J Behav Educ (2010) 19:1–6
DOI 10.1007/s10864-010-9098-1

ORIGINAL PAPER

Introduction to the Special Issue: Toward an Explicit Technology for Generalizing Academic Behavior

Robin S. Codding · Brian C. Poncy

Published online: 28 January 2010

Abstract This special issue of the *Journal of Behavioral Education* was designed to call attention to a much needed area of academic intervention research: generalization programming. Although the occurrence of generalized responding across items, settings, tasks, and time is clearly recognized as a goal of intervention, less research has been devoted to the technology through which such generalization may occur. This introductory article revisits the concept of generalization and the methods that may be used to facilitate generalization.

Keywords Generalization · Academic · Interventions

Stokes and Baer (1977) highlighted the notion that using behavioral technologies to impact discrete behavior in specified settings is rarely the ultimate goal of behavior therapy. Specifically, they argued that for most treatments to be considered successful, targeted outcomes must be evidenced across time, related behavior, and/or settings (Stokes and Baer 1977). This idea is prevalent across the education system. Reading experts specify that it is not sufficient that students decode words well but that they can use these skills to understand a variety of texts and genres (National Reading Panel 2000). Math educators recognize the importance of mastering computation facts but want students to use these skills to solve quantitative word problems (National Mathematics Advisory Panel 2008). These statements converge to underscore the importance of *generalized behavior* as a

R. S. Codding (✉)
University of Massachusetts, Boston, MA, USA
e-mail: robin.codding@umb.edu

B. C. Poncy
Oklahoma State University, Stillwater, OK, USA

crucial outcome variable in educational settings (Daly et al. 2007). Generalized behavior (i.e., generalization) refers to the transfer of a learned response across time, stimuli, or behaviors (Stokes and Baer 1977). Although generalization is considered by many as an essential outcome of treatment, this phenomenon continues to be empirically investigated with a relative lack of frequency.

Traditionally, educators have focused their instructional practices on occasioning accurate responding. Although it is necessary that students acquire skills (i.e., reach an accuracy criterion), this alone is insufficient. Students need to be able to respond both accurately and quickly (i.e., fluently; Binder 1996). Fluent responding is crucial to learning as it allows educators to alter and improve instruction by increasing rates of practice, rates of reinforcement, and opportunities to use skills across problem types (Skinner 1998). While accurate and fluent responding is an essential part of learning, the desired outcome for educators is for students to use, or generalize, taught skills across a variety of activities and contexts (Haring and Eaton 1978). For example, in math, students are taught how to round up or down, but it is hoped that this skill will generalize across activities (e.g., use rounding to assist with estimation tasks) and contexts (e.g., while shopping at the store).

A model that pairs treatment strategies with the goals of accurate, fluent, and generalized responding is the Instructional Hierarchy (IH; Haring and Eaton 1978). In order to achieve the goals of the IH, researchers have stated that educators systematically instruct students in a hierarchical method starting with accuracy, incorporating practice to become fluent, and providing varying conditions with novel stimuli and adapted responses to promote generalization (Ardoin and Daly 2007; Shahan and Chase 2002). Some studies have provided evidence to support the systematic manipulation of variables to promote the generalization of academic behavior (e.g., Mesmer et al. 2007). Unfortunately, a majority of instructional approaches rely on a “train and hope” method of generalization where educators assume students will generalize taught skills (Haring and Eaton 1978; Stokes and Baer 1977). This is in spite of a growing body of literature which clarifies what is needed to effectively program for generalization.

Although the necessary and sufficient conditions for promoting generalized responding are in need of experimental inquiry, guidance has been offered by several researchers. Shahan and Chase (2002) provide a framework for understanding novel behavior using a three-term contingency. These authors suggest that critical features of novel responding include stimulus control and stimulus variability as represented by classes of stimuli, responses, and consequences. Stimulus control may be considered a required prerequisite for generalization to occur (Daly et al. 2007). For example, if a student does not consistently respond with “4” when provided the verbal stimulus “2 + 2”, then it is unlikely that a worksheet providing a visual cue of the same problem will result in an accurate response. This is consistent with the IH, which states that skill proficiency begins with accurate responding under an appropriate stimulus condition. Generalization can occur because stimuli belong to classes that are similar according to some shared characteristic; therefore, once a behavior comes under stimulus control of one member of the stimulus class, it is possible for other members of that class to elicit the response (Shahan and Chase 2002). To further assist in the promotion of stimulus generalization, Daly and colleagues suggest that students need to be exposed to some degree of stimulus variability. Likewise, Cuvo (2003) suggests that focusing on stimulus class formation and training a range of these stimuli may be a first step. Herein may lie one challenge in programming for generalization. How much stimulus variability should be presented? Furthermore, as the IH suggests, it may not just be the accuracy of the response that matters but also the speed with which the response is emitted. Binder (1996) links the ideas of stimulus class and fluency by suggesting that a taxonomy of the component skills required to perform the expected generalized behavior be generated and trained to fluency. Binder provides evidence that fluent responding on appropriate component behaviors leads to progress on composite skills as well as access to more complex elements of a curriculum. Therefore, selected members of the stimulus class and/or component skills may need to be trained to fluency. Returning to the notion of variability, Shahan and Chase (2002) also suggest that it is important to consider the variability in consequences that could be provided for a given response(s). Although contrived reinforcers can help facilitate performance under a variety of conditions, exposure to naturally occurring reinforcers may lead to more sustained performance over time.

