequent

reinforcers during response acquisition (see Lechago & Low, 2015, for a review). As such, of the hypotheses listed above, the one that is more challenging and less explored in research is that information may not always function as a conditioned reinforcer (Endicott & Higbee, 2007). One needs to establish information as a reinforcer to teach mands for information. For example, assuming that candy functions as a potent reinforcer for a child, one may teach them to mand "Where's the candy?" by placing it out of sight. The information about the location becomes a conditioned reinforcer, in that it allows the child to access candy. In contrast, it may be more complicated to teach a child to mand for social information such as "Where did you go last weekend?" in that the value of this information as a reinforcer cannot be easily established by the receipt of tangible reinforcers (Landa et al., 2020). The reinforcing value of such information may depend on a complex verbal repertoire that includes sensitivity to social interactions as a form of reinforcement (Skinner, 1957). Stated otherwise, learning new information about others must function as a reinforcer, and lack of information should function as an establishing operation. Clearly, there is a continuum of complexity when teaching mands for information.

To begin establishing information as a reinforcer, one must manipulate motivating operations (Michael, 1993, 2000, 2004; Miguel & Michael, 2020). MOs have momentary effects—their value ranges from establishing operations (EO), where the motivation is high, to abolishing operations (AO), where the motivation is low or nonexistent (Laraway et al., 2003). Numerous studies have contrived MOs to teach mands for information (for a review, see Lechago & Low, 2015). For example, Landa et al. (2017) taught three children with ASD to use the autoclitic frame *when* to gain contingency-specifying information. In the EO (test) condition, whenever the participant manded for an item or an activity the experimenter said, "Not right now." Once the child manded for information (i.e., *when*), the experimenter provided

contingency-specifying information (e.g., “You can have candy after you wash your hands”). The completion of the task specified in the contingency (e.g., washing hands) was followed by access to the requested item (e.g., candy). In the AO (control) condition, the experimenter provided the contingency-specifying information *before* the child manded for an item or activity, presumably reducing the reinforcing value of the information. All participants learned to mand for information using the autoclitic frame *when* and demonstrated discriminated responding, with higher rates of mands for information when the information was not provided (EO) as compared to when the information was provided before the response (AO).

Lechago and Low (2015) conducted a narrative review of studies to teach mands for information to individuals with developmental disabilities. The inclusion criteria included participants with ASD, mands for information as one of the dependent variables, behavior analytic interventions, publications in English, and different communication modalities. The authors focused primarily on the analysis and discussion of contingency arrangements developed to teach mands for information. In 16 of the 23 studies identified, the researchers utilized procedures that included hiding preferred items or interrupting a behavior chain to contrive the EO for mands (e.g., hiding a spoon when someone was making hot chocolate). In 20 studies, the researchers provided only the information as a consequence for manding, while in three studies the researchers provided the information as well as additional reinforcers (e.g., praise, edibles; Koegel et al., 1998; Taylor & Harris, 1995; Williams et al., 2020) following a mand. Finally, some studies reported measuring the generalization of mands for information across settings, objects, behavior-change agents, and stimuli; however, generalization outcomes were inconsistent across participants and studies.

The current paper contributes to the extant literature in several ways. First, we conducted a systematic rather than a narrative literature search and are therefore confident that we included all the articles that met our inclusion criteria. Second, we extended the scope of the literature review to include all studies on mands for information regardless of participants' diagnoses (i.e., not exclusive to only individuals diagnosed with an autism spectrum disorder or other developmental disabilities). Third, our review of the literature since 2015 suggests an increase in the number of articles published on mands for information (i.e., 44% of articles included in this review; further discussed in the Results section). Three of these new studies (Patil et al., 2021; Pyles et al., 2021; Valentino et al., 2019) focused on teaching the autoclitic frame *why*, which had not been explored in previous studies. Fourth, when teaching mands for information, it is important to condition information as a reinforcer. As such, we analyzed different dimensions of the consequences provided for mands for information. Finally, one of our inclusion criteria was that studies manipulated MOs to teach mands for information. We included this criterion because mands are defined functionally as being controlled by MOs (Skinner, 1957). Such an integrated approach to evaluating and manipulating the sources of MO control can help develop a technology of teaching that programs for generalization, which is critical for developing a mand repertoire (Miguel, 2017).

Method

Data Search

The second author conducted a review of the literature on studies teaching mands for information. Our literature search adhered to the guidelines put forth by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA®) statement (Page et al., 2021). Figure 1 illustrates a flow chart depicting the data search process. Our inclusion criteria required

that studies were: (a) empirical (i.e., excluding book chapters, literature reviews, discussion articles, etc.), (b) published in English, (c) published in peer-reviewed journals, (d) published before January 2022, (e) the dependent variable consisted of the acquisition of mand(s) for information (regardless of the specific topography of the response), and (f) the independent variable consisted of a MO manipulation. In the context of teaching mands for information, an MO manipulation consisted of arranging evocative scenarios that either increased the likelihood that the participant is motivated to respond (EO) or not (AO). We finalized the data search in January 2022.

We conducted one search through PsycINFO® for the keywords *mands for information*. Thereafter, we searched for articles using two lists of keywords; each search consisted of a combination of keywords from the first and second lists. The first list included the following keywords: *mands for information, conditioned motivating operations, motivating operations, establishing operations, abolishing operations*, and *mands*. The second list included the following keywords: *where, when, why, who, what, which, how, question, requesting,* and *ask*. These keywords combined, and separate (i.e., mands for information), resulted in 61 searches. During these searches, we analyzed the abstract of each study to determine whether it met our inclusion criteria. For the articles that met our inclusion criteria, we then conducted reference list searches using PsycINFO® and citation searches using Web of Science®. We included these databases because they are commonly used in systematic literature reviews in behavior analysis (e.g., Sivaraman & Fahmie, 2020). For the reference and citation searches, we applied the same criteria described above to each abstract. Task analyses for the reference and citation searches are available upon request from the corresponding author.

Finally, we conducted a full-text review of the studies that met our inclusion criteria described above. The purpose of the full-text review was to ensure that all relevant information in the manuscript was considered when making determinations about studies meeting the eligibility criteria. For example, if the authors described procedures in the abstract that suggested an MO manipulation, a full-text review allowed us to determine whether the procedures met our inclusion criteria.

Data Analysis

For each article that met our inclusion criteria, we extracted information on several variables.

Source and Bibliographical Information

First, we extracted information on the source—PsycINFO®, reference, or citation search. The source referred to the stage of the study during which we identified the respective article. These stages are described in the Data Search section. Then, we extracted the following bibliographic information: authors, name of the article, year of publication, publishing journal, issue, and the page number. We copied the bibliographic information from the first page of each article.

Participant Characteristics and Setting

We extracted the following information on participant characteristics: number of participants, diagnoses, and age. We retrieved this information directly from each article, and we reported the same information as the authors. We then extracted information on the experimental setting. Experimental settings were then categorized as home, school, and clinic.

Methodology

We extracted the following information: experimental design, dependent variables (including the types of autoclitic frame, such as *when*, *where*, or *why*), response modality (vocal, Picture Exchange Communication System, speech-generating device, sign language), EO (test condition), AO (control condition), prompt–fading procedure, and the consequence for mands. The data we extracted for each of these variables reflected what the authors reported in their articles. We determined that an article employed both EO and AO conditions if they reported collecting and reporting data for these conditions separately. This criterion applied regardless of whether the authors referred to the conditions as EO and AO, respectively. An example of a study that employed both conditions is one where the reinforcing item was present (AO) on some trials, and absent (EO) on others to teach children to mand for information using the autoclitic frame *where.* In contrast, a nonexample is a study that included an interrupted chain procedure, but no separate explicit AO condition, to teach a child to mand for information using the autoclitic frame *where*. In the latter example, the participants may have been exposed to AO scenarios when items were present (i.e., during steps when the chain was not interrupted). However, if the authors did not collect and report data separately for responding for each step of the behavior chain (i.e., presence or absence of mands for information for each step), it is impossible to draw any definite conclusions regarding EO and AO control.

