ISSN: 3049-7272

Review Article

Journal of Biomedical Sciences and Biotechnology Research

Understanding the Role of Differential Reinforcement in Applied Behavior Analysis, to Reduce Thumb-sucking in Children- A Literature Review

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Received: March 15, 2024; **Accepted:** March 22, 2024; **Published:** March 29, 2024

ABSTRACT

The paper attempts to explain how differential reinforcement in applied behavior analysis works in shaping positive behaviors in the daily lives of children. Especially, some behaviors whose function is identified as 'sensory', like thumb-sucking are automatically maintained because reinforcement comes merely by engaging in the behavior. Such behaviors which feel good to children, that is appeal to their sensory needs, are hard to get rid of, and they come to be known as 'bad habits' in the common language of the world. The objective of the paper is to describe differential reinforcement as it applies to behavior analysis, and establish how the ABA procedure have been successfully implemented to reduce automatically maintained behaviors like thumb-sucking. The method of the paper is a literature review of contemporary researches that describe differential reinforcement in applied behavior analysis and focuses on the strengths and weakness of its core principles. The paper also analyzes a major literature which has implemented DRA as an intervention for reducing thumb-sucking in a 5-year-old girl. From the results, it is evident that DRA can be used as an effective intervention for reducing thumb-sucking behaviors in children.

Introduction

Differential reinforcement embedded in the theories of Behaviorism, is an operant procedure in applied behavior analysis, used to increase the occurrence of desirable positive behaviors while still simultaneously decreasing the undesirable behaviors (Vladescu et al., 2010). The strategy is crucial to behavior analysis for reducing problem behaviors because it uses positive reinforcement method to selectively reinforce specific behaviors while ignoring or discouraging the others. Positive reinforcement can be defined as the occurrence of behavior followed immediately by the presentation of stimulus which can increase the future frequency of the behavior in similar situations (Cooper et al., 2020). Therefore, differential reinforcement can be considered a variation of positive reinforcement where the situation is selected by the implementor to reinforce a child, such that certain positive behaviors increase in future, while challenging behaviors cease to occur (Weaver et al., 2021).

The two basic principles of differential reinforcement are extinction and positive reinforcement. Extinction is withholding attention for certain behaviors which we want to extinguish and positive reinforcement is appropriately providing attention, appreciation and reinforcing stimulus for desirable behaviors when they happen (Cooper et al., 2020). Both these procedures need to be implemented simultaneously during differential reinforcement for the intervention to work effectively. However, other factors like schedule of reinforcement and consistency are key to the success of differential reinforcement procedures. There are four types of differential reinforcements - DRA, DRO, DRI and DRL.

1. DRO is Differential Reinforcement of Other Behavior,
2. DRA is Differential Reinforcement of Alternative behavior,
3. DRI is Differential Reinforcement of incompatible behavior and
4. DRL is Differential reinforcement of Low Rates of behavior. Each of them refers to reinforcing different response classes of behavior as their name suggests and withholding reinforcement for the other response class (Cooper et al., 2020).

DRA is often used to reinforce an alternative behavior, instead of the target behavior so that the target behavior goes down. This method has been found to be effective for reducing thumb-sucking in ABA clinical practices by often providing a replacement behavior serving the same function, for example, chewy (Basu, 2023). However, therapist, practitioners and caregivers need to be aware about the hazardous effects of non-

Citation: Oyindrila Basu. Understanding the Role of Differential Reinforcement in Applied Behavior Analysis, to Reduce Thumb-sucking in Children- A Literature Review. J Biomed Sci Biotech Res. 2024. 2(1): 1-3. DOI: doi.org/10.61440/JBSBR.2024.v2.07

nutritive sucking items on the health of the individuals before providing a replacement reinforcer (Weaver et al., 2021). But in order to understand how differential reinforcement methods can improve bad habits like thumb-sucking, or how important are they for implementation or improving a child's life, it is essential to understand what 'bad habits' are and how they stick with and individual and affect their social development.

