

The importance of fluency outcomes in learners with autism

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Abstract

Many learners with autism exhibit fluency deficits that manifest in several ways including laborious motor responses, long response durations and long latencies in responding. Such deficits can result in poor learning and social outcomes. This article discusses the application of rate-building instruction and key fluency concepts to remediate such deficits and achieve fluency outcomes in learners with autism. While these outcomes appear achievable in theory, more rigorous, empirically-based research is needed to validate them.

Keywords: fluency, autism, rate-building instruction

Increasingly, fluency is being recognized as a critical outcome of instruction for learners with autism. Binder (1996) defined fluency as “the fluid combination of accuracy plus speed that characterizes competent performance” (Binder, 1996, p. 164).

In the classroom, fluent performance would be exemplified by highly accurate and quick responses that require seemingly low effort (more automatic) on the part of the learner. From a teaching perspective, this concept represents a departure from measuring learning outcomes based solely on percent of correct responses which is the basis of discrete trial instruction (DTI). While DTI is a proven and effective teaching method for learners with autism, the reliance on percent correct achievement may overlook a learner’s latencies in response time and/or difficulties in the motor response itself. These deficits are common among learners with autism and the use of rate-building instruction and timed practice to achieve greater fluency in responses may help overcome some of these performance deficits.

Why is it important to focus on remediating these deficits? Fluency problems in learners with autism can manifest in many ways including effortful or laborious motor responses, long durations of responses and long latencies in responding, all of which can result in poor learning and social outcomes. For example, in a classroom setting, if a learner is asked a question by the teacher and fails to respond within an appropriate amount of time or the response is disorganized, it is assumed she is not prepared or does not know the answer. For many with autism, such difficulties with responses are common, even when the student knows the answer. As a result, missed opportunities to participate in learning and group instruction occur.

Slow response times may also impact the degree to which a student can keep up with the larger group. Both speed of response and accuracy impact how well a learner integrates into an educational environment. If a student can correctly do all the problems on a math worksheet, but takes three times the amount of time to complete it as other students in class, he or she will inevitably fall behind. Endurance and perseverance in responses are also important instructional outcomes to consider to ensure that students with autism can perform skills for sufficiently functional lengths of time. While time to complete academic tasks will vary significantly depending on the activity, fluency-based instruction focuses on building overall performance endurance, which will, in turn, increase the likelihood that a student will persevere through longer tasks. This is especially important for learners with autism, who tend to have fleeting attention, brief effort, and difficulties with sustaining responses. It is important to build the duration of responses and increase their ability to sustain their effort. If they can engage in activities for longer periods of time, opportunities for obtaining reinforcement on naturally thinned schedules

are also greatly increased. This may not be of great significance in specialized instructional settings where reinforcement schedules are rich, but may be critical to maintaining a student's performance in more natural settings where reinforcement is much more intermittent (Fabrizio and Moors, 2003).

Further, improving endurance will also potentially increase the learner's level of flexibility when engaging in varied academic tasks, an important skill that is necessary for academic success but often inherently lacking in learners with autism. Unpredictably, academic tasks can vary in complexity and level of demand. In addition, some academic tasks and topics will be preferred or high interest, while others will be neutral or disliked, resulting in varied levels of motivation on the part of the learner. The gains in automaticity, endurance and flexibility achieved in fluency training may help reduce the extent to which motivational variation could negatively impact the student's performance.

Dysfluency can also have significant social impacts for learners with autism beyond class participation. Though a student may be taught how to ask and answer questions in a conversational manner, if he cannot sustain a conversation with a peer beyond a few exchanges, the overall utility of that skill is greatly diminished. This deficit becomes increasingly problematic with age, as conversations become more complex, longer, and more nuanced. Similarly, if a learner cannot maintain his attention long enough to participate in and/or follow a classroom discussion or a group activity, opportunities to appropriately engage with peers may be lost.

