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LEARNING TO READ IN A PERSON WITH AUTISM SPECTRUM DISORDER: AN APPLICATION OF 'EQUIVALENCE RELATIONS'

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ABSTRACT

The linguistic and cognitive difficulties of students with autism spectrum disorder often represent a significant obstacle to mastering written text, making teaching reading a real challenge for teachers and therapists. However, there are various habilitative procedures, tailored to different degrees of disability, which address the difficulties faced by educators when dealing with such deficits.

In this work, the focus will be on developing reading skills in an approximately eight-year-old child with autism spectrum disorder, implementing an ABA-oriented procedure: "equivalence relations".

KEYWORDS: Learning, Reading, Autism Spectrum Disorder, Equivalence Relations

INTRODUCTION

Reading is not just about correctly deciphering (distinguishing and naming) words, but above all about understanding what you read and adapting to the demands of everyday life to make a person as independent as possible. But what skills does reading involve? And what are the objectives to be pursued based on the characteristics of the learners?

To understand what happens when we decode a text, we need to consider two different perspectives: a neuropsychological one, which clarifies the processes involved in reading a written message, and a developmental one, which outlines the stages of learning to read.

According to, for example, the "dual-route" reading model of Coltheart, Curtis, Atkins and Haller (1993), so called because it provides for the possibility of processing written input through two distinct processes that are activated in parallel: a process of analysing the entire stimulus, or "lexical route", and a process of analytical decomposition of the stimulus, or "sublexical route".

In this model, an initial phase of analysing the visual characteristics of the stimulus and recognising the letters that make up a word is followed by two possible processing routes: a lexical route and a non-lexical (or sublexical) route (Coltheart, Rastle, Perry, Langdon, & Ziegler, 2001).

The lexical route involves "direct" access to reading through the processing of the whole word, retrieved from the lexical store. Once the phonological representation (*mapping* of the orthographic form with the phonological form) has been activated, this is transmitted to the phonemic system involved in production and, after a phase of articulatory planning, the response is produced, i.e. reading aloud.

The sublexical route, also called "indirect", does not involve processing the whole word, but uses a process whereby words are broken down into letters and graphemes. These units are associated with the phonological representation of the word through a system of rules called the "grapheme-phoneme conversion procedure".

These two reading pathways are activated in parallel, and depending on the type of stimulus, one or the other may prevail: the sublexical route, for example, is used in reading new regular words (with direct correspondence between spelling and phonology) and non-words (for which no information is stored in memory) and may also be a characteristic of the early stages of learning to read, while the lexical route is used in reading familiar words and would be typical of more advanced stages of learning in which the reading process is now automated (Temple, 1998). But what happens when a student with ASD or other neurodevelopmental disorders must read?

Educators should not conclude that there is little that can be done in these cases. On the contrary, they should take steps to organise the learning process in a differentiated manner, considering both the individual's skills and the level of autonomy they would like to achieve after carefully assessing the degree of disability. While recognising the difficulties that a student with disabilities encounters in learning to read, there are numerous curricula and habilitative procedures for teaching this skill based on the individual's abilities. These programmes can refer to two different methodological approaches: instrumental and functional.

Through instrumental reading, students are taught all the skills (visual analysis, abstract processing, fusion, etc.) necessary to decipher and understand any written passage. However, due to the complexity of the skills required, these programmes are only suitable for students with mild disabilities.

The functional approach, which is more suitable for individuals with moderate to severe disabilities, enables them to correctly decode words of ecological value (such as signs, behavioural prescriptions, prohibitions, and danger signs), i.e. these words are helpful for a minimum level of independent living in the community.

The latter programme can be considered at a "logographic" stage, as it does not require the ability to discriminate between the individual units that make up a word, but rather the ability to recognise in that written word the presence of certain clues that the child has learned to distinguish, but does not yet know the orthographic or phonological structure of the word (Frith, 1985).

This ability can be taught using various procedures, from those based on the "*errorless discrimination*" methodology to those based on "*equivalence relations*".

The latter, developed by Sidman (1971) to teach individuals with intellectual disabilities, involves first pairing spoken words with pictures and then with printed words. Subsequently, without further training, they can pair the printed words with the images and vice versa. According to Sidman and Tailby (1982), these newly learned relationships between classes of stimuli are reflective (A = A: elements that are related to each other must show the same relationship to themselves), symmetrical (if A = B then B = A: functional reversibility in the absence of direct training) and transitory (if A = B and B = C then A = C: relating the element common to two pairs of stimuli with a third pair). Class equivalence relations, therefore, imply a four-term contingency, in which the stimulus-response-reinforcement contingency is controlled by a conditional stimulus that functions as a "contextual control" (Sidman, 1994).