The consequence for mands was categorized as: (a) information only (with or without praise), (b) information and access to tangible items or activities concurrently, or (c) information, which then led to participants immediately accessing tangible items or activities (e.g., allowed to find the item and play with it for 2 min; see Table 1). We coded articles as *information* only if the information was not directly associated with a tangible reinforcer that was available for participants. For example, the experimenter could provide social information contingent on the

question “What did you have for lunch?” We coded articles as *information and access to tangible items or activities concurrently* if the authors provided both types of consequences at the same time. For example, contingent on the mand “Where’s the spoon?” the experimenter says, “I have it” while handing it to the participant. We coded articles as *information that immediately led to access to tangible reinforcers* if the tangible reinforcer became available immediately after the information was received, but the participant was required to respond as a listener to the information provided and retrieve the item themselves. For example, contingent on the mand “Where is the spoon?” the experimenter says, “It is on the table” and allows the participant to get the spoon themselves.

Finally, we evaluated whether the authors reported data that confirmed that the information was used, beyond the acquisition of mands for information. In other words, we assessed whether information functioned as a discriminative stimulus for other responses (e.g., the listener response of retrieving the missing item). We hypothesized that such data can suggest that the information functioned as a reinforcer. Examples include approach behavior following the mand about the location or possession of items (e.g., getting the candy after being told it is on the counter), data that confirm that the participant learned new responses (e.g., could tact novel items), and data on completion of activities after receiving information about how to do so (e.g., solving a math problem after being told what strategy to use).

Outcomes

We collected data on response acquisition, generalization (across variables and outcomes), and maintenance (including outcomes). We retrieved information about these variables directly from each article, and we reported the same information as the authors. We categorized generalization procedures across people, stimuli, and scenarios. As an example of

generalization across people, the intervention could be conducted by one experimenter and generalization probes could be conducted across teachers or caregivers. As an example of generalization across stimuli, one could teach a child to mand for a missing item (e.g., spoon) that is part of a behavior chain, and the experimenter could evaluate generalization across other missing items necessary for the completion of the respective behavior chain (e.g., cup). As an example of generalization across scenarios, one could teach a child to mand for information using a behavior chain (e.g., tying shoelaces), and evaluate whether the mand for information generalizes across a different behavior chain (e.g., solving math problems). For maintenance, we collected data on outcomes, as well as when the maintenance probes were conducted in relation to meeting the mastery criterion for intervention (e.g., 2 weeks after the intervention was completed).

Interrater Reliability

The first and second authors served as primary data collectors, and the fourth author collected data for interrater reliability purposes. We collected interrater reliability for 37% of the PsycINFO® searches, 34% of the reference searches, 34% of the citation searches, and 41% of the articles analyzed. We selected the articles for reliability purposes using a computerized online random-number generator. For articles retrieved, we calculated interrater reliability by dividing the smaller number of articles that met the inclusion criteria according to one observer by the larger number of articles that met the criteria according to the other observer and multiplied it by 100. For articles that met the inclusion criterion, we calculated interrater reliability by dividing the number of articles agreed upon by the total number of articles and multiplied the results by 100. We used the same formulas to collect interrater reliability across PsycINFO® search, reference search, and citation search. For the articles retrieved through

PsycINFO®, the agreement on the number of articles retrieved[1] was 99.63% (range, 96 to 100%), and the agreement on the number of articles that met the inclusion criteria was 95% (range, 60 to 100%). The 60% agreement for one session was an outlier, as evidenced by the overall high interrater score. The low score was due to the authors disagreeing on whether to include two studies for one of the keyword searches. For the articles retrieved through the reference search the agreement on the articles retrieved was 100%, and the agreement on the articles that met the inclusion criteria was 99.27% (range, 92 to 100%). For the articles retrieved through the citation search, the agreement on both the number of articles retrieved and the number of articles that met inclusion criteria was 100%. For consequences of manding for information, we reviewed 34% of studies using a random number generator. The mean interrater agreement was 85% (range, 67 to 100%). The lower scores were for the variable that referred to whether participants used the information (e.g., approaching the person who held the reinforcer, completing a behavior chain after being told how to do so).

For data analysis, we calculated interrater reliability by dividing the number of agreements between observers by the number of agreements and disagreements and multiplied it by 100. An agreement was defined as both observers coding a variable the same way (e.g., same diagnoses for each participant). An agreement or disagreement was calculated for each variable (e.g., the dependent variable in a study). The mean interrater reliability score was 94% (range, 80 to 100%).

Results

Data Search

[1] We noticed that different searches using the same keywords and parameters at different points in time resulted in a different number of articles retrieved. Our librarians informed us that this variability is likely due to PsycINFO® updating its search algorithms periodically. Therefore, some variability between searches conducted at different points in time is to be expected.

The search retrieved 1,745 articles, of which 297 articles met the inclusion criteria. Two hundred sixty-eight articles were duplicates, leaving 28 articles that met our inclusion criteria. We conducted reference and citation searches for each article. The reference search yielded 534 additional articles, of which 16 met our inclusion criteria (with duplicates removed). The citation search yielded 310 articles, of which six met our inclusion criteria (with duplicates removed). In total (i.e., across the PsycINFO® search, the reference search, and the citation search), we identified 50 articles that met our inclusion criteria. After reviewing the full text and applying the same inclusion criteria, we determined that 18 studies did not meet our inclusion criteria because they failed to manipulate MOs as we described previously. Therefore, the total number of articles included in this review was 32. Speckman et al. (2021) had only one experiment that met our inclusion criteria (Experiment 2); therefore, we only included information about the respective experiment. Three of these articles included two experiments (Carnett et al., 2020; Endicott & Higbee, 2007; Sundberg et al., 2001). In total, we report data for 35 experiments.

Data Analysis

The articles were published in eight journals. The largest number of articles published in the *Journal of Applied Behavior Analysis* (n=13), followed by *The Analysis of Verbal Behavior* (n=10), *Research in Autism Spectrum Disorders* (n=4), *Behavioral Interventions* (n=1), *Behavior Analysis in Practice* (n=1), *Developmental Disabilities Bulletin* (n=1), *Education Sciences* (n=1), and *Journal of Behavioral Education* (n=1). Even though we did not restrict our search to behavior analytic journals, all the studies that met our inclusion criteria were published in such outlets. The first published article on teaching mands for information was by Williams et al. (2000). Since 2000, authors continued to publish one to two articles per year until 2010, followed by a steady increase in the number of publications (see Figure 2 for a cumulative record of

publications by year). Of note, 44 % (n=14) of studies were published after the publication of the narrative literature review conducted by Lechago and Low (2015).

Across experiments, there were 93 participants. Two participants were neuro-typical and without a diagnosis. Eighty-one participants were diagnosed with ASD, one was diagnosed with pervasive developmental disorder not otherwise specified, one with attention-deficit hyperactivity disorder, and one with mild mental retardation (language used by the authors). Three participants had two diagnoses, one was diagnosed with ASD and Down syndrome, another with ASD and cerebral palsy, and another with pervasive developmental disorder not otherwise specified and partial fetal alcohol syndrome. Two participants had language delays. One participant was diagnosed with ASD and a language delay. One participant was neurotypical with English as a second language. The participants' age range was 2 to 18 years old (Mode=5; *M*=6.05). Three participants were teenagers, and the remaining participants were children under the age of 13. The majority of participants (n=78) were male, which is not surprising given that the probability of receiving the diagnosis of ASD is four times higher for boys than girls (Duvekot et al., 2017).

Most participants (n=72) communicated only vocally. In four experiments (Howlett et al., 2011; Kahlow et al., 2019; Patil et al., 2021; Somers et al., 2014) the vocal participants also used a choice board (n=10), and in two experiments (Sundberg et al., 2001) the participants communicated vocally and used sign language (n=2). Finally, in four experiments (Carnett & Ingvarsson, 2016; Carnett et al., 2020 [two experiments]; Shillingsburg et al., 2019) the participants used a speech-generating device (n=9).

The experiments were conducted in one or more of the following settings: school (n=25), home (n=10), and clinic (n=6). Twenty-eight experiments were conducted in a single setting,

five were conducted in two of the settings, and one was conducted in three settings (Kahlow et al., 2019). Jessel and Ingvarsson (2021) did not specify the setting.