Thumb-sucking is an adaptive and normative behavior which can emerge in early childhood for purposes of defense mechanism or sensory pleasure. But if the behavior stays with the child for along time later into developmental age, it can lead to socially significant and or medical problems (Weaver et al., 2021). Let us consider a situation - A child sucks his thumb every time, everywhere; in class, in the park while playing, at home. Gradually, teachers, neighbors, and peers start complaining about this habit because it is unhygienic for others and also harmful for the child's health. Now every time the child sucks his thumb, mom shouts "Don't do it", the child continues the behavior, the mom spanks at his thumb to stop him. Why do you think it is so had to get rid of bad habits? Probably the same reason why it is hard to take our eyes off a street accident, or stop watching viral news (Basu, 2023). The brain's negative bias can be a really powerful tool in controlling our actions, creating our personalities and affecting our decisions, so we keep fixated on bad habits (Suttie, 2020).

However, applied behavior analysis base therapeutic decisions on evidences and holistic functional analysis of behaviors, that is why a behavior is occurring in an environment, instead of making assumptions based on mentalism, as to what could be going on inside the child's head (Basu, 2023). In fact, one of the fundamental scientific philosophies of ABA is parsimony which teaches practitioners to rule out the simple explanation for a behavior first, before considering complex explanations (Cooper et al., 2020). For e.g., a child doesn't want to eat; simple explanation can be he is not hungry. We do not start considering that the child might be having an existential crisis before ruling out the fact that he might not be hungry. Therefore, a parsimonious explanation for thumb-sucking in children would be, because it feels good to their senses. But punishment is not an appropriate method for reducing the challenging behavior, so even when mom spanks at him, the child doesn't stop sucking thumb.

A negative reaction is also a reaction which may help maintain the sucking behavior. Hence, we have to use extinction or planned ignoring for some challenging behaviors because statements like "don't do it", can actually provide the needed negative attention to the behavior and maintain it. Moreover, punishment can often trigger more complex problematic behaviors, so applied behavior analysis advocates on focusing into positive strategies, which is why differential reinforcement of alternative behavior can be understood as a solution to thumb-sucking in children (Basu, 2023).

Literature Review

Weaver et al., emphasizes on the negative consequences of thumb-sucking behavior in children (Weaver et al., 2021). Thumb-sucking is an adaptive and normative behavior in early childhood but if it persists later in the developmental phase, it can cause socially-significant and or medical problems affecting the child's health and social situation (Weaver et al., 2021). Thumb-sucking is a non-nutritive sucking behavioral habit which is found in 73% of children between ages 2-5 years. The behavior tends to stop as the children grow up but the behavior has been found to "persist in 1.9% of 12-year-old children" (Weaver et al., 2021). If thumb-sucking continues into late childhood, detrimental health effects like nail deformity, dental malocclusion, digital deformities, speech difficulties and paronychia may occur. Also, the negative effects of non-nutritive sucking on digestive systems are also under discussion (Weaver et al., 2021). Besides, the behavior can create social stigma for children as peers may avoid the child due to unhygienic reasons. Hence, we understand the importance of targeting thumb-sucking behavior.

Vladescu et al. identify the necessity of differential reinforcement procedures in early intervention programs because children in EI often do not require skills in the absence of motivational operations, but recognizes that prompting procedures may be required to use differential reinforcement in EI programs because children in these curriculum may not have the necessary skills in their repertoire (Vladescu et al., 2010). Another important criterion in early intervention is independent response from the child, which makes sure that the child can emit a response without assistance which also proves that the intervention has been effective (Vladescu et al., 2010). From this literature, we understand that if differential reinforcement with appropriate prompting procedures and prompt delays are implemented in early intervention programs, EI can be helpful in reducing behaviors like thumb-sucking that emerge in early childhood (Vladescu et al., 2010).

Athens et al. focuses on the challenges that we may have to face while implementing the principles of differential reinforcement (Athens et al., 2010). One of the challenges can be implementation of extinction with fidelity. DRA typically involves withholding reinforcers following problem behavior (extinction) and providing reinforcers following appropriate behavior (Athens et al., 2010). Even though extinction is important and powerful tool of DRA, it is not always possible to implement it in real time scenario due to other ethical and practical issues. For example, we cannot use extinction for self-harm behaviors because not blocking SIBs is a major ethical concern for practitioners and caregivers while working with a client who exhibits such behaviors (Cooper et al., 2020). Hence it is difficult to withhold attention/reinforcement for behaviors maintained by attention due to physical contact like blocking, for e.g., a child's attention-maintained eye-gouging can be a threat to his/her eye-sight so the therapist or caregiver will have to block such behavior, therefore in such situations, extinction cannot be implemented with integrity (Athens et al., 2010).

