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Review Article

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Role of Applied Behavior Analysis in Developing Expressive Verbal Communication in Intermediate Learners with Autism

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ABSTRACT
Verbal behavior is a fundamental mode of communication and human interaction. Any form of obstruction in the performance of verbal behavior can lead to life-long impairment. In this paper, I want to do a literature review of four research articles, which focus on different treatment strategies based in applied behavior analysis, to improve the verbal and expressive communication of children with autism. I also want to propose a methodology for intervention based in applied behavior analysis which can improve all the different operants of verbal behavior. The proposed intervention involves a combination of visual perceptual aids, verbal shaping, stimulus fading and stimulus transfer. As my objective is to improve the communication of intermediate learners who are more functional, we can improve evidence-based music therapy as well in developing speech structure and consistency in learners.

Keywords: Applied Behavior Analysis, Verbal Operants in ABA, Visual Perceptual Stimuli in ABA, Verbal Behavior, Expressive Verbal Communication, Verbal Behavior in Autism, Autism Spectrum Disorder

Introduction

One of the major deficits in children with autism, remains the shortage of verbal and communication skills, and it is earliest signs of autism, yet lack of verbal behavior on its own doesn't substantiate for diagnosis of autism [1,2]. Improving and developing communication skills may become additionally challenging in intermediate learners who have a moderate level of functionality in verbal communication but lack the appropriateness and range to effectively communicate with people in different environments.

For e.g., a child who goes to school, can do reading and math, but cannot form 3-word sentences for asking what he wants can be an example of communication skill deficit that is hard to form and develop. Such a kid may be able to ask for bathroom, but may not be able to respond when asked a general question like 'what did you do in school?' or 'where did you go yesterday'. He may have the intraverbal skills to give one-word responses when asked about objects based on their function, however, he may not be able to describe the same object in a full sentence during a conversation. That is, he may be able to say "ball", if you ask him "what do you play with", but may not have the skills to describe a ball in terms of its shape, color, function etc. especially in a sentence [3].

Potential Problems with Developing Verbal Behavior in Intermediate Learners and Literature Gap

There can be several causes which affect language skills in children of the developing age, more so, a longer delay may be caused to children who have some language skills but not sufficient to fulfil positive communication outcomes. These include autism as a disorder itself, lesser exposure to multivarious stimuli in the environment, ineffectivity of standard intervention procedures that are not relevant for a functional child, lack of awareness on the part of parents, teachers and caregivers or lack of motivation [4]. When I speak about the absence of effective teaching methods for developing verbal behavior in intermediate learners, I indicate that there isn't sufficient literature on instructional methods that can be relevant to more functional

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learners on the spectrum to improve their exposure to different stimuli such that they can construct sentences expressively.

Standard applied behavior analysis interventions that are used for verbal behavior skills in children with autism, like PECS are not applicable to these children, because they do not need picture icons to ask for basic necessities like candy or bathroom in one word. More in-depth understanding of objects and their features and the environmental contexts in which they appear are necessary to develop relational frames which will help them identify stimuli in different social and environmental contexts and use prior knowledge to build on their future communications [5]. Such training procedures can be complex due to limited literature on specific interventions that can accelerate the verbal repertoire of intermediate learners who have moderate capability in emitting 3-4-word mands, tacts etc. but may not be able to contextualize responses, receptively [3]. It can also be labor intensive on the part of therapists, analysts and caregivers to maintain consistency with teaching loosely as the learner finds himself in different social environments [5].

Research indicates that highly structured behavioral methods based on applied behavior analysis can have positive effects on early communicative skills of children with autism, in fact, behavioral sciences can improve frequency, form and consistency of communicative performance in children with ASD [6]. Other treatment strategies like visual-perceptual aids, receptive identification training, shaping, stimulus fading and stimulus transfer can be implemented complimentarily in therapy sessions to induce effective verbal communication in intermediate learners. Additionally, technological tools like AI and even music therapy integrated in ABA have been found to be effective for improving verbal behavior in kids with autism spectrum disorder [7].

Literature Review

Different visual methods can help learners develop the verbal operants of tacting, matching, manding and intraverbal skills. PECS are the most popular visual methods for teaching children with autism the skills of manding, i.e., asking for a required item. Similar function is served by technological devices for communication like the AAC. DeAlmeida et al. describes the impact of implementation of picture exchange communication on understanding of instructions in children with autism [8]. Picture Exchange communication uses a board with different images, often called icons, which the kids can pick or point to indicate what they require or want. However, the images need to be paired with the item of desire and that is a time-consuming process.

