**Misinformation in Autism Spectrum Disorder and Education**

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Abstract

Students with autism spectrum disorder (ASD) show significant challenges in learning and participation at school. Although a number of evidence-based effective practices to support these students have been developed, practices lacking empirical support, or indeed with evidence of ineffectiveness or harm, are still being used at high rates in schools. The range of available ASD intervention practices is overviewed in this chapter, along with recent research into teacher knowledge and use of these practices. The impact of misinformation about the evidence base of practices is discussed as a potential contributor to continued use and uptake of ineffective practices. Strategies to respond to this misinformation in the educational context are overviewed. We conclude with a discussion of the need for ongoing, multi-level support, to instigate and maintain sustained change in terms of reducing or eliminating use of ineffective or fad practices, and increasing the use of effective practices.

## Misinformation in Autism Spectrum Disorder and Education

Autism Spectrum Disorder (ASD) affects approximately 1 in 50 school-aged children (Blumberg et al., 2013) and is characterized by impairments in social communication and the presence of restricted and/or repetitive behaviors or interests (American Psychiatric Association, 2013). ASD is associated with significant challenges in learning and participation at school (Australian Bureau of Statistics., 2014). Despite the availability of well-documented and effective interventions (e.g., National Autism Center, 2015), ineffective or even harmful practices have been applied in schools at alarmingly high rates (e.g., Carter, Stephenson, & Strnadová, 2011; Carter, Strnadová, & Stephenson, 2012; Hess, Morrier, Heflin, & Ivey, 2008). In fact, ASD has been described as a "fad magnet" (Metz, Mulick, & Butter, 2005, p. 237) with over 50 unsupported or disproven therapies documented (Smith, 2008), and over 1,300 identified online (Research Autism, 2018). In this chapter, we explore the extent to which misinformation and quackery occur in the education of children with ASD. We will cover the range of available intervention practices and recent research into teacher knowledge and use of intervention practices. We will consider ways in which misinformation may be contributing to the uptake and persistence of ineffective intervention practices. We consider how research involving teachers may contribute to the development of strategies to counter misinformation and quackery in the educational setting. Finally, we will discuss the need for ongoing multilevel support to facilitate sustained change in the use of effective practices and present examples of implementation models.

### Autism Spectrum Disorder and Education

Internationally, there has been an increasing shift from education of students with ASD in specialist settings, to inclusive education settings with general education teachers. This has resulted in the majority of students with ASD spending some or all of their education in general/regular education classrooms and settings in the United States (US

Department of Education National Center for Education Statistics, 2016) and Australia (Australian Bureau of Statistics [ABS], 2014). There is consistent, and troubling evidence that school is challenging for the majority of these students. In Australia, for example, 85% of students are reported to have difficulties at school and approximately 28% attend special schools (ABS, 2014). The three most common difficulties identified are fitting in socially (63%), learning difficulties (62%), and communication difficulties (52%), with even foundational skills such as sitting during lessons a challenge for nearly 1 in 5 students. These difficulties both arise from, and contribute to, the challenges faced by educators in catering for often large and diverse groups of students, many of whom face personal and environmental barriers to education. Given the importance of educational achievement to long term health and social outcomes, and the extensive time spent by students in school, there is a marked need for effective interventions that can make education more accessible and successful for students with ASD. There is also a significant risk in terms of the implementation of fad treatments instead of effective interventions. Fad treatments may on the surface appear logical, use scientific-sounding terms, and may be endorsed by popular media, celebrities and so forth, but have no evidence of effectiveness, or indeed have evidence of ineffectiveness or harm.