In summary, while attempting to program for generalization, one should consider not only stimulus control (often the primary element of generalization training) but also stimulus class, response class, and various consequences that can be used to reinforce the target behavior. Furthermore, component behaviors should be addressed in relation to the generalized target behavior (i.e., programming may systematically emphasize component skills en route to an aggregate skill). Given the complexity of these variables, questions remain regarding which of these elements are necessary and sufficient to produce generalized responding. For example, how many responses within the stimulus class should be trained? What are the fluency criteria these responses should be trained to, and what is their relationship to the composite behavior? Is it the case that we always need to build fluency to a range of stimuli as well as provide reinforcing consequences across situations?

Fortunately, Stokes and Baer (1977) offer a variety of strategies that draw on many of the principles reviewed above. These can be employed and compared to answer some of these questions and facilitate generalization. Antecedent approaches consist of training sufficient exemplars, training loosely (instead of training hierarchical skills sequentially using simultaneous training methods), and programming common stimuli across settings or tasks. A variety of consequence approaches were also described such as sequential modification (training across settings), eliciting natural contingencies, indiscriminable contingencies (delayed or intermittent schedules of reinforcement), and mediated generalization (students monitor and report generalization which itself is reinforced).

Overview of the Special Issue

Over the last 10 years, great strides have been taken to emphasize student outcomes in academic achievement (see *Individuals with Disabilities Education Improvement*

Act of 2004 and the *No Child Left Behind Act*). One notable result of this was the adoption of Response to Intervention (RtI) models to determine special education eligibility. RtI models necessitate the use of empirically validated interventions in order to determine how a student responds to various types of instruction. Information about student's instructional gains gleaned from this process is considered along with the resources required to achieve an adequate response rate to determine the level of services that a child needs (Heartland Area Education Agency, 2007). To assist in this endeavor, there are a variety of empirically validated procedures available to increase the accurate and fluent responding of students. However, despite a consensus of opinion that generalized academic skills are paramount to student achievement, school psychologists and educators have few empirically validated procedures to promote the generalization of academic skills. The special issue presents a series of six empirical articles investigating procedures to promote the generalization of academic skills followed by a commentary from two leading researchers in the area. Four of the empirical articles deal with reading, and two address mathematics. Each of the articles investigates a unique method to obtain and/or detect generalized responding.

Three of the four articles that addressed the generalization of reading or early reading skills used some form of antecedent procedure (training multiple exemplars, common stimuli, and cuing), whereas the fourth study examined treatment format of, and the generalization gains from, a commonly employed and empirically supported reading intervention. Klubnik and Ardoin used an alternating treatments design to extend the research on repeated reading. These authors directly tested the impact of a repeated reading treatment package presented in two formats (group and individual) compared to a control condition on generalization passages that represented a 54% word overlap with intervention passages. In addition to examining the most efficient and effective format for instruction, a unique contribution of this study is that generalization passages served as the primary dependent measure. Maintenance of reading performance on these generalization passages was also examined.

Silber and Martens used a group design to compare the effectiveness and efficiency of two intervention procedures on generalized reading fluency. Specifically, a traditional repeated readings intervention and a multiple exemplar approach targeting key words and sentence structures were investigated. A rare but astute investigation of learning rate (i.e., achievement gains per minute of instructional time) was used to examine treatment differences in generalized responding. This study reiterates the positive effects that fluent responding has on generalization and highlights the importance of investigating intervention effectiveness by learning rate when compared to just learning.

Mesmer et al. used a multiple baseline design across participants to examine the effect of a common stimulus procedure designed to promote generalization from taught words to unknown words that contained similar word structures. The study programmed common stimuli by highlighting orthographically and phonetically similar cues, in this case, colored word endings. This study provides an example of when a "train and hope" approach fails to work and additional stimuli need to be incorporated into instructional methods to ensure generalization.

