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Chapter 2

Applied Behaviour Analysis and Autism: Science, Profession, and Practice

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Abstract

Applied Behaviour Analysis (ABA) is recognised as the scientific basis of effective interventions in many educational, social, and medical fields, including autism. In this chapter, the basic tenets of ABA are described and briefly reviewed. Autism aetiology, diagnosis and prevalence are sketched out and the remainder of the chapter focuses on ABA-based interventions for children with autism. The chapter concludes with an examination of internationally recognised training standards for behaviour analysts.

Keywords: applied behaviour analysis (ABA), autism spectrum disorder (ASD), international perspectives, Europe, United States of America (USA), dissemination, Behaviour Analyst Certification Board (BACB), Board Certified Behaviour Analyst (BCBA)

1. Introduction

Procedures based on the science of behaviour analysis have been used successfully to address socially important behaviours at home, in communities, clinics, classrooms, and businesses [1, 2]. Common goals include improving social skills and academic attainments or the reduction of disruptive behaviours. Many of these methods have been used successfully to support individuals on the autism spectrum [3]. In this chapter, behaviour analysis is described first, then autism aetiology, diagnosis, and prevalence are briefly explicated. The focus then moves onto specific procedures that are particularly effective in supporting children with autism and, finally, professional certification for behaviour analysts is described.

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2. Behaviour analysis

The experimental analysis of behaviour has a long history, starting with pioneering work in Thorndike's puzzle boxes and Watson's and Pavlov's work on respondent conditioning, exploring involuntary behaviours that resulted from the presentation of a variety of stimuli. Skinner built on this work with explorations and discoveries related to voluntary operant behaviours, focusing on the effect of consequences on responses [4].

Behavioural pioneers rejected the prevailing mentalistic approach of mainstream psychology, that promulgates a dichotomy between body and mind on the premise that behaviour is caused by an inner state or 'the mind' and coined the term 'radical behaviourism' (from the Greek [rædɪkᵊl] adj. 'arising from or going to a root or source') to describe the underlying philosophy of behaviourism. By categorizing thoughts and feelings as inner/private behaviour shaped by the same behavioural principles as publicly observable behaviour, radical behaviourism offers a holistic, non-dualistic approach to human behaviour [5].

Applied Behaviour Analysis (ABA), i.e., the application of behavioural knowledge to socially significant behaviours, is a distinct discipline with dedicated journals (Journal of Applied Behaviour Analysis; Behaviour Analysis in Practice), large membership associations (Association for Behaviour Analysis-International, ABAI; European Association for Behaviour Analysis, EABA; Association of Professional Behaviour Analysts, APBA), and professional certification (Behaviour Analyst Certification Board, BACB) recognised as a licenced profession.

ABA employs and expands knowledge gained from the experimental analysis of behaviour for the benefit of socially or clinical important behaviours. Social validity is measured through assessments of social appropriateness and significance of target behaviour, intervention, and outcome [1]. Applied behaviour analytic interventions satisfy seven dimensions. They have to be

- Applied (focus on socially significant behaviours)
- Behavioural (targeting measurable behaviours)
- Analytical (decisions are based on data)
- Technological (procedures are replicable)
- Conceptual (clearly based on behaviour analysis)
- Effective (positive impact on the target behaviour)
- Generalizable (behaviour occurs in general, not only where/when/how it was taught) [1].

ABA provides the tools for behaviour change across many human affairs, e.g., seat belt use, littering, sports, language acquisition, health and exercise, emotional behavioural difficulties (EBD), social validity, and staff training [6, 7].