Fortunately, a range of effective evidence-based interventions have been developed for pre-school and school-aged students with ASD. *Focussed* interventions target the development of skills in a specific domain such as communication or social skills (e.g., helping a student learn to request preferred items, or to transition between activities), and are commonly added to or embedded within broader educational practices in mainstream classrooms. In contrast, *comprehensive* interventions target a range of developmental domains which typically include social, communication, and independent living skills (Odom, Collet-Klingenberg, Rogers, & Hatton, 2010), and may form the basis for teaching in

specialist education settings (e.g., the Treatment and Education of Autistic and Related

Communication Handicapped Children program; Mesibov, Shea, & Schopler, 2005).  The

two most recent systematic reviews of focussed interventions (National Autism Center, 2015;

Wong et al., 2015) identified 14 and 27 effective practices, respectively, that show sufficient

research evidence for effectiveness, with evidence for a range of comprehensive interventions

based on developmental and behavioral principles now also established (Schreibman et al.,

2015). Thus, educators, parents, and allied health professionals are seemingly in a strong

position, with access to accurate information, to address the needs of students with ASD

through the selection and use of effective practices that are based on sufficient research

evidence to be classifed as effective.

Unfortunately, misinformation is common, both regarding the evidence base of

effective treatments and the alleged effectiveness of ineffective treatments. We use the term

misinformation here to refer to all information that is potentially accepted to be true, despite

it being demonstrably false (Lewandowsky, Ecker, Seifert, Schwarz, & Cook, 2012). A

pervasive source of misinformation, is information from marketing of the wide array of

interventions that have not been supported by research evidence, henceforth referred to as

'fad' treatments. These fad treatments are developed for, and in some cases marketed to,

students with ASD, their teachers, parents, and other supporters. The number of effective

interventions pales in comparison to the number of fad treatments. In fact, Research

Autism—which aims to increase understanding about the evidence base of interventions—

has identified over 1,300 interventions, treatments, and therapies, the majority of which have

not been subjected to rigorous, if any, research evaluation. These range from *α-adrenergic-*

*antagonists* (a pharmacological intervention) to *Z therapy*, which they describe as *"a form of*

*attachment therapy; an extremely controversial group of therapies designed to help children*

*with attachment disorders"* (Research Autism, 2018). Unfortunately, this growing "haystack"

of proposed interventions makes stumbling upon effective intervention "needles" increasingly unlikely. In other words, ASD treatment decisions are made in a context that is ripe with misinformation and quackery. Arguably, it is educators who are most exposed and susceptible to these negative educational forces, but also uniquely positioned to be the greatest agents of change in the provision of effective practices.

**Knowledge and Use of Practices**

Teachers play a substantial role in the education of children with ASD, whether in inclusive classrooms or special education settings, due in part to the long hours children spend in these settings (Koegel, Matos-Freden, Lang, & Koegel, 2012). The success of students with ASD, therefore, falls substantially to teachers and their knowledge and skills— in particular their ability to navigate the (mis-)information landscape, to identify and implement effective practices (Goodman & Williams, 2007; Harrower & Dunlap, 2001; Koegel et al., 2012), and to reject the use of ineffective and/or fad treatments without evidence. The use of effective interventions is also mandated in some countries, for all children attending schools and, in some cases, specifically for children with disabilities (e.g., No Child Left Behind Act, 2001; Individuals with Disabilities Educational Improvement Act, 2004). Despite this, emerging research suggests that teachers use a combination of practices with varying levels of research support.

Burns and Ysseldyke (2009) investigated the frequency with which effective practices were implemented by a sample of North American special education teachers and school psychologists working with students with a range of disabilities (specific learning disability, emotional-behavioral disorders, ASD, etc.). Of eight special education practices, teachers self-reported using a combination of both effective and ineffective/fad practices (e.g., perceptual-motor training). Indeed, some of the ineffective interventions (e.g., modality instruction) were used more frequently than effective interventions (e.g., applied behavior

analysis). Carter, Stephenson, and Strnadova (2011) replicated this study with a sample of Australian special education teachers. Consistent with Burns and Ysseldyke, Carter and colleagues found that while effective practices were widely used by special education teachers, almost half of their sample employed ineffective practices at least once a week. Interestingly, when compared to the North American sample, Australian special educators were found to use one of the effective interventions (direct instruction) significantly less, with significantly higher use of a fad practice that lacks empirical support (perceptual-motor training). While it could be argued that less guidance is given to special educators working with students with disabilities other than ASD, the limited ASD-specific research available tells a strikingly similar story, despite significant efforts to identify effective interventions for use with this population.