Experiments arranged different evocative scenarios to manipulate MOs to teach mands for information (see Table 2). The evocative scenarios differed across autoclitics for mands for information: *what*, *when*, *where*, *who*, *which*, *how*, *why*, *I don't know, please tell me*, as well as mands for social information that did not have a specific autoclitic frame. For example, for the autoclitic frame *how*, researchers gave participants preferred toys they could not operate or allowed them to engage in behavior chains that they could not complete independently (Lechago et al., 2013; Shillingsburg & Valentino, 2011; Shillingsburg, Bowen, & Valentino, 2014). In contrast, for the autoclitic frame *when*, researchers denied access to preferred activities (Kahlow et al., 2019; Landa et al., 2017; Shillingsburg et al., 2011).

The most frequent dependent variable was the autoclitic frame *where* (n=11 experiments; see Table 2), followed by *who* (n=7), *what* (n=6), *which* (n=4), *when* (n=3), *why* (n=3), and *how* (n=3). Additional dependent variables were the response, *I don't know please tell me* (n=3), and mands for social information (e.g., "What is your favorite color?", n=2). There were five experiments in which multiple autoclitic frames were dependent variables; in four experiments the authors taught participants two autoclitic mand frames: *who* and *where* (Lechago et al., 2010), *who* and *which* (Shillingsburg, Bowen, & Valentino, 2014; Shillingsburg et al., 2019), and *what* and *where* (Jessel & Ingvarsson, 2021). In one experiment the authors taught participants four autoclitic frames, *who*, *where*, *when*, and *which* (Shillingsburg et al., 2011). Twenty experiments included a control (AO) condition; however, there is an overall increasing trend in experiments including both the EO and AO conditions after 2007 (see Table 1).

The authors of 17 experiments reported assessments (e.g., Vineland Adaptive Behavior Scales, Sparrow et al., 2005; VB-MAPP, Sundberg, 2008; Preschool Language Scale, Zimmerman et al., 2002) to evaluate the participants' verbal behavior (Carnett & Ingvarsson, 2016; Carnett et al., 2020; Howlett et al., 2011; Kahlow et al., 2019; Landa et al., 2017; Landa et al., 2020; Lechago et al., 2010; Lechago et al., 2013; Marion et al., 2011; Marion, Martin, Yu, Buhler, & Kerr, 2012; Pyles et al., 2021; Roy-Wsiaki et al., 2010; Shillingsburg et al., 2018; Shillingsburg et al., 2019; Somers et al., 2014; Speckman et al., 2021; Valentino et al., 2019), and the authors of 12 experiments reported those assessment results (all but Howlett et al., 2011; Lechago et al., 2013; Shillingsburg et al., 2018; and Somers et al., 2014). The authors of all 35 experiments reported anecdotal information for each participant's existing verbal repertoire (e.g., can tact more than 100 items; can mand for information using *wh*- questions, but does not mand for information using *how?*).

The authors of 26 experiments reported using preferred tangibles, edibles, tokens, and activities to reinforce correct responding (Betz et al., 2009; Carnett et al., 2020; Endicott & Higbee, 2007; Howlett et al., 2011; Ingvarsson & Hollobaugh, 2010; Ingvarsson et al., 2007; Kahlow et al., 2019; Landa et al., 2017; Lechago et al., 2010; Lechago et al., 2013; Marion et al., 2011; Marion, Martin, Yu, Buhler, & Kerr, 2012; Marion, Martin, Yu, Buhler, & Claeys, 2012; Roy-Wsiaki et al., 2010; Shillingsburg & Valentino, 2011; Shillingsburg et al., 2014; Shillingsburg et al., 2019; Shillingsburg et al., 2013; Shillingsburg et al., 2016; Shillingsburg et al., 2011; Somers et al., 2014; Speckman et al., 2021; Sundberg et al., 2002; Pyles et al., 2021). To identify preferred items or activities, direct preference assessments were used in 14 experiments (Betz et al., 2009; Endicott & Higbee, 2007; Ingvarsson et al., 2007; Kahlow et al., 2019; Landa et al., 2017; Shillingsburg et al., 2011; Shillingsburg et al., 2013; Shillingsburg et

al., 2014; Shillingsburg et al., 2016; Shillingsburg et al., 2019; Sundberg et al., 2002; Pyles et al., 2021) and both direct and indirect preference assessments were used in eight experiments (Carnett et al., 2020; Howlett et al., 2011; Ingvarsson & Hollobaugh, 2010; Lechago et al., 2010; Lechago et al., 2013; Marion et al., 2011; Somers et al., 2014). The authors of six experiments reported using indirect assessments (Marion, Martin, Yu, Buhler, & Kerr, 2012; Marion, Martin, Yu, Buhler, & Kerr, 2012; Roy-Wsiaki et al., 2010; Shillingsburg & Valentino, 2011; Patil et al., 2021; Williams et al., 2003), with one of those experiments (Williams et al., 2003) identifying objects that were aversive to the participants rather than reinforcing. Furthermore, in four experiments (Valentino et al., 2019; Williams et al., 2000; Jessel & Ingvarsson, 2020; Landa et al., 2020) the authors did not utilize preference assessments to identify reinforcing tangibles, edibles, or activities, and in two experiments (Carnett & Ingvarsson, 2016; Shillingsburg et al., 2018) the authors only provided information for mands for information.

We extracted several types of data regarding the consequence for mands for information. First, we extracted data on whether the consequence for the mand consisted of (a) information with or without praise, (b) information and access to tangible items or activities concurrently, or (c) information, which then led to immediate access to tangible items or activities (e.g., allowed to find the item and play with it for 2 min; see Table 1). In 17 experiments (see Table 1 for references), the authors reported that once the participant received the information they could immediately access the tangible or activity reinforcers. For example, Sundberg et al. (2002) taught participants to mand for information using the autoclitic *where*. Contingent on the mand for information, the participant was allowed to retrieve the item and engage with it for 30 s. In four early experiments (see Table 1 for references) the authors reported that participants received information and access to the respective tangible items or activities concurrently. For example,

Marion et al. (2011) taught participants to mand *What is it?* using several scenarios, one of which consisted of a hide-and-seek activity. Contingent on the mand, the authors provided the information, showed the hidden item, and allowed the activity to resume. In five experiments, the consequence for the mands was unclear (see Table 1 for references). Finally, in four experiments the consequence for the mand consisted of information, in three experiments it consisted of information and praise, and in one experiment it consisted of information, praise, and tokens (see Table 1 for references). It is important to note that in four of the experiments where the consequence consisted of information alone, or information and praise plus tokens, participants learned the response *I don't know* or *What is it* (Ingvarsson et al., 2007; Ingvarsson & Hollobaugh, 2010, Carnett & Ingvarsson, 2016; Speckman et al., 2021). In these experiments, praise (and tokens; Speckman et al., 2021) was provided for correct responses following the provision of information, rather than for the mand for information itself; therefore, praise and tokens can be viewed as the terminal reinforcers. The evocative scenario consisted of presenting participants with tasks that included items that they were not familiar with, therefore establishing the information as the reinforcer. Finally, the information provided an opportunity to access tangible or activity reinforcers in most experiments; however, Williams et al. (2000) and Williams et al (2003) developed procedures whereby they first taught participants to ask for the location of hidden objects, which led to immediate access to information and the objects. Once participants acquired this mand, the authors then developed behavior chains of several mands and responses (i.e., "What is in the box?" which led to information about the item, followed by "Can I see it?" which led to "Can I have it?" and final access to the item). This latter arrangement introduced a delay to the reinforcer following the receipt of information.

Second, we recorded whether the authors reported data confirming that the information provided evoked listener or speaker behavior. The authors of 11 experiments (see Table 1 for references) reported such data, while the authors of the remaining 25 experiments did not. Data on the following behaviors were used to denote that the information served as a discriminative stimulus or evoked speaker behavior: approach behavior following the mand about the location or possession of items, data on the number of correct responses after receiving information that was not in the participants' repertoire, and data on completion of activities after receiving information about how to do so.

Generalization of mands for information was reported for 29 experiments, including across stimuli (e.g., items, objects, materials, tasks, n=13; see Table 1 for the type of generalization and outcomes for each study), settings (n=10), communication partners (n=12), and evocative scenarios (e.g., creating a volcano, making soup, n=3). Generalization across stimuli, scenarios, or mands for information is equivalent to different levels of MOs or different MOs (Miguel, 2017). Sixteen experiments reported maintenance of mands for information during scheduled probes following mastery, ranging from one day and up to six months (see Table 1).