Picture exchange communication happens stepwise, starting with the learner learning to pick the icon and handing it to the adult who has the reinforcing item. Following it, comes pairing of real objects with images of the icons, and then receptive identification of objects and response when SD "what do you want" is presented. The aforementioned research focuses on how the implementation of PECS could impact how children with autism followed instructions. The longitudinal study consisted of 15 non-verbal boys and 5 girls, aged 6-12 years, on the autism spectrum according to DSM-V diagnosis criteria [8]. For assessment, the researchers used 8 visual instructions and 8 oral instructions that were applied at two points of the PECS implementation program, phase II and phase IV. The program consisted of 24 individual speech therapy sessions with the presence of a family member and followed the six phases originally proposed by the PECS Training Manual [8]. The study used tools and instruments like Autism Behavior Checklist, which is a list of 57 non-adaptive behaviors divided into five areas, SON-R 21/2-7 and Vineland Adaptive Behavior Scale for assessment [8].

To check the verbal output of children, the average extension parameter of Vocal Behavior Assessment was used. The PECS program was implemented over 24 speech-language sessions of 45 minutes each. The McNemar test was used for statistical analysis of data. The results indicated expressive increase in the understanding of instructions while compared between two points of the study where the PECS were implemented, and this increase was statistically significant in six of the oral instructions ($p=0.001$) and five of the visual ones ($p=0.002$) [8]. This research proves that visual aid in the form of PECS can help in improving comprehension skills as well verbal output of children with autism.

Gillian R. Hayes and his team have also advocated for the effectivity of visual supports as cognitive tools for learning and production of language but they haven't negated the fact that such tools are time taking, costly, difficult to produce on paper and distribute [9]. This article refers to Kanner's study of Early Infantile Autism and discusses a set of five conditions that can be set as criteria for diagnosis of autism in the early ages, usually during the first 3 years of life [9]. The study proposes the use of technological devices as visual tools to support cognitive learning, in order to eliminate the limitation of reproduction and distribution of handmade paper instruments. To address the design challenges of typical visual support systems, the study presents large group displays, mobile personal devices and personal recording technologies. As we know, use of iPad and mobile phones have become extremely prevalent in children, including children with autism. These visual supports are used frequently to encourage communication and learning in children. The researchers indicate that these tools typically include speech-generation functionality, eye tracking, and other advanced features, such as those shown in the DynaVox suite of devices. In other cases, the components can also be used to induce understanding of time, order, events and follow visual schedule [9].

However, the researchers consistently mention the challenges that teachers and caregivers face in implementing, recording and monitoring the effectiveness of visual support systems with kids on the spectrum, therefore, they refer to companies like UbiCom who have made technological alternatives for these supports, and propose three interventions grounded in novel interactive visual supports that can be easy to implement, easy for record keeping and consistency of therapy [9]. They initially conducted a fieldwork in 3 schools of Orange County, California, by interviewing three educational instructors and took their feedback collectively, to understand the limitations and challenges of the existing visual tools. Based on the input, they introduced three technological interventions across two focus groups (n=13 and n=8). The interventions namely were

Mocotos prototype mobile devices, vSked interactive and intelligent visual schedules, Microsoft SenseCam: automatic recording of daily images. These tools were observed to be used for the functional categories of prompting, selection, mediated speech and basic communication [9].

From the results of feedback of participants, the researchers found that since the interventions were computer supported, they were effective in improving learner-caregiver relations and communication; they could also support caregivers in implementing, record keeping and maintaining consistency of interventions with learners. Educators also indicated the use of these devices for setting goals and monitoring progress that are required for IEP in schools. However, these devices had issues with flexibility, especially with customization. As every child is different and children with special abilities need the individualized support to meet their skills and goals, the high tech devices have limited scope for customization for every individual [9]. From this study, we can derive that modern technical gadgets can also be implemented as visual tools to some extent for improving the communication skills of children with autism.

Additional therapies can often be beneficial too. To explore the concept, we can review the paper of Hayoung A. Lim and his peer, who have highlighted on the effectivity of music therapy combined with applied behavior analysis, versus regular applied behavior analysis alone, on the verbal behavior output of children with autism. This study explored how "the perception of musical patterns incorporated in ABA VB opérants impacted the production of speech in children with ASD. Participants were 22 children with ASD, age range 3 to 5 years, who were verbal or pre verbal with presence of immediate echolalia. They were randomly assigned a set of target words for each of the 3 training conditions: (a) music Incorporated ABA VB, (b) speech (ABA VB) and (c) no-training. Results showed both music and speech trainings were effective for production of the four ABA verbal opérants; however, the difference between music and speech training was not statistically different" [7].