Research specifically investigating interventions used by teachers of students with ASD paints a very similar picture. Hess et al. (2008) surveyed both special education (79% of sample) and general education teachers in one US state, to establish the types of interventions that were being used with students with ASD. Hess et al. included 43 interventions, which were classified as either effective, promising, having only limited support, ineffective, or not rated in reviews (derived from Green et al., 2006; National Research Council, 2001; Simpson et al., 2005). Hess et al. found that less than 10% of their sample reported using those interventions classified as effective, with a further 21% using interventions classified as promising. Similarly, Morrier, Hess, and Heflin (2011) surveyed both special education (58.9%) and general education teachers in the US, and found fewer than 5% of teachers reported using practices classified as effective (using Simpson et al., 2005 criteria). This suggests that, 7-10 years ago, use of effective interventions was less common than use of other types of interventions including fad/ineffective treatments, with participants reporting using interventions such as auditory integration training (shown to be ineffective, for a review

see Sinha, Silove, Wheeler, & Williams, 2006), rapid prompting (ineffective, for a review see Hemsley, 2016), and holding therapy (ineffective and also potentially harmful, see Pignotti & Mercer, 2007).

More recent research suggests ongoing use of fad treatments and non-use of effective treatments. Borders, Bock, and Szymanski (2015) reported that in their sample of 68 teachers of students with both hearing loss and autism, 16 of 25 effective interventions were not used, despite teachers reporting familiarity with those interventions. It is important to note, however, that Borders et al. did not directly look at associations between familiarity and use of interventions. The link between familiarity—or more specifically, perceived knowledge— and use of interventions was investigated recently by Sulek, Trembath, Paynter, and Keen (2018). Sulek et al. investigated general-education teachers' knowledge and use of 20 interventions (taken from Wong et al., 2015), which target school-readiness outcomes in children with ASD. Promisingly, teachers in this study did report using effective interventions more often than other interventions included. However, the two unsupported interventions included—music therapy (59%) and touch therapy (45%)—were used at least some of the time by a large proportion of participants. Interestingly, Sulek et al. found that perceived knowledge of effective interventions and their use were significantly correlated. This highlights the risk of misinformation, whereby perceived (but inaccurate) knowledge of an ineffective intervention may support use of that intervention.

Emerging research has indeed highlighted the presence of misconceptions in teachers and pre-service teachers, which could consequently impact on their selection and use of interventions and the way they approach teaching of students with ASD. Liu and colleagues (2016) conducted a survey of a stratified sample of 471 preschool teachers in China and found low levels of knowledge of ASD. This included, for example, the finding that only 5% of teachers accurately responded to the question *"Autism is curable if diagnosed early and*

*the appropriate intervention is provided"* (false); and only 28% accurately responded to *"Changing the diet of a child with autism will make a difference in their outcome"* (also false). Given lower general knowledge of ASD in China, as indicated by lower detection and prevalence rates of ASD (0.12%, relative to a median international prevalence of 0.6% see Elsabbagh et al., 2012), it is unclear whether similar findings would also be observed in Western countries. However, research with pre-service teachers in the US indeed suggests this may be the case: Bain, Brown, and Jordan (2009) found evidence for high endorsement of fad treatments for ASD in pre-service teachers. These included interventions with demonstrated risks for harm, such as facilitated communication (a debunked treatment associated with false sexual abuse accusations, see Ganz, 2014), avoiding measles-mumps-rubella vaccinations (a debunked proposed cause for ASD, for a review of the vaccine/ASD research see Taylor, Swerdfeger, & Eslick, 2014), and the particularly dangerous practice of chelation (this strips heavy-metals from the body, can cause death, and is ineffective, see Akins, Angkustsiri, & Hansen, 2010). Bain et al. found that 30% or more of pre-service teachers reported familiarity with these fad treatments, including direct experience and exposure. This experience is likely to then be taken into practice as a source of information (with practicum experience rated as a highly trusted source of information by practicing teachers, e.g., Carter, Stephenson, & Hopper, 2015) and maintain continued use of fad treatments in the field into the future.