Discussion

We identified 32 studies with 35 experiments that met our inclusion criteria. The most commonly investigated autoclitic frames were *where* (n=11) and *who* (n=7). The least investigated autoclitic frames were *why* (n=3) and *how* (n=3). In most experiments, the authors taught the participants vocal responses. In the majority of the experiments, the authors reported that participants received information contingent upon mands, which led to immediate access to

preferred tangible or activity reinforcers. Only 11 experiments reported data that confirm that the information provided for the mands was used (see specific studies listed in the results section).

Overall, we found that procedures to teach mands for information became much more robust throughout the years; for example, over half of the studies (57%) included an evocative scenario that served as a test condition (EO) but failed to include a control condition (AO). However, there is an increasing trend in including both conditions starting in 2007 (see Table 1). Even though it is common for our behavior to be controlled by multiple antecedent stimuli and establishing operations in the natural environment, during the early stages of verbal behavior acquisition it is necessary to ensure that the behavior is under the appropriate sources of control (Skinner, 1957). Therefore, including only an EO condition is problematic in that it prevents solid conclusions that the request was actually under the control of motivational variables rather than other aspects of the environment (e.g., discriminative stimuli) associated with the availability of the reinforcer. As such, we recommend that clinicians incorporate both EO and AO conditions when teaching mands for information. These conditions can be implemented concurrently during mand training, or clinicians can conduct AO probes occasionally to verify that the response is under the appropriate EO control by demonstrating differential rates of manding (i.e., high in EO, low or inexistent in the AO). For example, Carnett et al. (2020) implemented only an EO condition during mand training, and once participants mastered the response they conducted a follow-up phase where they alternated EO and AO conditions to demonstrate appropriate control by the motivational variables. As another example, Howlett et al. (2011) conducted one AO condition for every five EO conditions during mand training. Future research should evaluate the optimal procedural parameters to evaluate discriminative responding across the EO and AO conditions when teaching mands for information.

Similarly, the number of evocative scenarios across autoclitic frames has increased exponentially (see Table 2). Identifying and evaluating different evocative scenarios is not only important for exploring the full range of evocative scenarios that may control mands for information, but discrimination across different autoclitic frames and generalization within them as well. To foster generalization across EOs and stimuli, clinicians should use multiple exemplar training across these scenarios (LaFrance & Tarbox, 2019). For example, clinicians could provide interruptions at different points in a behavior chain to teach the autoclitic *where* across multiple items (e.g., spoon, mug, cocoa box; Carnett et al., 2020), or could use various evocative scenarios concurrently to teach the same autoclitic frame (e.g., for teaching "Where is the spoon?" an interrupted chain procedure to make a volcano, chocolate milk, and to set the table; Lechago et al., 2010). To promote generalization across different levels of EOs, clinicians should also consider teaching mands for information at varying fluctuations of EOs (Miguel, 2017). For example, one could teach a child to ask for the location of preferred hidden snacks at different levels of food deprivation. Finally, to facilitate discrimination between different autoclitic frames, clinicians should teach two or more autoclitics frames concurrently (Carnett et al., 2020; Shillingsburg, Bowen, Valentino, & Pierce, 2014). For example, one could conduct multiple-exemplar training across scenarios for the autoclitic frame *where* and *when* within the same session or in close temporal proximity.

Despite the aforementioned recent advances in experimental control and evocative scenarios explored, the current literature continues to focus almost exclusively on teaching mands for information for items that are immediately available (e.g. "Where is the spoon?" see Table 1). This mands-for-information repertoire, however, represents only a small fraction of the types of mands for information that neurotypical children and adults emit (Frazier et al., 2009).

For example, people use the autoclitic frame *where* to mand for the location of immediately available reinforcers, but also to mand for social information (e.g., “Where did you go last night?”), to mand for information that results in delayed access to a reinforcer (e.g., “When do I get paid?”), or to mand for information that is only paired with a tangible reinforcer under an intermittent or variable schedule of reinforcement (e.g., “When does it rain?”).

Most studies included in this discussion paper likely focused on teaching mands for information that result in immediate access to a tangible reinforcer due to the ease of manipulating EOs. For example, it is relatively easy to establish a previously neutral stimulus as a conditioned reinforcer using a missing item arrangement, and teach the child to engage in the autoclitic frame *where* (see Table 2 for examples of scenarios). However, it may be more challenging to arrange conditions to establish social information as reinforcing in teaching a child to engage in the autoclitic frame *where*. Even though both these mands have the same autoclitic frame and are associated with the same general category of reinforcers (e.g., information), the information varies in complexity. Indeed, Skinner argued that knowledge is a reinforcer to the extent that we engage in behavior for the sake of the new verbal behavior that results (Skinner, 1957). It is only then that mands for information can be evoked by nothing other than “curiosity.” This suggests we need to work on a technology to establish information in and of itself as a reinforcer. One way to do so is to pair information with numerous different reinforcers, which should help establish information as a generalized reinforcer (Moher et al., 2008).

Researchers should go beyond teaching mands for information that result in immediate access to tangible items—future research must focus on developing procedures to establish information as a form of social reinforcement as when a child seeks the answer to the mand

"Why is the sky blue?" For individuals who find certain topics reinforcing, developing equivalence classes based on similar interests or topics may create motivation to seek out information related to that person or their interests. For example, if an individual has an interest in dinosaurs (i.e., dinosaur facts are reinforcing), then they find out an adult or peer also has an interest in dinosaurs, this may, in turn, establish this person as reinforcing by learning that they also like dinosaurs (transfer of reinforcing function; see Shawler et al., 2022). Specific information such as being told, "Molly has 50 dinosaur figurines at home", could evoke mands for information such as, "What's your favorite dinosaur?" Such mands for information play a critical role in developing conversation skills, which is a core deficit of individuals with ASD (American Psychiatric Association, 2013), and may represent a behavioral cusp (Rosales-Ruiz & Baer, 1997). Of note, only two studies to date (Landa et al., 2020; Shillingsburg et al., 2018) evaluated procedures to teach mands for social information (e.g., "What do you like to play with?"). Further, only Carnett et al. (2020) focused on teaching persistence of responding under intermittent schedules of reinforcement (e.g., if an individual does not provide information, go to another one and ask again). Finally, none of the studies included in this review focused on teaching tolerance for delayed reinforcement (e.g., "When can I watch TV?" when the response is much later in the day). All of these are important directions for future research.

Speckman et al. (2021) is the only study included in this review that used a combination of discrete trial and observational learning procedures to teach mand for information; specifically, one participant learned through discrete trial instruction, while another participant learned through observation. We recommend that future studies explore such procedures that can increase the efficiency of training and that can capitalize on observational learning or emergent responding.

In continuing to build on this area of research, researchers must collect and report data that allow the reader to evaluate whether information served as discriminative stimuli for responding or that it resulted in the acquisition of information. Such data can indirectly confirm that information acquired reinforcing properties. Of the 11 experiments that reported such data, some examples include approach behavior after receiving information about the location or possession of items (Shillingsburg et al., 2016; Shillingsburg et al., 2019), data on the acquisition of information received (Carnett & Ingvarsson, 2016; Landa et al., 2020; Ingvarsson & Hollobaugh, 2010; Shillingsburg et al., 2016; Shillingsburg et al., 2018), and data on completion of activities after receiving information about how to do so (Lechago et al., 2013; Shillingsburg et al., 2013;).

Another related important future direction is to establish the developmental trajectory of learning mands for information. That is, depending on prerequisite skills and the level of complexity of the information that each of these different types of mands for information results in, some mands for information may be easier to acquire than others. Even though there is no exact agreement, the developmental literature generally found that the autoclitic frames *what* and *where* emerge around 26 months, and the autoclitic frame *who* emerges around 28 months. In contrast, *how*, *when*, *why*, and *which* emerge around 36 months (Bloom et al., 1982; McTear, 1985). This developmental literature can inform *when* these mands for information emerge but not *why* they emerge in this order. Future behavior analytic research can clarify the latter question by systematically evaluating the prerequisite skills necessary for each type of mand for information. In turn, clinicians can use this information to ensure that participants have the appropriate pre-requisite skills to learn each autoclitic frame for mands for information to ensure their success.