Recognition of the effectiveness of behaviour analytic interventions was enshrined in an amendment to the Individuals with Disabilities Education Act of 1997:

> *In the case of a child whose behavior impedes his or her learning or that of others, consider, when appropriate, strategies, including positive behavioral interventions, strategies, and supports to address that behavior (Sect.614 (d)(3)(B)(i)).*

This legislation requires behavioural intervention plans to be based on a functional behavioural assessment (FBA) [8] and therefore constitute a significant step in the recognition of ABA-based procedures for a wide group of students, including children with autism in the United States of America (USA). In contrast, in the United Kingdom (UK), reports and guidelines, such as those from the National Institute for Clinical Excellence [9], miscategorised 'ABA' as one specific intervention for autism and do not recommend their use in general, although specific ABA-based procedures, such as functional behavioural assessments are recommended.

Functional behavioural assessments (FBA) identify the environmental factors of which the targeted behaviour is a function and thereby are the cornerstone of effective behaviour analytic interventions. FBAs include descriptive methods (e.g., record reviews and service user and/or caregiver interviews), direct behavioural observations, as well as functional analysis in which experimental procedures are used to establish the causal relationship between the dependent and independent variables. After ruling out medical reasons for enduring challenging behaviours, a thorough FBA increases the likelihood of intervention success.

For situations where the function of a behaviour is difficult to determine by descriptive means alone, several experimental functional analysis conditions have been developed. Iwata and colleagues [10] were the first to explore functional analysis of self-injurious behaviour (SIB). They used four experimental conditions: (1) social disapproval or reprimands; (2) academic demand; (3) alone; and (4) unstructured play/enriched environment.

1. The social disapproval condition was used to assess if the SIB was positively reinforced. The researcher engaged in an unrelated activity (e.g., reading papers) without interacting with the child, while the child engaged in an activity that was not overly demanding for them. If the child engaged in the challenging target behaviour, the researcher interacted with the child by delivering a reprimand (e.g., 'Don't do that'; 'That's not nice').
2. The academic demand condition was used to assess if the behaviour in question was negatively reinforced through escape from demand. The child engaged in an activity that was novel, appropriate, and somewhat demanding (e.g., table-top picture matching). As a consequence of SIB, the task demand was discontinued.
3. The alone condition was used to assess if the SIB had a self-stimulatory function. The child was left in a room on his/her own without toys or other materials. This condition was included only if the SIB was not considered dangerous.
4. The unstructured play/enriched environment condition was used to assess the potential of social reinforcement for alternative behaviours. It consisted of the child sitting in close proximity to the researcher who responded with praise and social interaction in the absence of the target behaviour. Inappropriate/challenging behaviours were ignored in this condition.

The functional analysis procedures originally detailed by Iwata and colleagues form the basis of good ABA practice and have been adopted widely and successfully to address many different behaviours, including core indicators of autism.

3. Autism: Aetiology, diagnosis and prevalence

The term 'autism' has been attributed to the Austrian-American psychiatrist Kanner in the early 1940s, although individual cases had been described well before that time. While Kanner's work was written in English and has been recognised widely, his predecessor, the Swiss psychiatrist Bleuler, who coined the term 'autism', and his contemporary, the Austrian paediatrician Asperger, both writing in German, were virtually ignored. Asperger was eventually recognised when his writings were translated into English posthumously. Subsequently, the body of research grew until the diagnostic classification was formalised for the first time in 1980 in the Diagnostic and Statistical Manual of Mental Disorders (DSM-III) [11].

The diagnostic category changed over time, from 'Pervasive Developmental Disorders' that including autistic disorder, Rhett's disorder, childhood disintegrative disorder, Asperger's disorder, and pervasive developmental disorder – not otherwise specified (PDD-NOS) in the DSM-IV-TR [12] to the single category 'Autism Spectrum Disorders (ASD)' in the DSM-5 [13]. The diagnosis of ASD is based on two symptom domains, i.e., impaired social/communication and restricted, repetitive behaviours, and three levels of support needs. Autism was recognised as a heterogeneous condition with many presentations, i.e., each person with autism affected in different ways.

