Video-based interventions for promoting positive social behaviour in children with autism spectrum disorders: a systematic review and meta-analysis

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VIDEO-BASED INTERVENTIONS FOR PROMOTING POSITIVE SOCIAL BEHAVIOUR IN CHILDREN WITH AUTISM SPECTRUM DISORDERS: A SYSTEMATIC REVIEW AND META-ANALYSIS

BACKGROUND

Autism Spectrum Disorders (ASD) are a group of neurobiological, pervasive, lifelong developmental disorder. As a spectrum disorder, there is much variation in the severity and types of difficulties the individual may face. It is reported to have a prevalence as high as 1.7% according to data extrapolated from a study of over 14,000 children (Russell *et al.,* 2014). The prevalence of ASD diagnoses is rising, thought to be a result of a combination of better public awareness and improved assessment methods (Fombonne, 2005). It affects males more frequently than females with a ratio of 5:1 (Russell et al., 2014), due to the prevalence differences between males and females, there is currently a wealth of research primarily concerned with its biological origins (see Abrahams & Geschwind, 2008 for a review).

Highly effective subsets of interventions are used with people who have a diagnosis of ASD, many have been developed on the basis of principles of applied behaviour analysis (ABA). One such intervention type is Video-Based Interventions (VBI; Nikopoulous & Keenan, 2006). Research on VBI is of very recent and current attention. Many evaluations of the efficacy of VBI do exist; however, the processes used are less than rigorous (Howlin, 1997). There is an ethical requirement to impartially test the effectiveness of the VBI before any assumptions can be made on the assured applicability of it on children with ASD. An individual's progress under VBI can be easily influenced by external factors such as pre-existing social skills, the patient's age, mental ability and the duration and intensity of the programme.

The diagnostic criteria as described in the fifth edition of the diagnostic and statistical manual of mental disorders (DSM-5, American Psychiatric Association, 2013) provides a consistent benchmark of how professionals should diagnose and understand autism. The DSM-5 characterises a person with autism to have deficits in two main areas: 1) social interaction and social communication and 2) focused, restrictive and repetitive behaviours. These social deficits are most often described as the most debilitating of the difficulties faced by an autistic individual, and if left untreated will persist and cause obstacles throughout the lifespan (Yirmiya et al. 2006; Bellini, 2004).

Deficits in social behaviour cause problems in interpersonal interactions, appropriate greeting techniques, establishing joint attention and safety skills, to name a few. These problems, when left to persist, affect the individual's quality of life across academic, personal relationships, community placing and vocational contexts (Gresham, 1986). Children with

competent social skills show advanced skills in initiating and maintaining meaningful friendships, navigating complex peer relationships, do better academically and vocationally and deviate from harmful situations. Some researchers propose that in measuring a child's social abilities it is highly predictive of later social, academic and psychological outcomes (Waddock & Graves, 1997; Tangney et al., 2004).

Social deficits relating to autism are the most difficult, debilitating and pervasive aspect of the disorder (Kanner, 1943). The problems an individual will face become evident in the following ways:

The interactive social engagement with peers

This lack of typical social engagement will become problematic as the individual is unable to interact and collaborate which can often lead to victimisation and discrimination (Laursen et al., 2007). This difficulty with instigating friendship is said to derive from the inability to share experiences with peers. Many people with autism find difficulties in expressing empathy or showing any awareness of another person's thoughts or feelings (Weiss & Harris, 2001), these complications with friendship experience can also become apparent in a further three ways. Firstly, they may try to interact but do so in an odd and socially unacceptable way (Dahlgren & Gillberg, 1989). Secondly, they choose to stay isolated as their own preference (Mundy *et al.,* 1994). Finally, the peer may avoid the individual with ASD due to prolonged conversations about a fixed and repetitive subject that may only interest the person with ASD (Gutstein & Whitney, 2002).

Social understanding. Individuals with ASD often have an inability to modify their own behaviour in a way that is a natural affective interchange from the presented social cue, difficulties are also reported in 'joint engagement' with another person, that is to say, the shared focus that two individuals will have on a single object. Joint engagement is achieved when one individual alerts another to an object by means of eye-gazing, pointing or other verbal or non-verbal communications. These difficulties become particularly evident in ASD when turn taking skills are needed or a need for an understanding of concept is required (Weiss & Harris, 2001). This difficulty in matching social behaviour to that of the response of a peer can lead to a disjointed and awkward social exchange. Research has found that the individual with ASD is aware of the anti-social behaviours they exhibit but are unaware, or unable, to know to how best change the pattern of their behaviour.