This methodology, which has been replicated numerous times since 1971 under various conditions, was used to teach a subject with autism spectrum disorder, approximately eight years of age, to read (De Souza, De Rose, & Domeniconi, 2009). The procedure used and the results of this treatment will be presented in the next section.

METHODOLOGY

The case study is Matteo, an 8-year-old boy undergoing ABA treatment with a diagnosis of autism spectrum disorder (ASD), level 3. At first observation, Matteo presented with social isolation, difficulty separating from his mother, a closed attitude, communication difficulties, stereotypical behaviour, clumsiness and motor awkwardness. Furthermore, from a communicative point of view, the child used adults to satisfy his own needs (requests), did not use deictic gestures or produce referential ones, and his vocalisations seemed to be made only for self-stimulation, but not for communicative purposes.

The initial rehabilitation intervention was designed to create a playful setting that would improve motivation, focusing on several objectives: encouraging the development of shared attention, promoting reciprocal and deferred imitation patterns, and enhancing motor development (particularly balance, coordination, and rhythm). This intervention continued for about twelve months, during which it was possible to improve sustained attention, work on personal autonomy, develop communication skills using PECS and the verbal operant "Mand", "Echoic" and "Tact", and enhance discrimination with matching exercises.

In terms of communication, his repertoire of gestures helped him convey his intentions in the moment. Still, his verbal language was minimal (imitation and repetition of very few words referring to images of frequently used objects). In addition, the child was unable to manage frustration (e.g., the removal

of a reinforcer) and waiting (e.g., delayed delivery of a reinforcer), which often led to echolalia, escape reactions and, sometimes, even hetero- or auto-aggressive behaviour (hitting his head).

Enrolment in primary school, agreed with the teachers, allowed Matteo to broaden his knowledge, using appropriate intervention strategies, while ensuring the educational consistency necessary to improve his performance level.

Based on this data, a procedure known as "equivalence relations" was introduced to provide Matteo with basic reading skills, enabling him to live a more independent life in various contexts.

Equivalence relations

Equivalence relations are a particular example of "matching-to-sample" that can explain emerging behaviour, i.e., new behaviour that has not been directly taught or reinforced and cannot be explained by the principle of stimulus generalisation.

Interventions inspired by these principles are based on teaching only two relations from which the others are then derived, without the need for direct teaching of the reading skill, which emerges as a derived behaviour (De Rose, De Souza & Hanna, 1996; De Souza, De Rose & Domeniconi, 2009).

From a practical point of view, they are based on two fundamental skills that the student must acquire (Sidman & Cresson, 1973):

1. *Visual discrimination*. This first skill requires a unimodal learning mode (the response involves the activation of the visual function alone), organised hierarchically:

a. Discrimination by matching to a sample *(matching)* carried out on photographs or pictures representing real objects.

b. Global discrimination of words in sample matching tasks.

c. Matching the printed word to the drawing of the corresponding object.

d. Matching the drawing of the object to the corresponding printed word.

2. *visual-auditory association*. Breakdown of the global reading task into a series of sub-skills, arranged in hierarchical order:

a. An indication of the drawing corresponding to the named object.

b. Attribution of the name to the indicated object.

c. Identification of the written word, upon verbal instruction.

d. global reading of the word.

This order allows the student to practise unimodal visual tasks until they achieve the required level of mastery, before moving on to more complex (intermodal) tasks, which require visual-auditory and auditory-visual integration.

Materials

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10 cm x 10 cm cards with ARASAAC pictograms and 3 cm x 10 cm cards with words printed in capital letters, Arial font, size 48, were used. The stimuli were identified by observing community services in the environments most frequently visited by the subject, and 18 ecologically relevant words were selected. In the initial phase (Steps 1-4), one of these words was presented to Matteo, and he was asked to identify it among four others.

Procedure

Initially, a baseline measurement was taken to assess the number of words Matteo could read (Table 1).

The baseline indicates that the child was unable to read any words, despite being familiar with all the letters and some high-frequency syllables in Italian. Therefore, it was decided to use the "Equivalence Relations" procedure to improve Matteo's reading repertoire, applying the following steps:

Step 1. Matteo matched identical pictograms (matching).
Step 2. He matched identical words (e.g., STOP– STOP).
Step 3. He matched the printed word (BUSSARE) to the pictogram for BUSSARE.

WORDS	**DATE** 23-oct	**WORDS**	**DATE** 23-oct
DANGER	-	ENTRANCE	-
STOP	-	EXIT	-
POISON	-	PUSH	-
BAR	-	CLOSED	-
FREE	-	TOILET	-
PULL	-	OPEN	-
HALT	-	KNOCK	-
PHARMACY	-	FREE	-
ALARM	-	BATHROOMS	-

Tab. 1 – Baseline: Matteo is unable to read any words on the list, despite knowing the letters.