The State of Evidence

The major issue on the state of evidence for applying this technology to learners with autism is that much of what is said is not yet empirically validated. There are many assumptions about the results of teaching skills to fluency, but very little data to support the assumptions (Heinicke, Carr, & LeBlanc, 2010). The theory of teaching skills to fluency is a compelling one, especially in the context of the dysfluencies that characterize the responses of many individuals with autism. However, even in the theoretical realm, there remain unanswered questions. For example, are the reported results of teaching a function of speed per se, or are they merely a consequence of overlearning (e.g., Dougherty, Chase, & O'Shields, 2004)?

There are many questions that can be methodically answered through lines of research with this population of learners, but such research is in the earliest stages. Most of the research projects completed to date have been presented at conferences, as opposed to being published in peer-reviewed journals. The majority of published studies have appeared in the *Journal of Precision Teaching*, and received limited distribution. Furthermore, many of the presented or published reports have not utilized singled case designs, but instead exist as descriptive studies of clinical effect (e.g., Heinicke, Carr, & LeBlanc, 2010). A wide variety of questions regarding the instructional approach or targets have recently been identified (Heinicke, Carr, & LeBlanc, 2010). These include: the functionality of increasing the rate of manding, the possibility of increasing escape-motivated behaviors, and the selection of targets for instruction.

For the purposes of this discussion, we will focus on two issues commonly discussed as relevant for learners on the autism spectrum: the teaching of motor component skills (referred to as the Big 6 and Plus 6) to improve complex, composite skills and the evaluation of the outcomes associated with fluency.

Implications of Big 6 Plus 6.

One of the major concepts in fluency-based instruction is that complex skills are comprised of smaller, molecular skills. Difficulties in the demonstration or speed of complex skills may result from basic dysfluencies in these molecular component skills. Fluency experts have identified common component skills that often are required for facile demonstration of complex skills and motoric chains.

These composite and component skills are part of all of our daily tasks and common behaviors. The relationship between these behaviors can be seen in daily actions, not just in academic contexts. Making a sandwich is comprised of many small tasks, such as selecting the materials, opening the jars, spreading the mayonnaise on the bread, putting it together, and cutting it in half. Matching items requires grasping items, placing them with their paired match, and releasing one's grasp. Many common activities are made up of more basic, fine motor component skills. The most prevalent and universally required movements have come to be known in Fluency Based Instruction as the Big 6 plus 6 (Binder, 1996; Cohen, 2010).

The Big 6 component skills were first identified by Haughton and defined as: reach, point, touch, grasp, place and release (Binder, 1996). Haughton and his associates then extended the list to include an additional set of six, which consisted of: twist, pull, push, tap, squeeze and shake. Together, these twelve component skills became known as the Big 6 plus 6 (e. g., Binder, 1996). Haughton and her colleagues found that if these twelve identified motor movements were performed at the rate of a competent performer, individuals were able to complete composite skills more independently. Preliminary findings (e.g., Cohen, 2010) indicated that adolescents or adults who reach rates of performance which match a competent performers rate, improved in their ability to access and manipulate items in their environment. These results, while requiring further research validation, are intriguing and may have strong implications for future program development.

Cohen's (2010) findings support the clinical and social significance for teaching and building fluency of Big 6 plus 6 motor skills. In this descriptive study, individuals who did timed practice on component motor skills were able to perform composite tasks, including ADL and self-help skills, more accurately and efficiently. Social significance was defined as changes in positive affect following the attainment of fluent rates.

Theoretically, if motor movements are fluent, complex skills requiring these movements can be executed with very little effort, or automatically (Binder, 1996). Speed in the execution of component skills enables the individual to competently perform many other related, broader skills. Mastery of broader skills can ultimately lead to outcomes that define success for those with autism - improved quality of life, greater independence, and potentially, employment.

RESA (aka REAPS, SEARS, RESAA)

Rate itself (i.e., speed of response) is often thought to be a key outcome of fluent behavior. The faster someone can demonstrate a skill, the more fluent they appear to be. Fluency, however, is a bit more complex than simply going rapidly, or even going rapidly while responding correctly. Advocates of fluency-based instruction argue that fluency is achieved once a behavior is demonstrated to have the qualities of Retention, Endurance, Stability and Application (RESA). These are the same qualities that were originally described by Haughton (1980) as REAPS: Retention Endurance Application Performance Standards.