Safety skills. This includes an avoidance or prevention of potentially dangerous situations occurring to maintain the safety of a person either through pedestrian skills (Steinborn & Knapp, 1982), first aid (Gast, 1992), emergency use of a phone (Koegel et al., 1989), fire safety (Self et al., 2007) and their response to the lures of strangers (Akmanoglu & Tekin-Ifer, 2011).

Imaginative play. Children with ASD are described as having problems with imaginative play; play consists of a number of complex behaviour skills and has an important function in the healthy development of a child (Jordan & Libby, 1997). Children with autism will rarely

take part in dramatic or spontaneous play but instead prefer a very focused and repetitive type of play such as methodically lining up their toys to match in size, shapes or colours (Stahmer, 1999).

Academic performance. Valuable social skill lessons are often learned within the education system, through interaction with peers or under a direct intervention instruction from their teachers. When a child enters into the school system, two social adjustments must be made in order to transition successfully. The first requires compliance to behavioural demands as set out by the teacher (Machalicek et al., 2007). The second requires complex social dynamics as witnessed during free play and often controlled by peers in the playground (Walker et al., 1998). Children with ASD have problems in these two main areas of academic involvement.

Community and vocational skills. It is extremely important for individuals with ASD to develop functional skills which can be used for community and vocational involvement as they mature. Research has been implemented in various areas of community and vocational skills such as shopping and purchasing (Haring et al. 1987).

Emotional Regulation. An often overlooked problem in social difficulties is the way in which individuals with ASD relate to their own emotional difficulties on an introspective level, that is their way of coping with problems such as anxiety, stress and anger management. Often, the outward behaviour of the individual with ASD does not make any 'sense' to the typical peer, that is, there does not seem to be a clear purpose. A typical peer may not understand why the individual is humming or flapping their arms continuously and often this misunderstanding will lead to complete avoidance.

Overcoming social interaction deficits in ASD

As the prevalence of ASD diagnoses is increasing, it is more crucial than ever to understand the most effective strategies for increasing positive behaviours and decreasing negative behaviours, such as those outlined above. Troublingly, a systematic review carried out on over 100 of these utilised interventions suggested that an overwhelming number of approaches have little or no effect on the progression of the child, and many lack a solid, sound research foundation altogether (Ospina et al., 2008). There is very little agreement on one focused and optimal method of intervention and no single intervention has ever been shown to have consistent effectiveness with all individuals (Higgins & Boone, 1996). An eclectic approach to autism is often shown to be less effective than a single, scientifically founded, and intensive intervention (Simpson, 2001). It has also been shown that early interventions are more conducive to positive outcomes, making the disorder highly time-sensitive (Dawson & Osterling, 1997).

Interventions must be based on scientifically rigorous principles in order to measure effectiveness and replicate successfully. For these reasons, more research must be conducted on treatments that currently exist, which show positive outcomes and that have been established as a result of a sound scientific research foundation (Simpson, 2001). ABA has

been shown to produce positive, valid and replicable results. ABA has been a prominent framework in effective academic instruction for many students and is not just limited to those with special educational needs. The principles and methods which underpin and define ABA include:

- Commitment to using reinforcement to encourage positive behaviours
- Teaching methods which encourage higher levels of correct response
- The use of extinction for problem behaviours
- Focus on ensuring that newly taught behaviours be maintained and generalised to other unique contexts.

These approaches have proved indispensable within the education setting - through classroom motivation, instructional approaches, assessment and behavioural support and management (Dunlap et al., 2001).