Step 4. Matteo matched the pictogram to the printed word.
Step 5: The child had to perform the same task for five sessions with a 100% mastery criterion.
Step 6: The therapist said a word (PULL) and Matteo identified the corresponding pictogram.
Step 7: The child named the pictogram presented (BATHROOM or TOILET).
Step 8: The therapist said a word (PHARMACY) that Matteo had to identify.
Step 9: The student identified the written word upon verbal prompting.
Step 10: The child read the words presented to him by the therapist.

Step 11: The child generalised what he had learned in different contexts, such as a shopping centre, a lift, and a cinema.

To achieve the final objective, an experimental design with changing criteria (Changing Criterion) was used. This experimental design consists of defining, after the baseline measurement, an initial behaviour criterion, which, once met, is followed by a second, more demanding criterion, and so on. The effectiveness of the intervention and the requirements adopted are demonstrated when the behaviour conforms to the established criterion (Guazzo, 2021). After establishing the baseline, the first criterion of three words was set, followed by criteria of 6, 9, 12, 15, and 18 words (a criterion was achieved if the subject achieved 95% accuracy in 20 consecutive trials) (Fig. 1).

If the child did not meet the criterion, we returned to an intermediate stage between the previous criterion and the one we were working towards.

RESULTS

The results obtained from this study significantly indicate the improvement achieved with the application of "Equivalence Relations" to improve the functional reading of a child with ASD, who went from an initial performance of zero words read to a result of 18 words read correctly in approximately ten months of treatment (also considering absences for various reasons). They also suggest that ABA-oriented interventions, such as "Equivalence Relations", are effective in producing changes, even in school learning activities (reading), in children with ASD.

CONCLUSIONS

The use of the "Equivalence Relations" procedure corrects one of the mistakes often made with individuals with intellectual disabilities or ASD, namely that of starting reading instruction with an intra-modal task (the ability to integrate stimuli that activate different sensory modalities simultaneously; for example, if a student with atypical development pays auditory attention to the meaning of a written word, they are no longer able to analyse it graphically, or vice versa). The "Equivalence Relations" procedure overcomes this cognitive difficulty by guiding the subject first to the visual aspect and then to the auditory element (Sidman & Cresson, 1973).

However, further research is needed to extend these results, identify the variable that triggers change and evaluate possible predictors of success.

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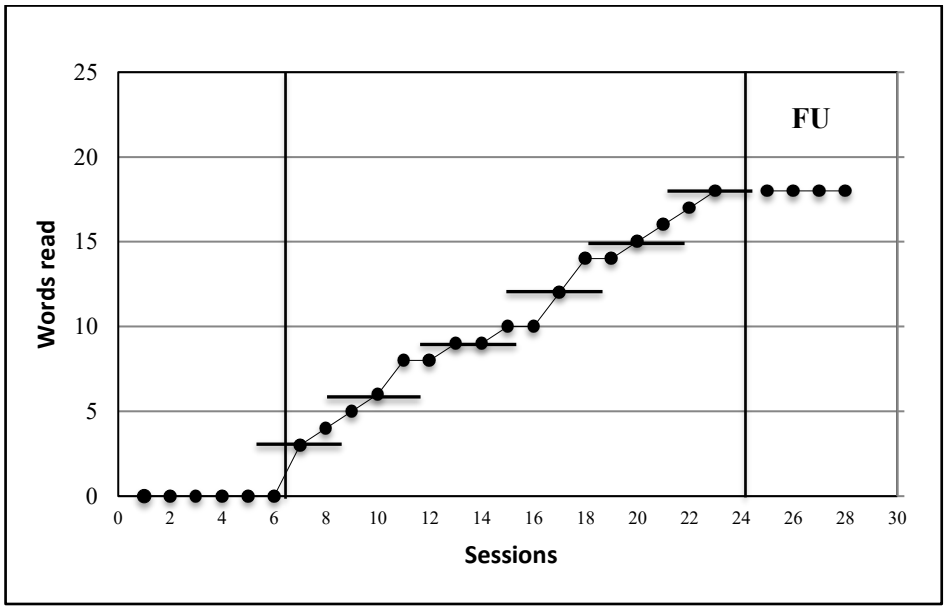

Fig. 1 – Experimental design with varying criteria. The bold horizontal lines indicate the various criteria to be met. In contrast, the vertical line separates the Baseline (the smallest area) from the intervention (the largest area of the graph) and the Follow-up (FU) observations.

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