On a similar note, in several studies published in the last decade (Carnett et al., 2020; Landa et al., 2017; Marion et al., 2011; Marion, Martin, Yu, Buhler, & Kerr, 2012; Shillingsburg, Bowen, & Valentino, 2014; Shillingsburg et al., 2014; Shillingsburg et al., 2016; Shillingsburg et al., 2019; Somers et al., 2014), the authors evaluated the current level of skills that may function as prerequisites to learning mands for information. These include (a) listener behavior (e.g., for locations, when the mand is *where)*, (b) speaker behavior (e.g., tacting the items to be manded), (c) engaging in behavior chains independently when applicable, (d) echoic behavior (e.g., from an instructor or voice recorder), and (e) textual behavior. Although evaluating the presence of potential prerequisites before teaching complex behavior is advisable, there is no research to date evaluating whether these skills are necessary and sufficient for teaching mands for information (i.e., whether they are indeed required prerequisites). In other words, a child may be able to learn mands for information in the absence of some or all of these skills. It is also possible that there are other skills, not highlighted in previous research, that are necessary for the successful acquisition of mands for information. Scores from verbal behavior and skill assessments (e.g., ABLLS; Partington, 2006; VB-MAPP, Sundberg; 2008) can potentially inform the successful acquisition of mands for information. Research should focus on evaluating the predictive validity of prerequisite skills in developing a mands-for-information repertoire.

Researchers should also continue to explore different evocative scenarios to capture the full range of MOs. For example, only three recent studies (Patil et al., 2021; Pyles et al., 2021; Valentino et al., 2019) evaluated scenarios to teach mands for information with the *why* autoclitic frame. The authors developed different scenarios that had in common two general evocative events: an unusual incident that happened and the experimenter did not provide any explanation

for it, and denied access to preferred items. Future studies could explore other evocative scenarios, such as unclear demands or questions, unclear information, or unknown, novel information. We provide an outline of potential evocative scenarios in Table 2; all of these and possibly others could benefit from empirical investigations.

Researchers should also evaluate procedures to teach mands for information to other populations. For example, if a child has a fully developed verbal behavior repertoire in one language, it is possible to only need to teach them to tact an item in the other language for the other verbal operants to emerge (i.e., derived relational responding; see Wu et al., 2019). In contrast, there are individuals with developmental disabilities who cannot communicate vocally. No studies examined augmentative alternative methods of communication to teach mands for information before Lechago and Low (2015), and only three studies did so since then (Carnett & Ingvarsson, 2016; Carnett et al., 2020; Shillingsburg et al., 2019). Participants in these studies were successful at using an augmentative communication method to mand for information; however, across studies, generalization outcomes were limited. Participants required further training to meet the desired generalization outcomes. Given that many individuals with developmental disabilities do not develop vocal language, establishing complex teaching procedures for higher-level mands for this population is imperative.

There are limitations to this literature review worth noting. First, we did not assess the methodological quality of the studies included in this review. Second, we did not collect any quantitative measures of treatment effectiveness (e.g., effect sizes); instead, we used the authors' reports of findings to determine treatment outcomes. Quality indicator tools (e.g., What Works Clearinghouse, 2021) can help clarify the strength of findings, potential risk of biases, and any other relevant methodological concerns. Third, our review only included published studies,

thereby, our findings may be subject to publication bias given the tendency for journals to mainly publish positive outcomes (Tincani & Travers, 2019). Future reviews should include unpublished literature to minimize the likelihood of reporting on only successful outcomes. Fourth, we used one database to search for articles (i.e., PsycINFO®) using 61 combinations of keywords and then conducted reference and citation searches for the articles identified through PsycINFO® that met our inclusion criteria. To confirm that our search procedures resulted in a comprehensive review of the literature and that we did not omit any relevant articles, we conducted hand searches of all the issues published in the *Journal of Applied Behavior Analysis* for the past 3 years (2019-2022). We chose the *Journal of Applied Behavior Analysis* because most studies identified in this review were published there. All the articles we identified (n=3) were already included in our review based on the PsycINFO®, reference, and citation searches. In addition, we identified a high number of duplicates using our search procedures as well (see Figure 1). However, we recommend that future studies conduct searches using multiple databases, or that they supplement database searches with hand searches, to ensure that they identify all relevant articles.

In conclusion, mands for information can have a meaningful impact on an individual's life. Teaching mands for information requires a nuanced approach to the analysis and manipulation of its controlling variables, which include MOs and reinforcers that information is associated with. There is a growing body of literature that can inform clinical practice and many directions for future research that can improve our technology of teaching mands for information.

References

A * denotes articles identified through this literature review.

American Psychiatric Association (2013). Diagnostic and statistical manual of mental disorders (5th ed.). Washington, DC: Author. https://doi.org/10.1176/appi.books.9780890425596.dsm05

*Betz, A. M., Higbee, T. S., & Pollard, J. S. (2010). Promoting generalization of mands for information used by young children with autism. *Research in Autism Spectrum Disorders, 4*(3), 501-508. https://doi.org/10.1016/j.rasd.2009.11.007

Bloom, L., Merkin, S., & Wootten, J. (1982). ‘‘Wh’’-questions: Linguistic factors that contribute to the sequence of acquisition. *Child Development, 53*(4), 1084–1092. https://doi.org/10.2307/1129150

*Carnett, A., & Ingvarsson, E. T. (2016). Teaching a child with autism to mand to answers to questions using a speech-generating device. *The Analysis of Verbal Behavior, 32*(2), 233-241. https://doi.org/10.1007/s40616-016-0070-6

*Carnett, A., Ingvarsson, E. T., Bravo, A., & Sigafoos, J. (2020). Teaching children with autism spectrum disorder to ask “where” questions using a speech-generating device. *Journal of applied behavior analysis*, *53*(3), 1383-1403. https://doi.org/10.1002/jaba.663

Chung, S. H. (1965). Effects of delayed reinforcement in a concurrent situation. *Journal of the Experimental Analysis of Behavior*, *8*(6), 439-444. https://doi.org/10.1901/jeab.1965.8-439

Duvekot, J., van der Ende, J., Verhulst, F. C., Slappendel, G., van Daalen, E., Maras, A., & Greaves-Lord, K. (2017). Factors influencing the probability of a diagnosis of autism spectrum disorder in girls versus boys. *Autism*, *21*(6), 646-658. https://doi.org/10.1177%2F1362361316672178

Eigsti, I. M., Bennetto, L., & Dadlani, M. B. (2007). Beyond pragmatics: Morphosyntactic development in autism. *Journal of Autism and Developmental Disorders*, *37*(6), 1007-1023. https://doi.org/10.1007/s10803-006-0239-2

*Endicott, K., & Higbee, T. S. (2007). Contriving motivating operations to evoke mands for information in preschoolers with autism. *Research in Autism Spectrum Disorders, 1*(3), 210-217. https://doi.org/10.1016/j.rasd.2006.10.003

Frazier, B. N., Gelman, S. A., & Wellman, H. M. (2009). Preschoolers' search for explanatory information within adult–child conversation. *Child Development*, *80*(6), 1592-1611. https://doi.org/10.1111/j.1467-8624.2009.01356.x

Horne, P. J., & Lowe, C. F. (1996). On the origins of naming and other symbolic behavior. *Journal of the Experimental Analysis of Behavior*, *65*(1), 185-241. https://doi.org/10.1901/jeab.1996.65-185

*Howlett, M. A., Sidener, T. M., Progar, P. R., & Sidener, D. W. (2011). Manipulation of motivating operations and use of a script-fading procedure to teach mands for location to children with language delays. *Journal of Applied Behavior Analysis, 44*(4), 943-947. https://doi.org/10.1901/jaba.2011.44-943

*Ingvarsson, E. T. & Hollobaugh, T. (2010). Acquisition of intraverbal behavior: Teaching children with autism to mand for answers to questions. *Journal of Applied Behavior Analysis, 43*(1), 1-17. https://doi.org/10.1901/jaba.2010.43-1

*Ingvarsson, E. T., Tiger, J. H., Hanley, G. P., & Stephenson, K. M. (2007). An evaluation of intraverbal training to generate socially appropriate responses to novel questions. *Journal of Applied Behavior Analysis, 40*(3), 411-429. https://doi.org/10.1901/jaba.2007.40-411

*Jessel, J., & Ingvarsson, E. T. (2021). Teaching two children with autism to mand for known and unknown items using contrived motivating operations. *Behavioral Interventions*. Advance online publication. https://doi.org/10.1002/bin.1777