Video Based Interventions (VBI)

Human learning often comes from observing a skilled person or 'model', already proficient in the skill and performing it adequately, which leads to the learner imitating that skill. This type of observational learning was described by Bandura (1969). Children with ASD have specific problems with learning these types of skills naturally through observation. Reasons for this include: poor motor imitation, reduced interactions with peers, inappropriate 'frame of reference' which will often lead to a total misunderstanding of the context of when and where it is appropriate to apply the behaviour and lack of attention and eye contact with an appropriate model (Mundy et al. 1986). Some form of imitation skills is a prerequisite for VBI, as the participant must be capable of imitating the model in order to benefit from the intervention (Kleeberger & Mirenda, 2010). Imitation requires a sophisticated understanding as to who is an appropriate subject to mimic and which behaviours should be mirrored. However, individuals with ASD sometimes encounter difficulty in choosing this appropriate 'frame of reference' (Mundy et al., 1994). One fundamental advantage of VBI is that it facilitates the participant with a definitive appropriate model, and appropriate set of behaviours, which allows the participant to observe desired behaviours without additional stimuli causing confusion. An ultimate requirement when teaching imitation to participants with ASD is that generalisation and maintenance need to occur in order for the intervention to be successfully removed.

VBI are defined and conceptually include (1) video feedback; (2) video modelling; (3) video self-modelling; (4) point-of-view modelling; (5) video prompting; and (6) computer-based video instruction (Rayner et al., 2009).

Video feedback (VF) is a self-monitoring technique where an individual is recorded on videotape, the observed behaviour is then collected and reviewed by an experimenter. The individual will be given the opportunity to watch and evaluate their appropriate or inappropriate behaviours as observed via the recording. The participant is then able to rate their behaviour while the experimenter provides direction and assistance in the subsequent

modification. It is hoped that in this attending to and processing of the appropriateness of their behaviour that the participant can develop more accurate self-perceptions and thus improve peer interactions and behaviours (Mechling, 2005).

Video modelling (VM) is the most widely researched and implemented of all facets of VBI, desired behaviours are acquired by watching a video demonstration of the desired behaviour by a proficient model and then imitating the behaviour. Video modelling interventions also include three further defining subgroups of; Adult Models - these can either be a parent, teacher or unknown adult performing the task (D'ateno et al., 2003). *Peer models* - typically the same gender and age as the participant and could be a sibling, classmate or unknown child (Haring et al. 1987), and *mixed models* - this technique combines some or all the above model types (i.e., familiar peer, unknown adult and familiar adult) in order to teach a specific skill (Nikopoulos & Keenan, 2003). Very little research has been done to compare the effectiveness of these three subgroups and it is still unknown which model type leads to the most effective learning tool. The observational learning theory (Bandura, 1969) predicts that learners would learn more effectively with models that are most like themselves. This would indicate that the use of an adult model would have a greater impact on adults with ASD and younger peer models would have a greater impact on youth with ASD (McCurdy & Shapiro, 1989). However, the literature does not seem to be concurrent with this assumption. Bellini & Akullian (2007) found within their review of the literature that no statistical differences could be found when comparing model types in relation to the intervention effect, the maintenance and the generalisation of the skill.

Video self-modelling can be approached in two ways. Either the participant can watch a video in which they have been filmed in a scenario and they are asked to self-critique their own behaviour (Thiemann & Goldstein, 2001) or through observing themselves exhibiting the targeted behaviour after the experimenter has edited out all the undesirable behaviours to produce a video that displays only the targeted behaviours (McCoy & Hermensen, 2007).

Point of view modelling (PVM). In this category of video modelling, the camera is directed to embrace the scene as the participant would see it, perhaps directed at a specific setting or as a set of hands performing the desired task. Benefits of using this type of modelling include reducing irrelevant stimuli and thus optimising the ability of the person to focus on the specific task (Tetreault & Lerman, 2010). PVM also increases the possibility of generalisation as the person is effectively learning through their own eyes. For example, they are less likely to attribute the skill to a specific age, gender etc. as the irrelevant stimuli usually associated with the model have been removed. Past research has found that PVM can assist in social and play skills (Hine & Wolery, 2006), Self-help skills (Norman et al. 2001; Sigafoos et al., 2005), functional living (Shipley-Benamou et al., 2002) and reducing disruptive transition behaviour (Schreibman et al., 2000).

Video prompting procedures are similar to VM procedures in that both present the participant with video clips of a model expertly performing a desired task or behaviour. However, they differ in that a video prompting procedure is usually filmed from the

perspective of the spectator and thus presenting the learner with a subjective viewpoint, also it is not presented as a fluid clip like VM procedures but rather as many mini-clips, usually based on a task analysis of the entire task. This facilitates the participant with the opportunity to watch and then perform each step of the task in time with the video. Although less utilised than VM, a comparison study by Cannella-Malone et al. (2006) revealed that video prompting was significantly more effective in teaching daily living skills to adults with learning disabilities than VM, however, video modelling is much quicker and easier to administer than video prompting which may explain the popularity of this intervention.