Target words or phrases were categorized under the four main verbal operants, mand, tact, echoic and intraverbal. The target words for mand were: (a) East Slow, (b) Loud Soft, (c) Stop Go, (d) Drum Guitar, (e) Car Train, and (f) Sing All Done, Target words for tact were: Brown Horse, Black Cat, Blue Fish, White Sheep, and Pink Pig, Target phrases for echoic were: Have a good day. Good morning, Nice to meet you, I love you. See you later, and / want more. Target words for intraverbal were: Eun, Happy, Hug, Point, Eat, and Friends, Target words and phrases were selected from functional vocabularies that 2 to 3-year-old typically developing children can use effectively in everyday interactions [7]. These target words were included in the songs designed by the investigator, such that each lyric line ended with a target word. The results showed that both music and speech training could be effectively used for improving verbal behavior. Results also indicated that music combined ABA Verbal behavior approach was most effective in echoic skills, and speech training in tact behavior [7]. From the study, we can conclude that music-based ABA therapy can be useful for developing verbal behavior of children with autism.

Another research by Joseph Vedora and his peers support the use of visual aids for teaching intraverbal skills in learners with autism [10]. Intraverbal response can be a very important skill especially for functional learners who have some verbal behavior but cannot express themselves while making associations with concepts and objects in real time. For e.g., a learner knows what a ball is but cannot explain 5 things or characteristics about a ball. Intraverbal training with 'what', 'when' and 'where' can often help with such associations and assist the learner in framing 3-4 word sentences for communication. The researchers in this paper discusses the challenges of verbal echoic prompts for intraverbal teaching, such that they make the children prompt dependent, therefore, they have proposed alternate visual supports like text prompts to make the intraverbal learning more effective [10].

For the study, 2 7-year-old boys were selected as participants, who were on the spectrum, and could emit 3 to 4-word sentences and follow one or two-step instructions. 10 minutes sessions were conducted twice a day with each participant, where three sets of questions were presented, and baseline data was collected. Following which, textual prompt was used as an intervention to support skill acquisition [10]. The results from the study indicated that textual prompts were more effective than echoic prompts for intraverbal learning and use of visual cues were further discussed in the paper [10].

The current literature that we have reviewed, each focuses on single specific intervention procedure that were tested on children of a certain demographic to improve verbal behavior. However, none use the approach of combining different teaching methods or instructional processes to effectively progress expressive communication, whereas in a practical scenario, no one method can always help in bringing about the most effective outcome for the child. Behavior analysts often combine multiple different treatment procedures in a treatment package to implement meaningful change in socially significant behavior [5]. Since none of the available literature speaks about a treatment package for verbal behavior, my research will attempt to fill in this gap, by proposing a methodology which will combine different alternative therapies of stimuli support and exposure combined with reinforcement principles of ABA to develop expressive language skills in children on the spectrum. Also, how technological tools can be best implemented along with affordable tools in applied behavior analysis for visual aid, will also be discussed.

Proposed Methodology

From the literature review, we can deduce that applied behavior analysis in combination with different tools and strategies, and alternative therapies can help improve the verbal expressive communication of children with autism. Based on the understanding, I want to design an intervention which will be a combination of visual-perceptual training, receptive identification training, intraverbal training, shaping, echoic and textual prompts, such that functional adolescent learners can demonstrate effective social communication. To test this intervention, we can use single-subject research design across different verbal operants of mand, tact and intraverbal behavior. The target positive response is 3-4-word sentence for each of the operants. We want to compare the effectivity of each intervention method, hence an alternating treatment design in three phases

can be used to select the most efficient method for generating verbal responses [5]. Additionally, multiple baseline design across the five target behaviors can be collected and graphed to see which verbal operant is progressing more with the respective intervention. For the purpose, a male or a female participant of the age group 9-15 years, who goes to middle school under Individualized Educational Program, can be selected as the experiment sample. The participant must have some verbal repertoire such as being able to use single or two words to ask for items, should be able to follow visual prompts and should be able to respond with single words.