*Kahlow, T. A., Sidener, T. M., Kisamore, A. N., & Reeve, K. F. (2019). Teaching the mand "When?" to children with autism spectrum disorders. *The Analysis of Verbal Behavior, 35*, 221-234. https://doi.org/10.1007/s40616-019-00115-z

Koegel, L. K., Camarata, S. M., Valdez-Menchaca, M., & Koegel, R. L. (1997). Setting generalization of question-asking by children with autism. *American Journal on Mental Retardation*, *102*(4), 346-357. https://doi.org/10.1352/0895-8017(1998)102%3C0346:SGOQBC%3E2.0.CO;2

LaFrance, D. L., & Tarbox, J. (2020). The importance of multiple exemplar instruction in the establishment of novel verbal behavior. *Journal of Applied Behavior Analysis*, *53*(1), 10-24. https://doi.org/10.1002/jaba.611

*Landa, R. K., Frampton, S. E., & Shillingsburg, M. A. (2020). Teaching children with autism to mand for social information. *Journal of Applied Behavior Analysis*, *53*(4), 2271-2286. https://doi.org/10.1002/jaba.733

*Landa, R. K., Hansen, B., & Shillingsburg, M. A. (2017). Teaching mands for information using "When" to children with autism. *Journal of Applied Behavior Analysis, 50*(3), 538-551. https://doi.org/10.1002/jaba.387

Laraway, S., Snycerski, S., Michael, J., & Poling, A. (2003). Motivating operations and terms to describe them: Some further refinements. *Journal of Applied Behavior Analysis*, *36*(3), 407-414. https://doi.org/10.1901/jaba.2003.36-407

*Lechago, S. A., Carr, J. E., Grow, L. L., Love, J. R., & Almason, S. M. (2010). Mands for information generalize across establishing operations. *Journal of Applied Behavior Analysis, 43*(3), 381-395. https://doi.org/10.1901/jaba.2010.43-381

*Lechago, S. A., Howell, A., Caccavale, M. N., & Peterson, C. W. (2013). Teaching "How?" mand-for-information frames to children with autism. *Journal of Applied Behavior Analysis, 46*(4), 781-791. https://doi.org/10.1002/jaba.71

Lechago, S. A., & Low, A. (2015). A review of the mand-for-information training research literature. *International Journal of Behavior Analysis & Autism Spectrum Disorders*, *1*(1), 35-54.

*Marion, C., Martin, G. L., Yu, C. T., & Buhler, C. (2011). Teaching children with autism spectrum disorder to mand "What is it?" *Research in Autism Spectrum Disorders, 5*(4), 1584-1597. https://doi.org/10.1016/j.rasd.2011.03.005

*Marion, C., Martin, G. L., Yu, C. T., Buhler, C., & Kerr, D. (2012). Teaching children with autism spectrum disorder to mand "Where?". *Journal of Behavioral Education, 21*(4), 273-294. https://doi.org/10.1007/s10864-012-9148-y

*Marion, C., Martin, G. L., Yu, C. T., Buhler, C., Kerr, D., & Claeys, A. (2012). Teaching children with autism spectrum disorder to mand for information using "Which?" *Journal of Applied Behavior Analysis, 45*(4), 865-870. https://doi.org/10.1901/jaba.2012.45-865

McTear, M. F. (1985). *Children's conversations*. Malden, MA: Blackwell Publishers

Michael, J. (1993). Establishing operations. *The Behavior Analyst, 16*(2), 191–206. https://doi.org/10.1007/ BF03392623

Michael, J. (2004). *Concepts and principles of behavior analysis*. Kalamazoo, MI: Society for the Advancement of Behavior Analysis.

Michael, J. (2000). Implications and refinement of the establishing operations concept. *Journal of Applied Behavior Analysis, 33*(4), 401-410. https://doi.org/10.1901/jaba.2000.33-401

Michael, J. & Miguel, C. F. (2020). Motivating Operations. In Cooper, J. O., Heron, T. E., & Heward, W. L. (Eds.). *Applied behavior analysis* (3rd ed.), Upper Saddle River, NJ: Pearson.

Miguel, C. F. (2017). The generalization of mands. *The Analysis of Verbal Behavior*, *33*, 191-204. https://doi.org/10.1007/s40616-017-0090-x

Nelson, K. (1978). How young children represent knowledge of their world in and out of language. In R. S. Siegler (Ed.), *Children's thinking: What develops?* (pp. 225-273). Hillsdale, NJ: Lawrence Erlbaum Assoc.

Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., ... & Moher, D. (2021). The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *International Journal of Surgery*, *88*, 105906. https://doi.org/10.1016/j.ijsu.2021.105906

Partington, J. W. (2006). *The assessment of basic language and learning skills-revised (the ABLLS-R)*. Behavior Analysts.

*Patil, P., Sidener, T. M., Pane, H., Reeve, S. A., & Nirgudkar, A. (2021). Teaching Children With Autism Spectrum Disorder to Mand "Why?". *The Analysis of Verbal Behavior*, 37, 1-16. https://doi.org/10.1007/s40616-020-00138-x

*Pyles, M. L., Chastain, A. N., & Miguel, C. F. (2021). Teaching Children with Autism to Mand for Information Using "Why?" as a Function of Denied Access. *The Analysis of Verbal Behavior*, 37, 17-34. https://doi.org/10.1007/s40616-020-00141-2

Rosales-Ruiz, J., & Baer, D. M. (1997). Behavioral cusps: A developmental and pragmatic concept for behavior analysis. *Journal of Applied Behavior Analysis*, *30*(3), 533-544. https://doi.org/10.1901/jaba.1997.30-533

*Roy-Wsiaki, G., Marion, C., Martin, G. L., & Yu, C. T. (2010). Teaching a child with autism to request information by asking, "What?" *Developmental Disabilities Bulletin, 38*(1), 55-74.

*Shillingsburg, M. A., Bowen, C. N., & Valentino, A. L. (2014). Mands for information using "How" under EO-absent and EO-present conditions. *The Analysis for Verbal Behavior, 30*(1), 54-61. https://doi.org/10.1007/s40616-013-0002-7

*Shillingsburg, M. A., Bowen, C. N., Valentino, A. L., & Pierce, L. E. (2014). Mands for information using "Who?" and "Which?" in the presence of establishing and abolishing operations. *Journal of Applied Behavior Analysis, 47*(1), 136-150. https://doi.org/10.1002/jaba.101

*Shillingsburg, M. A., Frampton, S. E., Wymer, S. C., & Bartlett, B. (2018). A preliminary procedure for teaching children with autism to mand for social information. *Behavior Analysis in Practice, 11*(1), 34-38. https://doi.org/10.1007/s40617-016-0163-7

*Shillingsburg, M. A., Gayman, C. M., & Wayton, W. (2016). Using textual prompts to teach mands for information using "Who?" *The Analysis of Verbal Behavior, 32*, 1-14. https://doi.org/10.1007/s40616-016-0053-7

*Shillingsburg, M. A., Marya, V., Bartlett, B. L., & Thompson, T. M. (2019). Teaching mands for information using speech generating devices: A replication and extension. *Journal of Applied Behavior Analysis, 52*(3), 756-771. https://doi.org/10.1002/jaba.579

*Shillingsburg, M. A., & Valentino, A. L. (2011). Teaching children with autism to mand for information using "How". *The Analysis of Verbal Behavior, 27*, 179-184. https://doi.org/10.1007/BF03393100

*Shillingsburg, M. A., Valentino, A. L., Bowen, C. N., Bradley, D., & Zavatkay, D. (2011). Teaching children with autism to request information. *Research in Autism Spectrum Disorders, 5*(1), 670-679. https://doi.org/10.1016/j.rasd.2010.08.004

Sivaraman, M., & Fahmie, T. A. (2020). A systematic review of cultural adaptations in the global application of ABA-based telehealth services. *Journal of Applied Behavior Analysis*, *53*(4), 1838-1855. https://doi.org/10.1002/jaba.763

Shawler, L. A., Miguel, C. F., Cengher, M., Zhelezoglo, K. N., & Luoma, S. M. (2022). Establishing derived reinforcers via stimulus equivalence. *Journal of the Experimental Analysis of Behavior*, *117*(2), 180-200.

Skinner, B. F. (1957). *Verbal behavior*. New York: Appleton-Century-Crofts.