Computer-based instruction (CBI) is often used interchangeably with the term 'multimedia'. In this approach, a computer is used to interactively present a variety of media, text, music, pictures and video footage (Mechling, 2005). Research has shown that using computers as an instructional tool have positive effects on students, due to higher attention rates, due to the recreational associations of computers and media files and thus, increased successful performance (Dautenhahn & Werry, 2004).

OBJECTIVES

The primary research question for this proposed review is: How effective are video-based interventions in promoting pro-social skills and interactive behaviours in children with autism?

Within this, the review will address the following more specific questions:

1) Is there a category of VBI which show more positive effects?

2) Which social skills and interactive behaviours are video based-interventions most equipped to encourage?

3) Which components of VBI are the most important to facilitate success?

4) Do VBI generally have successful rates of generalisation and maintenance?

5) Do VBI encourage positive outcomes related specifically to academic achievement?

And finally;

6) Does the effectiveness of VBI programmes vary with regard to the children's age or gender?

To answer these questions most effectively, a thorough systematic review and meta-analysis is required. The findings of the proposed study will be beneficial in clarifying the effectiveness of VBI and will provide future directions to researchers interested to know the circumstance/s in which they work best.

EXISTING REVIEWS

The first author has been extensively trained in using Sandiesons' Pearl Harvesting search framework (Sandieson, 2006) and has used the method within another review (Keenan *et al.,* 2016). This search methodology follows exact guidelines in order to find all relevant keywords that will locate the relevant articles. As this search methodology collects many more relevant articles than other strategies can feasibly collect, other search strategies within the following reviews have been limited from the outset.

Using the online thesaurus developed by Sandieson, the first author completed a search in December 2016. It was identified that there have now been over 100 studies in this area, especially from 2013 when the use of handheld tablets rapidly increased among children.

While there now exists a number of reviews and analyses, a thorough systematic search and meta-analysis of the effectiveness of these video-based intervention programmes is warranted as these existing reviews:

- Have not developed an advanced search strategy.

In the meta-analysis from Wang *et al.* (2011) they search 5 databases with the terms: (1) autism or autistic, (2) social or psychosocial, and (3) therapy or training or intervention or treatment. They limit their search to papers published from 1995 – 2008 to ensure consistency in the diagnosis of autism. This search returned 13 relevant papers, this is much less than the review team has located in our initial searches. The first published evidence of the use of a VBI as a treatment for a child with autism was reported by Steinborn and Knapp (1982). The study reported that it was possible to teach pedestrian safety skills to a child with ASD. The study used video recordings, video feedback and manipulating correct actions with a doll, to teach a 10-year-old child the conditions in which it was safe to cross the road. As this highlights that VBI was being employed as an intervention for autism from as early as 1982, then the authors may have missed many relevant papers which possibly could skew the results in a meta-analysis.

- They focus on one type of Video-based intervention.

A meta-analysis exists which looks at the efficacy of Point-of-View video modelling across 17 studies (Mason *et al.* (2013). While another meta-analysis from the same author analyses results from Video Self- modelling in their review of 23 research papers (Mason *et al,* 2016). These two specific video interventions are also summarised in a paper from Bellini & Akullian (2007) where they present positive results from 23 research papers.

This review would set out to be inclusive of all types of video-based intervention and so our sample will be much larger, which will present a much more inclusive and representative sample of children with autism spectrum disorders. Furthermore, by focusing on the multiple types of video-based intervention, the authors will be able to draw conclusions regarding their relative effectiveness within the included sample.

• They have not been autism specific.

In a doctoral thesis from Mason (2012), meta- analytical techniques test the efficacy of individuals with disabilities including Attention deficit – hyperactivity disorder, intellectual and developmental disabilities. As we are interested in the outcomes specifically for children with ASD we would choose to remain focused on this diagnosis so that we could provide information directly to the practitioners and policymakers interested in this area of disability. This research also excluded any paper which has not been published in a peer-review journal. This is a major limitation in a systematic search as grey literature should be uncovered and included to counteract publication bias.