The exact causes of autism are unknown and are likely to concern genetic vulnerabilities coupled with environmental risk factors. It is likely that there are a variety of aetiologies that lead to a variety of 'autisms' [14].

Rising rates of autism are associated with increased costs to society and quality-of-life for individuals and their families. Autism prevalence rates in children in the USA have risen from 1 per 110 (0.90%) to 1:50 [15] and even higher prevalence rates have been reported in South Korea (2.64%) [16] and the United Kingdom (3.5%) [17]. The individual lifetime support cost for someone with autism is estimated between USA$1.4 and USA$2.4 million (UK£0.9-UK£1.5 million) depending on the level of support needs. Assuming a prevalence of 60% co-occurring intellectual disability, 'the total annual costs are £3.4 billion (USA $5 billion) per year in the United Kingdom and $66 billion per year in the United States' [18]. Effective interventions can do much to ameliorate the situation for individuals with autism and their families.

4. ABA-based interventions for children with autism

Behavioural interventions were first used to support individuals with mental illness or intellectual disabilities in state care in the late nineteenth century. For example, Fuller showed that

physical movement (e.g., movement of the right arm) could be introduced to a previously totally non-responsive patient by contingent use of a positive reinforcer (e.g., sweetened milk) [19].

Fester [20] and Oppenheim [21] were among the first to utilise behavioural principles to teach new skills to individuals with autism; however, it was not until Lovaas utilised intensive behavioural interventions, mainly Discrete Trial Training (DTT) with young children with autism, that ABA-based procedures became popularised [22]. A follow-up report of the Lovaas et al. study evidenced the long-term maintenance of the gains that had been achieved with the children [23]. For many not familiar with the science of applied behaviour analysis, Lovaas' name became synonymous with ABA interventions for autism. However, Lovaas' studies have often been misinterpreted as an evaluation of a complete intervention system with little or no recognition of its basis in applied behaviour analysis. This kind of misinformation has led to the erroneous perception that Lovaas Therapy, Lovaas Programme, or Discrete Trial Training (DTT), are the same as the scientific discipline of ABA.

Many ABA-based interventions for children on the autism spectrum are conducted in the home, with parents as active partners [24]. Maurice [25], mother of two children with severe autism, was one of the first to recount how home-based intensive behavioural intervention resulted in her children's ability to be included in mainstream schools without additional supports.

Support groups and social media have played a key role in parental advocacy becoming a grass roots movement for rising autism awareness, demanding ABA-based interventions [26], and attaining relevant autism legislation. In the United States of America, Federal Government and States legislation in almost all states have dramatically improved the funding for behavioural interventions by requiring insurance carriers to provide coverage of ABA-based services. Individual State initiatives have also added to the endorsement, e.g., the State of Maine convened a task force to evaluate the educational interventions for autism as a means of determining appropriate State policy in the area. The task force, citing some of the key features of ABA, such as the use of observable goals, reliable data collection, and programme evaluation based on data evidence, declared behavioural interventions substantiated as effective. Similarly, the New York State Department of Health gave the highest rating to behavioural-based interventions [27]; the Kennedy Krieger Institute of Maryland [28] and Autism Speaks [29] are among many other agencies that promote the use of ABA-based interventions for the people with autism.

A non-exhaustive list of ABA-based interventions with empirical support as efficacious for use with individuals with autism spectrum disorders are briefly described below. For further detail on these and other behavioural methods shown to be effective for children and adults with autism, see the cited research.

ASD is a diagnosis of behaviour deficits in social-communication skills and behaviour excesses in restricted, repetitive behaviours [13]. These behaviours can challenge or disruptive other activities [30, 31], consistently across age groups [32, 33] and over time [33]. ABA-based interventions to support individuals who experience these challenges include functional behaviour assessment (FBA) and behaviour intervention plans (BIP) [34, 35]. Positive Behaviour Support (PBS) is probably the most widely used behaviour analytic, evidence-based intervention package use to support these individuals [36, 37].