Johnson and Layng (1992) later further refined Haughton's (1980) definition of the outcomes of fluent performance when they split Haughton's definition of endurance into two separate components: performance across extended periods (endurance) and performance in the

presence of distracting stimuli (stability). Thus, Johnson and Layng created a new acronym to describe the outcomes of fluent performance, RESA- Retention, Endurance, Stability and Application.” Commonly, RESA is now used to describe the important outcomes associated with training to fluency.

It is important to note that the order of the acronym RESA does not imply the order in which these checks should be administered. As a rule of thumb, the teacher should start with the component that historically has proven to be the most difficult for the learner: Does the student have difficulty generalizing to new materials, people or environments (application)? Is it typically challenging for the student to work in an environment rich in distracters (stability)? Has the student historically had trouble with maintaining a rate for longer periods of time (endurance)? Does the student seem to frequently lose skills (retention)? Generally, such difficulties influence the order in which the application, stability, and endurance checks are done. It may also influence the schedule of retention checks, as a learner with more significant maintenance problems may be tested for retention more frequently.

Individuals new to fluency-based instruction often ask several questions about the mechanics of instruction. One question frequently raised is how aims should be set. Another question commonly raised is when they should be doing checks. These questions are inter-related, as many instructors have been taught or infer that checks should follow the attainment of aims. There are published predicted fluency aims (e.g., Binder, 1996; Fabrizio & Moors, 2003) across different populations and domains which can be used to guide the development of goals and decisions regarding conducting checks. While these aims are empirically tested across many learners and skill sets, the aim rates are estimates. In order to ensure that a frequency aim for a specific learner is appropriate, issues such as age, disability, physical and behavioral characteristics, and peer speeds should be considered in setting it. Fabrizio and Moors (2003) have developed aims for the population of learners with ASDs that are very useful and commonly used for this population of learners. A major advantage of these aims is that they are empirically derived; that is, they are the rates at which the outcomes of retention, endurance, stability, and application have been demonstrated. In addition, they are population specific, and span a wide range of skills and ages.

In terms of RESA check schedules, clinicians generally test for these outcomes periodically throughout the teaching phase of a skill.

Once a learner has reached the determined or estimated frequency aim in a short timing interval, the length of that timing then increases. In general, the student needs to reach that frequency aim across incrementally longer and longer intervals before RESA testing would commence. Additionally, all identified key components or attributes should be taught prior to testing for fluency. Further analyses of number of timings (effort) and number of errors (accuracy) should be conducted in addition to the rate of correct responding in determining appropriateness of when to begin RESA checks.

Outcomes checks are “passed” when the learner meets or beats his or her best previous performance in one timing. That being said, it is integral to the outcomes represented in fluent behavior (the ability to retain, endure, be stable and apply this knowledge) that the learner attains the terminal frequency aim in no more than one or two timings.

Retention

Testing for Retention includes stopping all timed practice on a skill for a predetermined amount of time (1 month, 3 months, 6 months) and then going back and testing the skill again, in

timed practice. The components that were in place when time practice ceased are replicated: length of timing interval (or sprint), materials, schedule of reinforcement (DRH), location of previous practice and the tester.

In Binder's seminal article (1996), he describes many instances wherein getting learners to engage in high rates of behavior resulted in increased retention across a multitude of skills. As Fabrizio and Moors describe (2003), skills and entire skill sets frequently disappear from a learner with Autism's repertoire, which leads, among other things, to IEP goals being repeated year after year. It is crucial that skills become fluent in these learner's repertoires so that they can be building blocks to bigger and bigger composite skills, expediting their skill acquisition rate and allowing for newer skills to be mastered.

Testing for Outcomes

A common question or area of confusion regarding testing for retention is related to the fact that exposure to most skills taught can not be reduced to zero levels between retention assessments. Hopefully, learners are being taught skills that are relevant. We therefore would expect them to encounter those stimuli or need those responses in daily life. The essence of a retention check is not that the individual has had no exposure to the item/concept, but that he or she has not done timed practices on that skill.