To summarise, the majority of the literature describes major limitations in the body of knowledge, including little or no comparison between the differing VBI procedures, components and an overall lack of empirical data. There is also widespread confusion within the literature on who is the most effective model. McCoy & Hermansen (2007) reviewed the types and effects of different models and concluded;

> 'The verdict on who is the most appropriate and meaningful model for which type of behaviour is still out. . .Based on the literature in this review, at this time, the models with the most significant impact seem to be self and peers.' (2007: 206)

There also has been no definitive evidence to suggest exactly who would or wouldn't benefit from VBI and there is no available research which supports a measurement of predictions of an individual's success with a VBI programme. Indeed, individual characteristics such as visual processing and language skills may influence the effectiveness of such interventions (Delano, 2007).

INTERVENTION

VBI in educational practice

As outlined above, VBI has been used extensively among education approaches for promoting targeted behaviours in individuals with ASD. Benefits include the cost effectiveness, enables teaching to become standardised (e.g., by removing inconsistencies of different teaching methods from teacher to teacher), and the little time required to implement the programme (Sigafoos et al., 2007). Most notably, in a meta-analysis of 23 studies on video modelling, Bellini & Akullian (2007) found that video modelling did, in fact, meet the criteria warranting its designation as an evidence-based practice. This same study also found that video modelling leads to rapid skill acquisition and the skills were maintained and generalised effectively.

While VBI has proven effective within the educational setting for typical students, it is currently positioned within the literature to hold particular significance and relevance as an intervention technique for ASD.

Thelen et al., (1979) describe several advantages of using VBI as an effective teaching technique. These include:

1) Control over the modelling procedure to ensure the teaching technique is correct and appropriate
2) The ability to present a variety of examples and settings which will lead to greater generalisation and maintenance of the learned behaviour
3) Repetition of the same model
4) The ability to reuse the same video for different individuals thus, very time and cost effective

VBI is particularly appealing to teachers, as acting out live scenarios in order to teach a new skill can be costly, require more time for training and implementation and fundamentally less effective (Graetz et al., 2006).

Five literature reviews unanimously describe VBI as successful and lead to positive effects overall. Mechling (2005) describes the video programmes included within the review to show at least 91% positive intervention effects.

This systematic review carries particular importance and responsibility as it will be carried out without bias and with a sole focus to attain answers from research that is already available. There will be efforts made to find relationships and correlations between all available studies. This work can act as a guide by synthesising and analysing all the available results and therefore possibly moderate the intervention outcome to aid the choosing of the correct intervention for the appropriate individual and in doing so, producing data on amendable components to match individual differences and thus working towards a way of benefitting every individual across the spectrum.

POPULATION

Participants must be aged between 3-18 years old with a professional diagnosis of ASD.

As this systematic review will encompass all published studies worldwide (accessible in English), an inclusion strategy of age 3-18 will support coverage for those studies which are carried out in an educational institution. Although our review is not limited to those interventions carried out in an educational institution, we choose the school-age population as our benchmark so that we could include all relevant studies. Countries such as Israel, America and Belgium have a higher school leaving age of 18 compared with the UK, Australia and Italy who have a school leaving age of 16. The age range begins at three years old as children most often enter preschool at this stage.

Only participants who had a professional diagnosis of ASD as defined by the DSM- 5 will be included. We will include participants with comorbid diagnosis. Information on whether the participant group was ASD-only or ASD with comorbidities will be recorded to compare whether the effects of VBI are similar across comorbid and non-comorbid populations.

OUTCOMES

The primary outcome which encompasses the focus of this review will be any improvement in social behaviours of children with autism spectrum disorders. These targeted outcomes will include aforementioned aspects of social skills and behaviours:

- The interactive social engagement with peers
- Social Understanding
- Safety skills
- Imaginative play
- Academic performance
- Community and Vocational Skills
- Emotional Regulation

STUDY DESIGNS

Within the meta-analysis, only studies which use a 'true' control group design will be included. The included research will provide data from an original study which reports on intervention effects collected from an intervention group and at least one untrained control group. These groups (intervention and control) may be assigned randomly or non-randomly. Non-random studies will be coded in relation to how suitably matched the two groups were at pre-test and also whether attempts were made to control for pre-test differences.

Within the systematic review, we will provide descriptive tables on all other studies which match our pre-determined inclusion criteria, the systematic review will provide data from studies carried out using single subject research designs, including; Multiple Baseline designs, combined designs, A-B-A-B designs and alternating treatment designs.

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