Functional communication training (FCT) is an effective method of addressing communication problems [38]. FCT uses shaping procedures to build appropriate communication repertoires, thus reducing the need for non-functional communication efforts [39]. Similarly, picture exchange communication systems (PECS) can improve functional communication in people with autism [40] by using pictorial strategies in an augmentative communication system [41]. Pivotal response training (PRT) is a verbal response prompting methodology for teaching communication to students with autism [42]. Taken together these naturalistic behavioural approaches to the acquisition of verbal and/or vocal communication skills provide powerful interventions for individuals with autism [43].

Precision teaching (PT), focusing on accuracy and speed, i.e., fluency, of behaviour [44, 45], is used very effectively across behavioural and academic curricula as generalisation and maintenance of skills improve with fluency [45]. Other widely used ABA-based procedures include Direct Instruction, using instructional pacing to maintain student motivation, and coral responding, using scripted sequences thus allowing for high frequency of individual responses in large groups to gain and maintain curriculum-based knowledge [46].

With regards to educational interventions for children diagnosed with autism in jurisdictions outside of the USA, the support for ABA-based intervention has not always materialised despite the fact that Research Autism (UK) disseminates research evidence in favour of ABA-based interventions. Noticeably, ABA-based methods of autism support and education have been absent in official reports and, consequently, governments across Europe still support an 'eclectic' approach, rather than demanding scientifically supported interventions [47].

One of the key problems with an eclectic approach to autism interventions is that there is no consistent theoretical framework for the different interventions experienced by the children and thus potentially conflicting messages are propagated, staff training is necessarily inconsistent and training content rather variable, and the interventions are not evidence-based. In fact, Eikeseth and colleagues [48] compared an intensive behavioural programme with an eclectic approach in which both groups received one-to-one instruction for 28 h per week over the course of 1 year. The behavioural treatment group showed significant gains in IQ (i.e., an average of 17 points), language, and adaptive behaviours while the eclectic group showed only an average 4-point gain in IQ. Similarly, Howard and her team [49] reported significant advantages for the behavioural intervention group in the areas of cognitive, non-verbal, and communication measures in comparison to eclectic groups. Clearly, the potential inclusion of unsubstantiated or even hazardous interventions in an eclectic approach is problematical (e.g., facilitated communication and auditory integration training are still used despite evidence of ineffectiveness or even significant harm).

The contradictory reports across different jurisdictions are likely to have adverse effects as teachers and school administrators question the evidence status of different methodologies. Consequently, behavioural interventions may be implemented with less than recommended intensity, low levels of staff training, not at all, or as a part of an eclectic approach. At times it seems that opponents thrive on or even profit from misrepresenting the science [50].

In the absence of coherent and evidence-based guidance, parents educate themselves [51], relying on word of mouth, anecdotes from other parents, celebrity endorsements, and information

provided by autism charities, rather than good quality scientific peer-reviewed journals. Evidently, misinformation about ABA on the internet abounds and this can lead to parents being dissuaded from scientifically validated interventions usually to the detriment of their child [52].

Even if they find accurate information about ABA-based interventions and want to utilise these in support of their child's skills development, implementing home and school programmes requires significant resources. In most of Europe there is no state funding and parents have to pay for ABA-based services themselves, or fight for a little bit of state funding through the tribunal system [53].

In the USA, nearly all States declared ABA-based autism interventions empirically validated and mandate Health Insurances to cover the cost [29]. Yet, although they are not permitted to do so, Health Insurers still try to avoid providing cover by considering autism as a pre-existing condition, a mental illness, or a long-term disability, rather than a neurological disorder. Others try to avoid cover by viewing ABA as 'experimental' or purely educational, rather than medically necessary or pointing to perceived disagreement in the literature, rather than welcoming the large body of evidence supporting ABA-based interventions for autism. At the same time, insurers are right to expect that services they cover are managed by an appropriately qualified professional. Board Certified Behaviour Analysts (BCBA) manage home-based as well as clinic and school-based services in applied behaviour analysis.