Often, when learners fail stability checks, they are then re-tested for retention on a richer schedule. It may be that they are placed on a weekly, bimonthly, and monthly retention check schedule. Even richer check schedules may be developed for learners with serious retention issues.

Testing for Endurance includes increasing the amount of time the learner practices the skill without fatiguing, by increasing the length of the timing interval/sprint. Generally, an endurance check is done at three times the length of the terminal training interval. All other components of timed practice on that skill remain constant: reinforcement schedule, materials, level of distractibility.

Testing for endurance is important for learners with Autism specifically to ensure that they are able to engage in a skill for the amount of time that they are likely to come in contact with it in its natural context. As Fabrizio and Moors described, if students are able to answer and ask questions but are unable to sustain long enough in order to engage in a conversation with a peer, then the value of the skill is significantly diminished. Similarly, if a student can do three math problems, but is expected to do a ten-problem worksheet, we want to be sure they can persist in the task as long as needed.

In testing for stability as an outcome of fluent behavior, the instructor changes the environment to ensure the learner can engage in the skill in the face of distracting stimuli. This may include the introduction of sounds, activities, items and/or people that are not in place during instruction on that skill. The reinforcement schedule, length of timing and materials remain constant; the only variable that is changed is the level of distractibility.

Fabrizio and Moors (2003) stated that "Stability is a particularly important outcome for children with autism given their difficulty with skill generalization" which have been well documented elsewhere (e.g., Sundberg & Partington, 1998; Belifore & Mace, 1994). In order for a learner to show fluent behavior, they must exhibit the skill(s) in their communities and natural environments, rather than only in a contrived and distraction-free teaching environment.

In practice, stability checks are determined on an individual basis. The key element in the stability check is that the skill be tested in the presence of an intensely distracting stimulus.

To prove that a behavior is fluent in a learner's repertoire, he or she must be able to apply the knowledge to untrained stimuli, ensuring that appropriate stimulus control has been established. This may include using materials (e.g., pictures, text, objects) that were not used in instruction, rephrasing questions from how they were taught while maintaining critical information or testing for a concept rather than a particular response (e.g., has the student learned to imitate any gross motor movement?). Teaching concepts, including examples and non-examples is an efficient instructional strategy. Fabrizio and Moors (2003) answer the question "How many different cups do we teach the child to receptively label?" by saying "As many as are needed to produce generalized responding". The number may vary from learner to learner, supporting the need for frequent assessments.

The application outcome is significant for learners with autism in particular, as concepts and response classes are a common deficit area. Extending knowledge is challenging for learners on the autism spectrum, and teaching with the goal of expansion in mind can be a more efficient strategy.

In testing for application of a skill or skill set, all other components of instruction remain constant: timing interval, reinforcement schedule, level of distractibility; the only variable that is changed is the instructional materials. In most cases, then, this takes the form of novel, untrained materials.

State of Intervention

Few empirical studies have been done for learners with autism on these essential questions. One study did demonstrate excellent retention for a large sample of learners with autism who were taught to fluency (Weiss, Fabrizio, & Bamond, 2010). However, these authors point out that a comparative study is essential to identify the key elements responsible for good retention. In other words, were the good retention results a function of overlearning (practice) or training up the speed of response? To answer this question, skills taught to fluency would need to be compared to skills taught through other established ABA instructional techniques, such as Discrete Trial Instruction.

This question is critically important on several levels. First, it is essential to identify the effective components of instruction. Second, from a dissemination perspective, it may be the case that it would be simpler to instruct teachers to practice learned skills longer than to do timed practice sessions with skills.

As for this and the other outcomes associated with fluency, the data are mainly non-experimental and anecdotal. Rigorous experiments should be conducted to empirically demonstrate these outcomes, and to assess whether training component skills to fluency results in improved performance on composite skills.

Summary

It is imperative that we hold our own science to the highest standards by which we judge other interventions. Within ABA, there are methods that have been demonstrated as effective for learners on the spectrum. There are also interventions that are theoretically compelling and possibly efficacious. These interventions require our clinical caution and our research rigor. With careful attention to empirical analysis and research design, the questions regarding how

teaching skills to fluency can improve outcomes for learners with autism can be definitively answered.

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