Duhon, House, Poncy, Hastings, and McClurg used a multiple baseline design across three students to examine correspondence between increases in letter sound fluency (LSF) and letter sound blending of nonsense words. After training students to mastery criterion levels on LSF tasks and examining the possibility of “train and hope,” these authors examined three generalization interventions that represented increasingly intense treatments; two cuing strategies as well as exemplar training. Results of this study are discussed in terms of the idiosyncratic needs that students may have when training for generalization.

The remaining two studies in this special issue of the *Journal of Behavioral Education* examine treatment generalization on mathematics performance. Poncy, Duhon, Lee, and Key examined the extent to which an explicit timing treatment package that increased fluency of addition facts to a mastery-level criterion resulted in generalized responding to related and unrelated subtraction fact families. In addition to “train and hope”, these authors examined the impact of conceptual instruction and fact family training using a cloze procedure on subtraction performance. This paper highlights the challenges that can be faced while programming for generalization.

Although various studies in the issue demonstrated that systematic programming was needed for generalization to occur, Codding, Archer, and Connell provided an example of an occasion when the “train and hope” method was actually successful. The researchers used a multiple probe design across problem sets to investigate the effectiveness of incremental rehearsal to increase accurate and fluent responding to multiplication facts. In addition, data were collected to observe whether generalized effects could be detected across various related skills including the completion of fact problems via a multiplication single-skill mixed-math probe, fractions, and multiplication word problems.

A series of themes can be identified among the papers of the special issue. Several studies explore the relationship between fluency under one stimulus condition and responding under a related stimulus condition without direct generalization programming. These studies explore whether generalized responding can occur without the additional use of instructional resources (i.e., “train and hope”). Although effective in some situations, a “train and hope” approach often times does not occasion generalized responding, and direct programming is needed. The majority of studies in this special issue examine various methods (mostly antecedent strategies) that can be used to directly program for generalization. As generalization programming can be time and effort intensive, some articles also investigate the efficiency with which these procedures can be implemented. We hope that this special issue draws attention to the importance of generalizing academic responding as well as some of the complexities and challenges that accompany this phenomenon. Each of the articles suggests and investigates methods to achieve generalized academic responding and may provide readers with effective and efficient options while dealing with academic problems. Although our understanding of how and/or when to program for generalization needs refinement, it is hoped that the current special issue will substantively add to the literature and perhaps facilitate future research in the area. As generalized responding is further investigated, our understanding of this phenomenon and the conditions under which it does and does not occur will hopefully increase and lead toward an explicit technology for generalizing academic behavior.

References

Ardoin, S. P., & Daly, E. J., I. I. I. (2007). Introduction to the special series: Close encounters of the instructional kind—how the instructional hierarchy is shaping instructional research 30 years later. *Journal of Behavioral Education, 16*, 1–6.

Binder, C. (1996). Behavioral fluency: Evolution of a new paradigm. *Behavior Analyst, 19*, 163–197.

Cuvo, A. J. (2003). On stimulus generalization and stimulus classes. *Journal of Behavioral Education, 12*, 77–83.

Daly, E. J., Martens, B. K., Barnett, D., Witt, J. C., & Olson, S. C. (2007). Varying intervention delivery in response to intervention: Confronting and resolving challenges with measurement instruction and intensity. *School Psychology Review, 36*, 562–581.

Haring, N. G., & Eaton, M. D. (1978). Systematic instructional procedures: An instructional hierarchy. In N. G. Haring, T. C. Lovitt, M. D. Eaton, & C. L. Hansen (Eds.), *The fourth r: Research in the classroom* (pp. 23–40). Columbus, OH: Charles E. Merrill.

Mesmer, E. M., Duhon, G. J., & Dodson, K. G. (2007). The effects of programming common stimuli for enhancing stimulus generalization of academic behavior. *Journal of Applied Behavior Analysis, 40*, 553–557.

National Mathematics Advisory Panel. (2008). *Foundations for success: The final report of the national mathematics advisory panel*. Washington, DC: U.S. Department of Education.

National Reading Panel. (2000). *Teaching children to read: An evidence-based assessment of the scientific research literature on reading and its implication for reading instruction*. Washington, DC: National Institute of Child Health and Human Development and U.S. Department of Education.

Shahan, T. A., & Chase, P. N. (2002). Novelty, stimulus control, and operant variability. *The Behavior Analyst, 25*, 175–190.

Skinner, C. H. (1998). Preventing academic skills deficits. In T. S. Watson & F. Gresham (Eds.), *Handbook of child behavior therapy: Ecological considerations in assessment, treatment, and evaluation* (pp. 61–83). New York: Plenum.

Stokes, T. F., & Baer, D. M. (1977). An implicit technology of generalization. *Journal of Applied Behavior Analysis, 10*, 349–367.