To start the procedure at a moderate scale, I suggest five goals to begin the experimental intervention. The targets can be as follows "describing ongoing activity in 3-4-word sentences", "tacting common actions from real observation of behavior", "mand for desired item in 3-4 word sentences", "explain why someone is angry/sad/happy/frustrated/excited" and "follow conversation volley about preferred items: basketball, grocery, Chick-fil-A". Let us understand how each intervention will look like:

Describing ongoing activity in 3-4-word sentences

Goal: Learner will describe 20 different ongoing activities in 3-4-word sentences, with at least 2 adults across all environments without engaging in challenging behaviors, with 80% independence over 5 consecutive sessions.

Implementation: When the client is working on a task or engaging in reinforcements in the natural environment, use the opportunity and motivation to place SD, "what are we doing now". The learner should be able to describe "we are working on math problems", or "we are playing ball in the garden", "we are reading a story book" etc. as per the context of the activity without prompts. Start with errorless teaching by exposing him to the correct answer initially, then fading prompts from full-verbal to partial verbal, then gestural and so on. Use multiple exemplar training and stimulus generalization by providing visual cues through technological tools like video games. For e.g., the child like to watch basketball games on computer; use his motivation to ask while he is watching, "what are the players doing"/ "what is happening in the game now"; the learner should be able to describe "the players are playing basketball" or "the Mavericks are winning with 1/0" etc. as applicable. If learner respond correctly, provide high verbal praise, and let him engage with the reinforcement immediately, or continue with it for an additional 2 minutes.

One of the potential solutions to the problem of limited exposure, would be to use extensive visual supports as intervention, in the form of technological gadgets that can expose the child to various different visual cues and stimuli in different interfaces and environment, which may be virtual but provides variety and range for learning [9]. Technology is the reality of today's world, and whether we like it or not, children are most often exposed to technological devices like mobile phones, video games, iPads and other media with display screens. Research has proven that such devices have advanced in a way to develop speech, eye-tracking and adaptive functionality of children [9]. In current times, even AI and virtual reality in ABA therapy is being researched upon. Showing more videos of action items, objects, people, human expressions and social situations on technological devices like iPad, iPhone, Virtual reality devices etc. can increase the exposure of the child even within a restrictive supervised environment.

Tacting common actions from real observation of behavior

Goal: Learner will tact 20 different actions in real world in 3-4-word sentences, with at least 2 adults across all environments without engaging in challenging behaviors, with 80% independence over 5 consecutive sessions.

Implementation: When child is watching video game on basketball, ask him "what is the man in yellow shirt doing", he should be able to say "he is throwing the ball". Children learn most from their organic natural environment, so pretend actions and ask him to tact them in full sentences too. For e.g., "what am I doing", he should respond "you are drinking", "you are dancing", "you are eating", "you are sleeping" as applicable. Implement stimulus generalizations by varying contexts and people like asking same questions when sister or mom are doing an action, or performing the target in different environments so that the response in evoked under different stimuli [5]. Start with errorless teaching by exposing him to the correct answer initially, then fading prompts from full-verbal to partial verbal, then gestural and so on. Provide reinforcement immediately, if he is able to respond independently.

Mand for desired item in 3-4-word sentences

Goal: Learner will mand 20 different items in 3-4-word sentences, with at least 2 adults across all environments without engaging in challenging behaviors, with 80% independence over 5 consecutive sessions.

Implementation: Like any mand training, if the learner is motivated for a particular item or activity, withhold access to it and place SD "what do you want". The learner should respond, "I want break for 5 minutes", or "I want to play basketball" or "I want to go to the garden" or "I want a cupcake" etc. as applicable. Prompting may include verbal and visual support. Use a PEC board with customized icons which will have common nouns, verbs, adjectives and potentially reinforcing items and activity icons for the specific learner. Show him the PEC board initially to prompt him use multiple words and phrases to communicate his need. Do not reinforce one-word responses, provide access to reinforcement only if he appropriately uses 3-4 words verbally for each mand while pointing to the icons on the PEC board if necessary. Fade stimulus prompt by removing PEC board and gradually moving to partial verbal [5].

Visual support can also be additionally implemented through existing evidence-based ABA methods like PECS. If the PEC board can be integrated into social situations as a medium to use 3-4-word sentences for manding, expressing, responding etc., just like an AAC device, it can help with the child's classroom communications, peer networking, expressive communications etc. [4]. For e.g., the picture icons on the PEC board can have nouns and pronouns, common verbs and adjectives like 'I', 'want', 'can', 'go', 'milk', 'ball', 'cup', 'tea' etc. so that whenever the child is ready to communicate in single-words, he can be prompted to say full sentences using the PEC board. Visual assistance and read through the picture icons on the

PEC board can gradually build up the repertoire of the child to learn new words, phrases, expressions. A PEC board can be helpful for teachers at school and therapist to prompt expressive communication in more natural environments, where other technical devices may be hard to carry or implement [4].