But Vladescu et al. have explained some other factors that can be controlled while implementing differential reinforcement such that intervention is more effective, such as varying the schedules of reinforcement which is also an important component of DRA programs (Vladescu et al., 2010). Research has found that when fixed ratio schedules were variably used, differential reinforcement was more effective. In a sample test, FR1 schedule was used to reinforce every independent correct response, and FR6 or 8 was used for prompted responses during tact training. A 5s prompt-

delay mechanism was also practiced. The results from the study found that all participants had the highest accuracy and number of independent responses on the FR 1 schedule for independent responses indicating that schedules of reinforcement that favor independent responding can bring in rapid skill acquisition an information which may be favorable for implementing DRA too (Vladescu et al., 2010).

Weaver et al. on the other hand, conducted their research using single-subject research design, on a 5-year-old girl who had thumb-sucking behavior (Weaver et al., 2021). Data was collected with antecedents and consequences to determine what caused the behavior. Caregivers were also interviewed for behavior assessment. From the FBA it was found that the behavior was maintained by automatic reinforcement (Weaver et al., 2021). Therefore, they created a detailed intervention plan based on DRA, through phases and sub-phases, which on implemented on the child over 16 sessions, after which the skill was mastered with mean frequency of 4.31. After phase 3, without thumb guard and shift of reinforcement, the frequency of thumb sucking 0.56 (range 0-4). With implementation of DRA intervention, thumb-sucking behavior decreased significantly through all the phases.

Discussion

DRA refers to differential reinforcement of alternative behavior, which is one of the four differential reinforcement methods used in applied behavior analysis for reinforcing appropriate behaviors and reducing problem behaviors (Cooper et al., 2020). DRA can be used to reinforce an alternative behavior instead of the exact challenging behavior we want to see go down in frequency. Most often a replacement behavior serving the same function is offered to a child and reinforced through DRA, to fade away the probability of the problem behavior. E.g., a child sucks and bites his thumb, adult/mom gives him a sucker or chewy to suck and bite on, as a replacement. If the child appropriately asks/takes the chewy every time he has the urge to mouth his thumb, the adult/mom gives high verbal praise "great job using your chewy" and allows him to play by himself for a while (Basu, 2023).

From the literature review, we found that implementing differential reinforcement procedures may have challenges like implementing extinction with integrity. It may be difficult to implement extinction procedures with fidelity in real life situations especially if doing so means harming the child (Athens et al., 2010). On the other hand, we can focus on schedules of reinforcement which are more in our control. Research indicates that varying schedules of reinforcement have been useful is expediting skill acquisitions, hence they can be useful in implementation of DRA too (Vladescu et al., 2010). Varying the schedules of reinforcement can be especially helpful in the fading phase of DRA, when we might want to convert DRA to DRO gradually, so that we provide a meaningful reinforcement when the child no longer engages in any type of sucking or mouthing at all, which is our ultimate goal.

We have to acknowledge the fact that even though providing a replacement item like a chewy or mouthing object instead of thumb may be our first step, but non-nutritive sucking can have long-term health hazards which therapists and caregivers should recognize so we have to fade away the intervention which was also done by the authors of the research where DRA was implemented on the 5-year-old girl, MaTi to extinguish thumb-sucking behavior (Weaver et al., 2021). Hence while implementing DRA or any differential reinforcement procedure, the behavior analysts and caregivers should identify the end objective clearly, and then carefully construct an intervention plan with proper prompting, prompt delay and intervention fading procedures, for the DRA program to be successful and effective.

Conclusion

Thumb-sucking is a very common negative habit in kids which is extremely hard to get rid of. Differential Reinforcement is a powerful tool within the realm of ABA, promoting positive behavior change through the strategic reinforcement of desired behaviors while minimizing reinforcement for undesirable ones. This approach recognizes the individuality of behaviors, and tailors reinforcement strategies to meet the unique needs of each person undergoing behavior modification. If DRA is implemented with consistency and fidelity, it can be very helpful in reducing the frequency of such mouthing behaviors.

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