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Selecting effective intervention strategies for escape-maintained academic-performance problems: Consider giving 'em a break![☆]

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ABSTRACT

This study compared consequence-and antecedent-based strategies to determine which treatments or combination of treatments produced the strongest improvements in math computation fluency with four elementary-aged students whose math computation was under the control of an escape contingency. Functional analyses were conducted to identify elementary-school students whose academic responding was under a negative-reinforcement contingency. A multielement design was then used to examine the impact of four treatments (DNRA, DRA, task choice, and task choice plus DRA) on each student's rate of correct digits per min. All four treatments increased rate of responding. Differentiated results were obtained for all participants, indicating a reliable effect. Yet, participants responded differently to the treatments, illustrating the need to investigate and adapt interventions for escape-motivated behavior on a case-by-case basis. Results are also discussed in terms of the effectiveness of choice relative to reinforcement procedures, whether there were additional benefits to combining treatments, and which type of reinforcement procedures (DRA or DNRA) appears to be more effective for students whose behavior is under the control of an escape contingency.

1. Introduction

The National Math Advisory Panel (2008) identified multiple variables over which educators have direct control that influence a student's progress in math, including curricular content, instructional methods and materials, and teacher preparation. While a school system's choice of high-quality curriculum, instructional methods and materials, and well-qualified teachers will likely have a positive overall impact on the general level of math proficiency in the local student population, there is still no guarantee that they will eradicate difficulties for all students. The emergence of Response-to-Intervention as a multi-tiered instructional model represents a practical acknowledgement in the educational community of the need for a continuum of remediation that varies in intensity to meet the needs of all students. Indeed, almost one in five (18%) fourth-graders and one in three (29%) eighth-graders are below the basic level of math achievement in the United States (National Center for Education Statistics, 2015), and are at risk for continuing to lag behind their same-aged peers in the absence of effective remediation.

But, "more of the same" instruction with greater frequency for these students is not necessarily the answer, however common that response may be in some educational settings. When a student fails to meet curricular expectations, the reason for poor proficiency

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lies somewhere in the complex interaction of the student's current skill level, his or her motivation, and curricular, instructional, and teacher decision-making practices (Howell & Nolet, 2000). Although it is virtually impossible (and not necessary) to validly reconstruct the specific variables that resulted in poor proficiency for a particular student, educators do have a responsibility to differentiate instruction according to individual student need, particularly in math (Chard, Ketterlin-Geller, Junghohann, & Baker, 2010). For instruction to be effective for students experiencing academic difficulties, educators need valid models for adapting instruction with greater precision to the students' skill and motivational levels.

Well over 40 years ago, Bijou (1970) exhorted the field of school psychology to embrace an approach to intervention that rigorously adhered to the scientific method with a unique methodology and a distinct conceptualization of what causes problems in human learning. Applied behavior analysis (ABA; Bijou's recommended approach) is characterized by the analysis of well-validated controlling variables for the purpose of identifying individualized interventions, which is consistent with more modern precision-based approaches to intervention programming (Bickman, Lyon, & Wolpert, 2017). Relying on robust and generalizable principles of behavior, behavior-analytic practitioners examine the function of behavior as emerging from the interaction between an individual (a student in this case) and the natural environment, which will be the classroom in school-based applications. It is expected that controlling variables will vary from case to case because of students' different learning histories, meaning that treatments must be differentiated according to the controlling variables that are operable for a particular student at a given time. Yet, it is also expected that controlling variables can be reliably identified through replications carried out using single-case experimental design elements. Thus, each new case calls for an individual analysis and an investigation is conducted until the examiner identifies a reliable effect, very much in line with recent calls for Precision Mental Health practices (Bickman et al., 2017). Within this approach, one does not assume that the same treatment will be valid for different students, but one investigates until a clear pattern emerges in the data to indicate which treatment is most valid for that student. The conceptual framework is based on principles of behavior like reinforcement and stimulus control (Catania, 2007) and the investigative method is functional analysis, which has enjoyed enormous success for over 30 years (Beavers, Iwata, & Lerman, 2013).

From a behavior-analytic perspective, to complete an instructional exercise like a math computation problem, a student's behavior must come under the stimulus control of the numbers composing the problem (e.g., "7 + 4 = ") and not be controlled by other stimuli like a teacher prompt, which suggests that responding is dependent on something other than the natural stimulus that should evoke the behavior (the math problem). Stimulus control comes about through the application of differential reinforcement (Miltenberger, 2016). In the classroom, the teacher may deliver a programmed reinforcer (e.g., social attention like "Correct!" or points as a part of a token economy) for a correct response and withhold reinforcement when an incorrect response is given. To speed up the effects of instruction, the teacher can add modeling, prompting, and/or error correction to differential reinforcement (Daly, Lentz, & Boyer, 1996). Therefore, according to this model, if a student does not give a correct unprompted response when presented with "7 + 4 =," either the response is not under sufficient stimulus control or, if it is under stimulus control, the consequence for responding is not sufficiently reinforcing, each scenario necessitating different actions on the part of the teacher. Lentz and Shapiro (1986) and Lentz (1988) made a useful heuristic distinction between skill deficits (the former reason for a lack of responding) and performance deficits (the latter reason for a lack of responding), and VanDerHeyden (2014) describes a variety of methods for assessing skill and performance deficits. With a skill deficit, the student cannot give the correct response, regardless of how strong the consequence is. With a performance deficit, the student can give a correct response but chooses to behave otherwise (according to competing contingencies for other behavior).

While many students' math difficulties are due to skill deficits, some students' math difficulties are due to performance deficits. The problem is that the reinforcing contingencies are not strong enough to maintain responding relative to available contingencies for other behavior. In this case, responding improves with a change in consequences and not with instructional strategies like modeling, prompting, or error correction, which would be more appropriate for a skill deficit. Thus, if a student's academic responding increases when effective consequences (reinforcers) are presented and no additional instructional assistance (e.g., modeling, prompting) is offered, a performance-deficit is inferred, and an intervention emphasizing consequences is indicated as the preferred treatment (Daly, Witt, Martens, & Dool, 1997; VanDerHeyden, 2014). For a performance-deficit, two types of consequences can increase behavior. Contingent access to preferred stimuli of some type (e.g., social attention, a preferred activity, food) that leads to increased responding is a positive reinforcement effect. Contingent termination of a demand (e.g., removal of an instructional exercise) that leads to increased responding is a negative reinforcement effect.

It may be helpful to consider both options (positive and negative reinforcement) when dealing with a performance deficit. Hofstadter-Duke and Daly (2015) reported the results of a study in which they conducted functional analyses that differentiated controlling variables (adult social attention, peer social attention, and escape) among participants whose behavior was already under stimulus control for the math problems used in the analyses. In this study, they applied different types of reinforcing consequences for completing problems (unlike a traditional form of functional analysis in which reinforcement is delivered for engaging in competing problem behavior). Social attention (adult attention for one participant and both adult and child attention for another participant) served as effective reinforcers for increasing responding for two participants, whereas task escape (allowing a brief break) served as an effective reinforcer for the third participant. Therefore, even for a student displaying a performance deficit, one can expect individual differences in terms of types of reinforcing consequences (positive versus negative reinforcement) that influence just how much work the student completes, which means that treatment for performance-deficit problems might need to be further differentiated to achieve maximum effect.

The results of such an analysis have clear implications for treatment selection because they directly test different types of consequences that may then be used as a therapeutic intervention. For students displaying escape-motivated behavior, a logical treatment selection is differential negative reinforcement of alternative behavior (DNRA; Geiger, Carr, & LeBlanc, 2010). With DNRA, a