*Somers, A., Sidener, T. M., DeBar, R. M., & Sidener, D. W. (2014). Establishing concurrent mands for items and mands for information about location in children with autism. *The Analysis of Verbal Behavior, 30*, 29-35. https://doi.org/10.1007/s40616-014-0007-x

Sparrow, S., Cicchetti, D., & Balla, D. (2005). Vineland-II Adaptive Behavior Scales (2nd ed.). Minneapolis, MN: Pearson.

* Speckman, J., Du, L., & Greer, R. D. (2021). Increasing Requests for Information by Preschoolers with and without Language-Based Disabilities. *Education Sciences*, *11*(3), 1-16. https://doi.org/10.3390/educsci11030094

Sundberg, M. L. (2008). *Verbal behavioral milestones assessment and placement program: the VB-MAPP*. Concord: AVB Press.

*Sundberg, M. L., Loeb, M., Hale, L., & Eigenheer, P. (2002). Contriving establishing operations to teach mands for information. *The Analysis of Verbal Behavior*, *18*(1), 15-29. https://doi.org/10.1007/BF03392968

Sundberg, M. L., & Michael, J. (2001). The benefits of Skinner's analysis of verbal behavior for children with autism. *Behavior Modification*, *25*(5), 698-724. https://doi.org/10.1177%2F0145445501255003

Tager-Flusberg, H., Paul, R., & Lord, C. (2005). Language and Communication in Autism. In F. R. Volkmar, A. Klin, R. Paul, & D. J. Cohen (Eds.), Handbook of autism and pervasive developmental disorders (3rd ed., pp. 335–364). Hoboken, NJ: Wiley.

Taylor, B. A., & Harris, S. L. (1995). Teaching children with autism to seek information-acquisition of novel information and generalization of responding. *Journal of Applied Behavior Analysis*, *28*(1), 3-14. https://doi.org/10.1901/jaba.1995.28-3

*Valentino, A. L., Fu, S. B., & Padover, J. L. (2019). Teaching mands for information using "Why" to children with autism. *The Analysis of Verbal Behavior, 35*, 245-257. https://doi.org/10.1007/s40616-019-00113-1

Wetherby, A. M., & Prutting, C. A. (1984). Profiles of communicative and cognitive-social abilities in autistic children. *Journal of Speech, Language, and Hearing Research*, *27*(3), 364-377. https://doi.org/10.1044/jshr.2703.364

*Williams, G., Donley, C. R., & Keller, J. W. (2000). Teaching children with autism to ask questions about hidden objects. *Journal of Applied Behavior Analysis, 33*, 627-630. https://doi.org/10.1901/jaba.2000.33-627

*Williams, G., Perez-Gonzalez, L. A., & Vogt, K. (2003). The role of specific consequences in the maintenance of three types of questions. *Journal of Applied Behavior Analysis, 36*(3), 285-296. https://doi.org/10.1901/jaba.2003.36-285

Wu, W. L., Lechago, S. A., & Rettig, L. A. (2019). Comparing mand training and other instructional methods to teach a foreign language. *Journal of Applied Behavior Analysis*, *52*(3), 652-666. https://doi.org/10.1002/jaba.564

Zimmerman, I. L., Steiner, V. G., & Pond, R. E. (2002). Preschool Language Scale (4th ed.). San Antonio, TX: The Psychological Corporation.

U.S. Department of Education, Institute of Education Sciences, National Center for Education Evaluation and Regional Assistance, What Works Clearinghouse. (2021). Retrieved from What Works Clearinghouse website: http://ies.ed.gov/ncee/wwc/pdf/wwc_scd.pdf.

Table 1

Procedures and Outcomes across Studies

Study	Autoclitic Frame	EO Test	AO Control	Consequence	Data to Confirm That the Information Was Used	Generalization	Maintenance
Williams et al., 2000	What	Hidden objects	None	Information and access to the object concurrently	No	With the mother	20 days to 11 months
Sundberg et al., 2002	Exp 1 Where	Hidden objects	None	Information, which led to access to the object	No	Novel items	None
Sundberg et al., 2002	Exp 2 Who	Nonspecific possession statement	None	Information, which possibly led to access to the object	No	Novel items	6 months
Williams et al., 2003	What Can (I see) Can (I have)	Hidden objects	None	Information and access to the object concurrently	No	None	None
Endicott & Higbee, 2007	Exp 1 Where	Hidden object	None	Information, which led to access to the object	No	At home	None
Endicott & Higbee, 2007	Exp 2 Who	Nonspecific possession statement	None	Information, which possibly led to access to the object	No	None	None

Ingvarsson et al., 2007	I don't know, please tell me	Correct answer unknown	Correct answer known	Correct answer and praise	Data on response acquisition	Teachers, unknown questions	None
Betz et al., 2010	Where	Hidden objects	None	Information, which possibly led to access to the objects	No	Objects, settings	None
Ingvarsson & Hollobaugh, 2010	I don't know, please tell me	Correct answer unknown	Correct answer known	Correct answer and praise	Data on response acquisition	Teachers, unknown questions, settings	None
Lechago et al., 2010	Where Who	Interrupted chain	None	Information, which possibly led to access to the object	No	Objects, behavior chains	None
Roy-Wsiaki et al., 2010	What	Hidden objects	None	Information and access to the object concurrently	No	Family members, activities, settings	1-4 weeks
Howlett et al., 2011	Where	Hidden objects	Object present	Information, which possibly led to access to the object	No	Teachers, toys, natural situations	3-4 weeks
Marion et al., 2011	What	Hidden objects	None	Information and access to the object concurrently	No	Activity, script	1-4 weeks

Shillingsburg & Valentino, 2011	How	Cannot operate objects independently	None	Information, which led to the opportunity to operate the object	No	None	None
Shillingsburg et al., 2011	Who Which Where When	Non-specific possession statement (who), location statement (which), (where) hidden object (where), denial statement (when)	None	Information, which led to access to the object	No	Multiple evocative scenarios	1 day to 10 weeks
Marion, Martin, Yu, Buhler, & Kerr, 2012	Where	Hidden object	None	Information, which led to access to the object	No	Activities, materials	1 to 4 weeks
Marion, Martin, Yu, Buhler, Kerr, & Claeys, 2012	Which	Hidden objects	None	Information, which led to access to the object	No	Activities, materials	1 to 5 weeks
Lechago et al., 2013	How	Cannot complete the task independently	None	Information, which led to the completion of the task	Data on the completion of the chain	Novel evocative scenarios	2 weeks

Shillingsburg, Bowen, & Valentino, 2014	How	Cannot complete the task independently	Can complete tasks independently	Information, which led to the completion of the task	Data on the completion of the task	Novel evocative scenarios	None
Shillingsburg et al., 2014	Who Which	Non-specific possession statement (who), non-specific location statement (which)	Specific possession statement (who), Specific location statement (which)	Information, which led to access to the object	Data on approach behavior	Materials	None
Somers et al., 2014	Where	Hidden objects	Objects present	Information, which led to access to the object	No	Objects, trainers, settings	2 weeks
Carnett & Ingvarsson, 2016	I don't know, please tell me	Correct answer unknown	Correct answer known	Correct answer and praise	Data on the acquisition of novel responses	Unknown questions (training required)	None
Shillingsburg et al., 2016	Who	Nonspecific possession statement	Specific possession statement	Information, which led to access to the object	Data on approach behavior	None	None
Landa et al., 2017	When	Denial statement	Denial statement plus contingency management	Information, which led to access to the object	Data on the correct responses	None	None

Shillingburg et al., 2018	Mands for social information	Social information unknown	Social information known	Information	Data on the acquisition of social information	Conversation partners	None
Kahlow et al., 2019	When	Denial statement	Denial statement plus contingency statement	Information	No	Location, denial statements, activities	1 week
Shillingsburg et al., 2019	Who Which	Non-specific possession statement (who), non-specific location statement (which)	Specific possession statement (who), specific location statement (which)	Information, which led to access to the object	Data on approach behavior	None	None
Valentino et al., 2019	Why	Explanation not provided for an ambiguous event	The explanation provided for an ambiguous event	Information, and allowed the participant to complete the ongoing activity when applicable	No	Novel scenarios	4 to 6 weeks
Landa et al., 2020	Mands for social information	Information not known	Known, observable, or unobservable information	Information	Data on the acquisition of social	Communication partners (peers)	None

					informatio n		
Carnett et al., 2020	Exp 1 Where	Interrupted chain	None	Information, which possibly led to the completion of the chain	No	Novel objects	None
Carnett et al., 2020	Exp 2 Where	Interrupted chain, also worked on mand persistence	No interrupted chain, item present	Information, which possibly led to the completion of the chain	No	Commun ication partners	1 month
Jessel & Ingvarsson, 2021	What Where	Interrupted chain (what), missing item (where)	The location of the item is known (where), items known (what)	Information, which led to the completion of the chain	No	Novel objects	None
Patil et al., 2021	Why	Missing information, denied access, emotional response, unusual event	AO1: information is known, AO2: no EO event	Information, which led to a solution or alternative reinforcer	No	Novel stimuli, partners, and locations	1 week
Pyles et al., 2021	Why	Missing causal information	Information provided	Information, followed by the opportunity to mand for information that reportedly led to access to an object	No	Novel tasks	2 weeks

Speckman et al. (2021)	What	Information not known	Information known	Information, followed by praise and tokens	No	None	None

Note. The articles in the table are listed in the order in which they were published.