To date, much of the research has focussed on special educators; this research suggests a strong presence of misinformation and common use of ineffective/fad treatments. Although limited in nature, the available research presents a consistent picture across professionals and settings, namely that ineffective and fad practice use persists. While more research is warranted to further understand teacher knowledge and use of interventions, it is

also critical that we understand the underlying factors that contribute to the knowledge and use of effective interventions and continued use of ineffective and/or fad interventions.

**Influences on Teacher Practice**

**Teacher training.** Knowledge and use of specific interventions in teachers may be influenced by teacher training, the school system, personal experience, information accessed of teachers' own accord, and their own attitudes. A significant gap in teacher training may contribute to the problem, whereby neither special-education nor general-education teacher training includes sufficient preparation for inclusion of students with ASD in general-education settings (Morrier, Hess, & Heflin, 2011). Consistent with this, fewer than 15% of teachers (including both special and general education teachers) reported receiving training on specific effective practices from their university-based teacher education program (Morrier et al., 2011). In contrast, and more promisingly, a recent study found that close to 60% of special educators did report receiving direct instruction or discussion of effective practices in their training (Hsiao & Petersen, 2018). However, this still suggests a significant number of special educators (around 40%) did not report training in effective practices. Further, while some tertiary education courses may provide training and effectively promote what to use (i.e., effective practices), they are less adept at providing instruction about what *not* to use (Carter et al., 2011). This is consistent with reviews of educational research in ASD (e.g., National Autism Center, 2015; Wong et al., 2015) tending to focus more on what practices are effective, with less attention paid to (or indeed no mention of, e.g., Wong et al., 2015) practices that are ineffective and not recommended. Thus, teachers entering the profession may not be prepared for dealing with fad and/or ineffective practices they encounter and may be vulnerable to misinformation.

**School system.** Practices may be introduced to teachers through the broader school system. Indeed, rather than at an individual level, decisions to adopt a particular program or

practice are often made by administrators or school systems (Carrier, Sohn, Jao, & Shah, 2014). Thus, it is important for these systems to have a strong capacity to seek out, evaluate, and disseminate accurate information from research to inform practice selection. However, previous research has suggested deficits in these skills, such as a lack of formal process (Levin, 2010). Where school systems lack a formal process, they may become vulnerable to fad practices promoted or endorsed by a small number of individuals in the system (Levin, 2010). This may be a particular challenge in ASD, with a plethora of interventions available and often aggressively marketed to educators and education systems. This challenge is further exacerbated by teachers' and administrators' trust that if resources are invested in a practice, and the practice is endorsed by a school system (e.g., a ministry of education, a school board), then it must be effective (Barwick, Barac, Akrong, Johnson, & Chaban, 2014). However, this is not true in practice. For example, the perceptual-motor program Brain Gym (see Equilibrium, n.d.) is a fad treatment promoted for students with ASD; it lacks empirical support of efficacy and has a questionable theoretical basis. Yet, it has been endorsed by school systems in Australia, which has included explicit endorsement of its use and evidence base, as well as promotion of training and workshops (Stephenson, 2009). Thus, school systems are vulnerable to the promotion of misinformation regarding fad treatments in education, which may consequently impact on teacher practice.