5. Behaviour analyst certification

The Behaviour Analyst Certification Board (BACB) [54] verifies behaviour analytic training at Universities and sets the standards and examinations for Board Certified Behaviour Analysts (BCBA) internationally. Thus, it offers a certain level of consumer protection against those who claim to offer applied behaviour analytic interventions without adequate training. In addition, a number of States in the USA have introduced licensure for Board Certified Behaviour Analysts (BCBA) to improve practice standards and ensure insurance coverage.

The BACB is an accredited credentialing body (i.e., the National Commission for Certifying Agencies) and, although the organisation is based in the USA, it has world-wide reach. In fact, the European Association of Behaviour Analysis (EABA) endorses the credentials and offers information about European course sequences through its website. In Ireland, the Division of Behaviour Analysis (DBA) of the Psychological Society of Ireland (PSI) endorse the BACB credentials [55].

The number of BACB verified University programmes across Europe is growing. A full list of courses is available on the BACB webpage. Behaviour analysts are not regulated within European Union laws. The Czech Republic is the only country in Europe to legally regulate the profession of behaviour analysts, based on BACB standards [56].

There are four levels of professional BACB registration or certification, each with course work and supervised practice requirements and examinations. The Registered Behaviour Technician (RBT) is a pre-degree level qualification, while the Board Certified assistant

Behaviour Analyst (BCaBA) requires a verified undergraduate degree. The Board Certified Behaviour Analyst (BCBA) is a master's level qualification and the Board Certified Behaviour Analyst-Doctoral (BCBA-D) is the doctoral level designation.

All certificants must meet entry requirements, complete the required verified behaviour analysis course sequences at University, and fulfil supervised experience requirements before applying for eligibility to take the appropriate extensive examination. In addition to the various levels of certification the BACB has developed a Professional and Ethical Compliance Code that applies to all certificants. The code requires behaviour analysts to practice only in the areas of their training, continue to develop areas of expertise through continued professional development activities, and use and contribute to the evidence-base for behaviour analytic methods. The BACB also developed a good practice guide for autism interventions and publishes translations of BACB resources.

The coursework content of BACB verified course sequences (VCS) includes ethics, functional assessment and functional analysis, interventions and applications, experimental analysis, and conceptual issues. The number of hours for coursework and supervised experience differs depending on the level of certification sought. Supervisors are required to be BCBAs and have completed specified supervisor training.

6. Conclusions

The application of the science of behaviour analysis has provided a range of evidence-based interventions to support individuals on the autism spectrum. Implementation and funding for these interventions differ widely across the world. They are typically home-, school-, or clinic-based, usually starting with a one-to-one therapist-to-child ratio and moving to group work as soon as possible. Outcomes have been very positive and social validity and satisfaction with the outcomes has been high.

This chapter offered a brief description of the scientific discipline of behaviour analysis, summarised the present state of knowledge around autism aetiology, diagnosis and prevalence, and focussed on applied behaviour analysis (ABA)-based interventions for children with autism. Finally, the requirements for professionals working in the field, i.e., Board Certified Behaviour Analysts (BCBA), were described.

Applied behaviour analysis-based interventions for autism clearly have a large evidence-base of effectiveness. The continued failure of governments across Europe to recognise this has left a vacuum, that all too often is filled by fads and fictions [57]. To avoid misinformation and ensure that these interventions are delivered with fidelity, well-trained staff are necessary. Parents of children with autism require and deserve the best information and supports available.

Although policy reform in the USA is still somewhat inconsistent across states and, yet, many are left without financial support, there is reason for optimism that offers a platform from which to lobby for further access to ABA-based interventions for all people with autism who need it.

Conflict of interest

Both authors declare they have no conflict of interest in publication of this chapter.

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