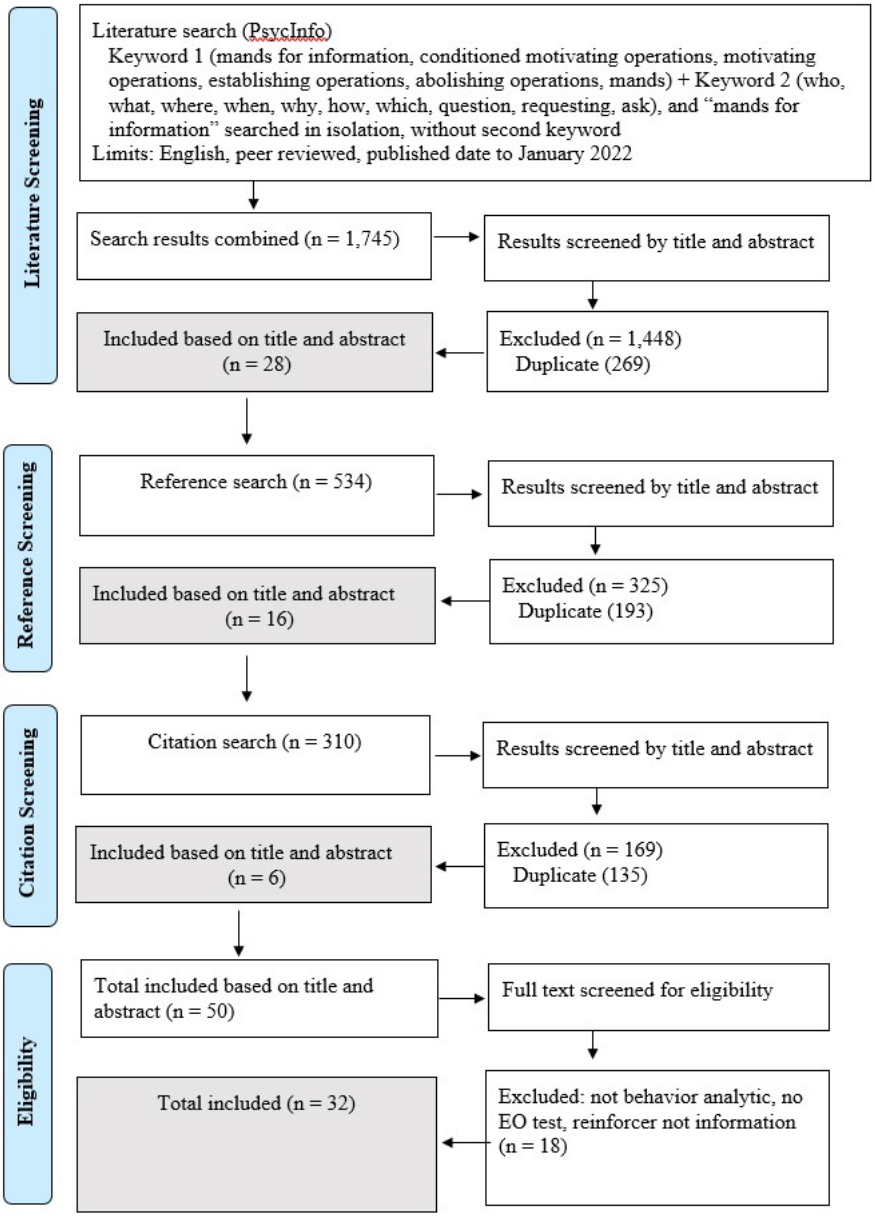
Table 2

Evocative Scenarios for Each Type of Mand for Information

Mand Type	Evocative Scenario	Number of Studies
What	Concealed object, hidden object, unknown information	5
	Information unclear	0
	Unknown item or activity	0
	Purpose of object or activity unknown	0
When	Denial statement (e.g., "not now")	3
	Unknown time for on/offset of preferred/nonpreferred activity	0
Where	Hidden object	4
	Missing object	6
Who	Possession unknown	7
	The person who completed an activity known	0
Which	Specific identifier unknown, hidden object, specific location unknown	4
How	Cannot operate object, unable to complete behavior chain	3
Why	Explanation not provided for ambiguous/unusual event denied access to a preferred item, observation of emotional response	3
I don't know, please tell me	Correct answer unknown	3
Mands for social information	Social information unknown	2

Figure 1

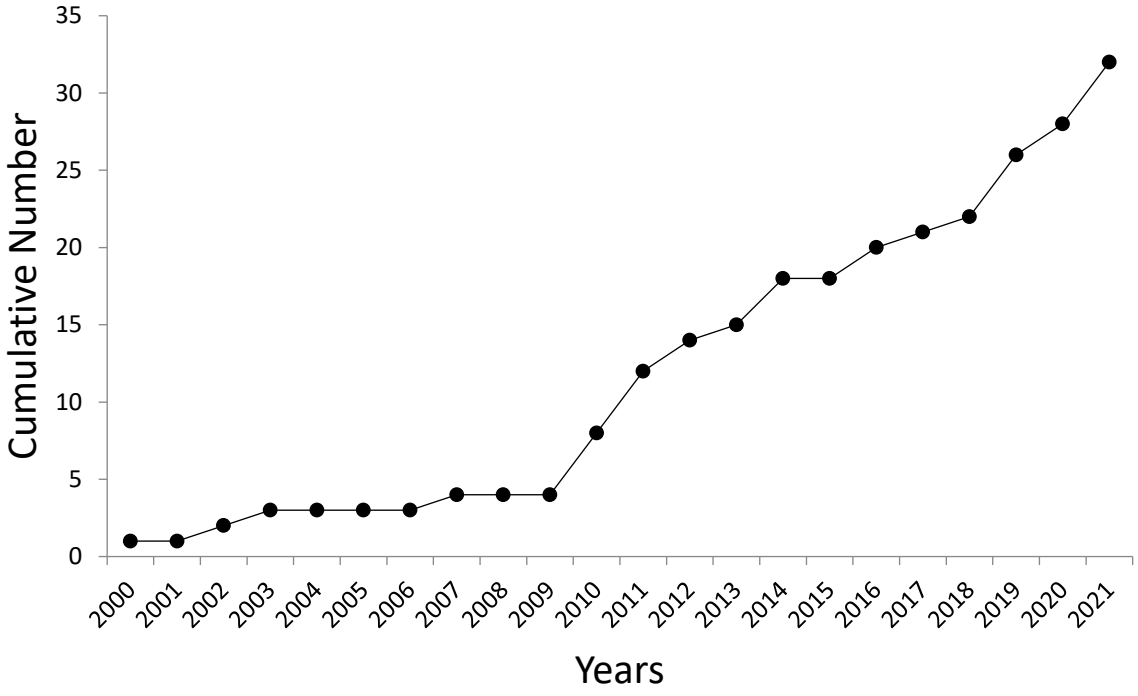
PRISMA® Diagram Denoting the Search Procedures



Note. The inclusion and exclusion criteria (e.g., not behavior analytic, EO test) are described in the Method section.

Figure 2

Cumulative Number of Publications



Human Studies and Subjects

All procedures performed in studies involving human participants were following 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.

Informed Consent

Informed consent was obtained from all individual participants included in the study, before its onset.