**Personal experience.** Decisions to use a specific practice by an individual teacher may be further influenced by a range of factors beyond empirical evidence, including anecdotal sources of evidence that are often rated as more important (e.g., Barwick et al., 2014; Carter et al., 2015; Greenway, McCollow, Hudson, Peck, & Davis, 2013). Personal experience (e.g., through practicum placements) has been rated as the most important influence on teacher practice by pre-service teachers (Carter et al., 2015). Further, practicing general and special education teachers have reported observations of other teachers to be an

important factor informing decision making (Barwick et al., 2014). This means that observation of fad and/or ineffective treatments that are commonly used in education settings with students with ASD can provide a model for others to endorse them and maintain their use. Evidence for this may be seen in a recent study that found 60% of pre-service teachers falsely reported facilitated communication (an ineffective practice, see Lilienfeld, Marshall, Todd, & Shane, 2014; Trembath, Paynter, Keen, & Ecker, 2015) was effective, and of these 47% reported direct exposure to this practice (Bain et al., 2009).

**Information access.** The question arises why teachers seem to show relatively lower use of research than other factors (e.g., personal experience) in informing their decision making. A number of factors influence teachers' use of research, including their ability to access and navigate information; preference for specific information types or sources; and general attitudes towards science, research, and the evidence-based practice (EBP) framework more generally. Teachers, like the general population, express a preference for information that is simple to understand (Barwick et al., 2014), which can conflict with the way research is often communicated. This may explain why previous research has found teachers engage in little professional reading of scientific journal articles or other sources of empirical information (Carter & Wheldall, 2008). Further, attitudes towards EBP may form barriers to seeking and using research information in the first place.

**Attitudes of teachers.** Attitudes that may form barriers include skepticism of scientific research and the EBP concept in general, and concerns about applicability of general information to individual cases. Skepticism arises from beliefs that research may be manipulated to support any particular position (Boardman, Argüelles, Vaughn, Hughes, & Klingner, 2005) or may be used to sell or market a particular product or intervention (Greenway et al., 2013). Further, special educators often express concerns with generalising to the needs of their specific population, which may mean research evidence is viewed as

inappropriate or not applicable to their particular students (Boardman et al., 2005; Greenway et al., 2013). This may be particularly salient in ASD, where significant heterogeneity is present. Even when teachers are keen to use research, challenges may arise from the differentiation of valid research evidence, and misinformation.

**The Impact of Misinformation**

The amount and complexity of information available to the general public has grown exponentially over past decades (Emmons et al., 2009). This has resulted in a significant shift in education from difficulties finding information and support for students with ASD, to difficulties with sorting through the vast amounts of information available (Carrier et al., 2014). While this problem has arguably been exacerbated by the rise of "web 2.0" and the social media—where misinformation is often spread more quickly and more widely than valid information (Vosoughi, Roy, & Aral, 2018)—misinformation comes in many guises and from many sources. This includes websites that purport to be evidence-based; in a recent analysis of such websites, which ostensibly provided evidence-based information regarding special education practices, around half of them (43%) were found to be of poor quality and were hence not recommended (Test, Kemp-Inman, Diegelmann, Hitt, & Bethune, 2015). Further, dubious claims can be found in education department communications, as discussed earlier, as well as magazines, advertisements, and they can even be promoted by health professionals. For example, recent research has suggested that some health professionals hold misconceptions regarding the evidence base of educational practices for ASD (e.g., falsely reporting facilitated communication was evidence-based, Paynter, Sulek, Luskin-Saxby, Trembath, & Keen, 2018); thus, these professionals may also promote misinformation to teachers.