Explain why someone is angry/sad/happy/frustrated/excited/worried

Goal: Learner will explain 10 different emotional expressions in full sentences, with at least 2 adults across all environments without engaging in challenging behaviors, with 80% independence over 5 consecutive sessions.

Implementation: Show the learner digital images of real people emoting expressions 'angry', 'sad', 'happy', 'frustrated', 'excited', 'peaceful', "worried" respectively and place SD, "can you say why someone is angry/happy/sad…" etc. The learner should explain at least one reason for each emotion in full sentence, example, "a person is angry because someone did wrong to him" or "a person is worried because he has a problem" etc. as applicable. Begin with errorless teaching by exposing him to the appropriate responses for each emotion. Then gradually fade verbal prompts by using partial verbal.

Visual support through technological devices like computers, TV screens and phone screens are readily available these days. We are using them in some form as a therapist, analyst or learner, so using them to provide visual stimuli is an effective way of exposing the learner to various emotional human contexts. Technological devices are also reinforcers for most learners so motivations in play can be utilized to teach loosely in natural environments. This target can also be implemented when the client is watching a motivating video or movie. Ask him, "how is the hero feeling and why", the client can respond "he is feeling funny because he ate some weird tasting cake" as applicable to the context. Such methods can promote generalization of behavior too.

Follow conversation volley about preferred items: basketball, grocery, Chick-fil-A

Goal: Learner will say 5 sentences about 10 different preferred items in full sentences, with at least 2 adults across all environments without engaging in challenging behaviors, with 80% independence over 5 consecutive sessions

Implementation: Assuming the learner likes basketball, doing grocery and Chick-Fil-A, place SD "tell me five things about basketball, grocery, chick-fil-a…." etc. The learner should be able to explain 5 different things about these items in full-sentences. The therapist can make this target a conversation volley by inserting a couple of sentences about the items from their side like "a basket ball is played at the court"… Use intraverbal questions as prompts to evoke a response, like "how many players are there in a basketball game", or "where do we play it" or "what do you like about it" and things like that. Also, using motivating operations at work for example if he is already watching the basketball video game, use the opportunity for NET. Or create establishing operation by withholding access to the game, or providing varied reinforcers, and ask him about basketball to let him earn reinforcer. You can also allow him to engage him in an alternate interface basketball game like a VR basketball game if he is able to respond correctly on al teast two sentences about the topic. Usage of technologies like VR and AI can create new reinforcers and develop novel contingencies to evoke effective responses [5].

Discussion

At least five trials of each target should be initiated during a 3-hour session each day. Data should be collected over 21 sessions, the first 3 sessions being baseline scores. Measurement should be done in the form of percentage independence for each target behavior as we want to understand the ratio of opportunities provided vs. response rate [5]. Prompt levels used during intervention should also be recorded to gain accuracy on progress. Prompting can ideally start with errorless teaching or as directed in the respective target description, and progress towards fading. If baseline data doesn't improve after three sessions, AAC device can be suggested as an alternative prompting technique for communication. Graphical analysis of data should be done as well as Cohen-d should be calculated to establish the statistical significance, i.e., to what extent scores differ from baseline to intervention. If response growth occurs when and only when intervention is applied, we can say that the prompting strategies including, visual, verbal and augmentative support worked [11].

Conclusion

Applied behavior analysis based in different strategies like visual support, perceptual training, stimulus fading, stimulus transfer and shaping are beneficial for developing verbal behavior. Developing exposure through technological tools like phone, iPad, television and even AI or VR games can be effective for stimulus generalization Technology can be implemented for providing augmentative support for improving range and consistency of speech in intermediate learners on the spectrum [3]. The above methodology when implemented using the tools and techniques mentioned, can help teachers in school better implement verbal behavior instructions, and also caregivers use affordable and available medium for supporting expressive communication for children on the spectrum. However, learning happens organically in natural environment through the learner's interaction with real-world elements like human beings, birds, trees, shops, gas stations and many other natural stimuli we find around us, hence we should not underestimate the value of NET integration along with digital media for developing the verbal functional communication of children on the spectrum.

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