There are many factors that contribute to people's belief in misinformation generally, that are likely to apply also to teachers. First and foremost, people are hardwired to seek

explanations for events, to find patterns in noise, and to build coherent mental models of the world around them (e.g., Kay, Whitson, Gaucher, & Galinsky, 2009). If there is no good explanation, no pattern, or no coherence, this human tendency naturally predisposes people to form misconceived views. The area of ASD may be particularly prone to such effects, as there is no clear cause for ASD, and no single intervention or support plan recommended for all students. A good example of this tendency is the powerful illusion of causality, also known as the *post hoc, ergo propter hoc* fallacy: If an individual seems to show some form of improvement after an intervention has been started, then it is tempting to assume causality even in cases where this is not warranted (e.g., Matute, Yarritu, & Vadillo, 2011). Thus, when a student shows progress, a teacher may falsely attribute causality to a fad treatment, thus promoting trust in misinformation and continued use of a fad treatment.

Secondly, people are often willing to "give anything a go." In this case, even if there is no firm belief in the misinformation used to promote ineffective or harmful treatments, the risks and opportunity costs associated with those treatments are often underestimated (Wardle & Adams, 2014). In education, this may be combined with optimism in the potential for change in an individual with ASD, which is a positive (Bain et al., 2009) but may make educators vulnerable to exaggerated claims frequently made by promotors of fad treatments. Consistent with this possibility, openness to new treatments has been linked to greater use of fad treatments in other professionals working with individuals with ASD (Paynter, Sulek, et al., 2018).

Finally, people are faced with so much information on a daily basis that it is impossible to scrutinize everything we encounter. This promotes use of mental rules of thumb such as the availability and recognition heuristics, which often work surprisingly well (e.g., see Gigerenzer & Gaissmaier, 2011), but when coupled with existing false beliefs, lead to bias. Specifically, people are generally motivated to seek out and accept information that

bolsters their preconceptions (Nickerson, 1998). Information that confirms a pre-existing belief will be more fluently processed, and will appear more familiar and more plausible; such information is thus more likely to be believed (Begg, Anas, & Farinacci, 1992; Schwarz, Sanna, Skurnik, & Yoon, 2007). In other words, people demonstrate "motivated cognition": they fall for plausible misinformation that affirms their worldview. To illustrate with an example from education, where a particularly tenacious myth concerns the existence of distinctive "learning styles": People with individualistic views will be especially motivated to uncritically accept the myth that children have different "learning styles", as this myth emphasizes individual differences, which meshes well with an individualistic worldview (Reynolds, 1997). It is also consistent with educator concerns regarding the individual vs. general case (Boardman et al., 2005; Greenway et al., 2013).

**Misinformation Correction**

There are thus many reasons to believe in misinformation initially; unfortunately, however, it is well understood that misinformation is not easily corrected (Lewandowsky et al., 2012). There are two dominant reasons for this. On the one hand, knowledge revision requires significant cognitive flexibility. Processing a retraction or a refutation requires non-trivial information integration and memory updating processes, serving to resolve the conflict between invalidated knowledge or belief and the new factual information, and construct a valid and coherent, updated representation (Ecker, Hogan, & Lewandowsky, 2017; Gordon, Brooks, Quadflieg, Ecker, & Lewandowsky, 2017; Kendeou, Walsh, Smith, & O'Brien, 2014). Moreover, even after a correction has been successfully processed, the old, invalidated representation may still remain accessible in memory (Ayers & Reder, 1998); thus, when cued, a person needs to ensure they retrieve the valid, updated representation from memory rather than the invalidated representation (Ecker, Lewandowsky, & Tang, 2010).

On the other hand, a significant barrier to misinformation corrections lies again in motivated cognition—people will not only be motivated to believe in worldview-congruent misinformation, they will also be motivated to resist corrections of this misinformation (Ecker & Ang, 2018; Nyhan & Reifler, 2010). Misconceptions are especially difficult to counter if the associated belief system fulfils an important social-identity function. For example, the framing of ASD as a communication deficit or a gastroenterological syndrome may serve a specific psychological function, and thus interventions such as facilitated communication or special diets that feed the associated misconception will be defended against corrective "attacks." Debunking is often made even more difficult by people's tendency to surround themselves with significant others (online or in peer groups) that share the same belief system.

Making corrections as effective as they can be thus requires optimal presentation of accurate, alternative information (Ecker, Lewandowsky, Swire, & Chang, 2011; Seifert, 2002). The accurate information should be as plausible as the misinformation that is being corrected, and communicated in simple, easy-to-understand language. Presenting alternative information is of particular importance because the alternative information can serve to fill the gap created by a retraction or correction in a person's mental model (Ecker et al., 2010). The correction should come from a trustworthy source (Guillory & Geraci, 2013), such as other teachers, rather than researchers or administrators who may not be viewed as credible by teachers. Finally, lasting knowledge and belief revision requires repeated debunking efforts: one-off interventions, even if effective in the short-term, may not have sustained impact because the effect of a correction may be offset in the long-term by the familiarity of the misinformation (Swire, Ecker, & Lewandowsky, 2017; see also Paynter, Ecker et al., 2018).

**Social Norming and Nudging**

Given the difficulties associated with correcting misinformation, even under optimal conditions, debunking misinformation is not necessarily the most effective way to induce behavioral change in general. Much research is therefore looking at avenues involving social norming and nudging approaches as alternative pathways to behavior change. *Social norming* attempts to reduce undesired behaviors by making transparent a person's extremeness in a social distribution. For example, a person whose drinking behavior puts them beyond the 95$^{th}$ percentile of a relevant comparison distribution will worry more about their drinking than a person who is merely told they drink more than the average (Aldrovandi, Brown, & Wood, 2015). This approach may in future be used in ASD education to highlight when a teacher is using an unusual fad intervention—however, such an approach first requires social norms to evolve in education that are more supportive of EBP. *Nudging* may be a more promising approach in the current climate; nudging refers to changing the environmental context or informational architecture to influence a behavior (e.g., moving from an opt-in to an opt-out organ donation scheme; Marteau, Ogilvie, Roland, Suhrcke, & Kelly, 2011). This may be applied to ASD interventions by making resources (e.g., training, materials) for effective practices more readily available and an easier choice than those required for fad treatments (e.g., *not* offering training or resourcing for fad treatments). This may also include increasing the administrative burden placed on teachers seeking to use or engage in training for fad treatments.

**Strategies to Create Sustained Change in Practice**

The rate at which fad therapies or treatments are introduced to the marketplace is rapid, making it difficult for researchers to evaluate these in a timely manner to demonstrate a lack of efficacy. Vigilance is required to refute claims effectively and in a sustained manner. However, creating sustained change in practice requires more than debunking of

misinformation regarding fad treatments, social norming, or nudging. Educators also need access to professional development in building their knowledge and skills in the use of effective practices. It is not sufficient to attempt to reduce the use of ineffective practices in the absence of providing a viable alternative.

A major emphasis in translating research to practice in ASD, has been the almost exclusive focus on increasing knowledge and use of effective practices. Such an approach fails to counter misinformation and its impact as it does not address knowledge or use of ineffective or fad treatments. Traditionally attempts to increase knowledge and use of effective practices have been completed through delivery of information about effective practices only via one-off workshops and seminars. Unfortunately, this has proven relatively ineffective in bringing about a change in practice (Fixsen, Naoom, Blase, Friedman, & Wallace, 2005). Recently, job-embedded professional development has become more widely used and is now considered a preferred and more effective model (Dunst, 2015). Job-embedded professional development incorporates strategies such as demonstration, modelling, and performance feedback that occur in situ. Fidelity of implementation can also be improved through this approach to teacher professional development.

While there is evidence that increasing knowledge of interventions supported by research can be effective in changing teacher practice (for a recent review see Alexander, Ayres, & Smith, 2015), it may not be sufficient to bring about sustained change in the face of continual exposure to new fad treatments. That is, while use of effective practices may increase following professional development, use of ineffective practices may continue, with teachers using a combination of both effective and ineffective teaching practices, as seen in previous research (e.g., Hess et al., 2008). This may be due to continuing to believe misinformation that an ineffective or fad practice is evidence-based. To ensure change, it is important to directly target misinformation about ineffective practices and replace them with

effective practices. Teachers are likely to need professional development to increase their skills and to facilitate implementation of effective practices. Without this support, teachers may continue to use ineffective practices, even if correction of misinformation has brought about some change in their beliefs about those practices.. Thus, real-world change may be supported through provision of skills training in addition to correction of misinformation to achieve the greatest impact.

There are however, several barriers to the implementation of job-embedded professional development approaches. One of these barriers concerns the resource-intensive nature of the strategies. One-to-one coaching and mentoring is labour intensive and often relies on employing external specialists with expertise in the practices to be learned. In the education of students with ASD, some commonly used practices that are well supported by research require specialized training accompanied by high costs. These include the Picture Exchange Communication System and Functional Communication Training, both needing extensive training to ensure implementation with fidelity.

While schools face the challenge of overcoming the barriers outlined above, additional issues must be addressed in order to achieve change in practice and to sustain this change over time. Professional development alone is necessary, but not sufficient, to ensure the sustained use of effective practices across an organisation. To establish and maintain an evidence-informed approach to students with ASD, factors such as organisational culture, education policy, and effective structures, systems, and resources that facilitate knowledge and use of effective and non-use of ineffective and fad practices is needed. This has led to a growing body of research that is examining ways of applying to education what has been learned through implementation science in the field of medicine.

Implementation science concerns the study of the adoption of interventions into practice, in the context of real world settings. Various other terms have been used to describe

this method including knowledge transfer, knowledge translation, and translational research (Cook & Odom, 2013). It is evident through studies in implementation science that key to achieving and sustaining effective practices in an organisation is the role of an individual or group to convey information about effective and ineffective practices. Sometimes referred to as purveyors (Fixsen et al., 2005) or knowledge brokers (Dew & Boydell, 2017), these individuals or groups take evidence that has been produced and synthesized, then distribute or transfer it to front-line professionals. Without this important link, evidence collected in repositories can gather dust, potentially leaving gaps in knowledge and skills that can be filled via misinformation. Knowledge brokers are frequently identified as purveyors of knowledge about effective practices but they can play an equally important role as trusted sources in defusing arguments put forward by promoters of pseudoscience (Smith & MacDonald, 2017).

To create sustained change in practice requires alignment across all components of the evidence chain: evidence producers, evidence synthesizers, evidence distributors, and evidence implementers. In ASD research, important advances have been made in building an evidence base for strategies that can support the learning, development, and behavior of individuals. This evidence has been synthesized through good-quality studies that have evaluated the quality of the evidence and made recommendations regarding practice efficacy. There are some signs that evidence distribution and implementation is growing but with room for further development in this area (Knight, Heartley, Kuntz, Carter, & Juarez, 2018).

**Conclusion**

The provision of high-quality education to students with ASD represents a significant challenge to educators, as evidenced by the poor outcomes shown in students with ASD. While syntheses of the empirical evidence have been created to support effective teacher practice, combined with federal mandates to use only practices supported by research, a

significant gap between policy, research, and practice exists whereby use of both ineffective and fad treatments continues. The proliferation of available practices poses significant challenges at both the system and individual-teacher level.  Gaps in information literacy leave teachers and administrators vulnerable to misinformation, and reliant on anecdotal sources of information, impacting on teacher decision making and practice. Understanding how misinformation is spread, and how it can be effectively debunked, is important in order to improve knowledge of the evidence base of interventions and support teacher decision making. However, sustained change may only be achieved if ongoing support and coaching is provided to build knowledge and skills, requiring significant investment. Such an investment is vital, however, to support the best possible outcomes for students with ASD and to protect them from the risks of ineffective and fad treatments in terms of opportunity cost, false hopes, and harm.

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