Bridging the gap: Understanding Irish teachers' use of evidence-based practices with children with autism.

Bridging the gap: Understanding Irish teachers' use of evidence-based practices with children with Autism.

Lorna Barry

A thesis submitted to the University of Limerick for the Degree of Doctor of Philosophy

Supervised by Dr. Jennifer McMahon, Dr. Jennifer Holloway (National University of Ireland, Galway) and Professor Stephen Gallagher.

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ABSTRACT

Background: Improving the translation of evidence-based practices (EBPs) for students with autism from research into practice in classrooms is a key issue in autism education provision. Employing EBPs in educating students with autism has been associated with improved teacher and student outcomes, yet the potential for improved outcomes often goes unrealised due to implementation issues in adopting EBPs in the classroom. Identifying factors which help or hinder the adoption of EBPs is critical in bridging this research to practice gap. Furthermore, gaining an understanding of contextual factors in autism education is important to drive understanding of the implementation of EBPs in Ireland and more broadly.

Aim: The aim of this thesis is to explore Irish teacher's implementation of EBPs by identifying levels of knowledge and use of EBPs, levels of training, identifying barriers and facilitators to implementation, and by analysing factors which impact EBP use.

Method: This thesis consists of a scoping review, three empirical studies and a protocol. The first study, a scoping review of the barriers and facilitators to autism EBP implementation in schools, sought to identify barriers and facilitators that school personnel experience when implementing EBPs in schools in the broader literature. Study 2 qualitatively examined teachers' preparation for teaching students with autism and their perspectives of EBPs. Study 3 aimed to provide novel insights into the Irish context by identifying teacher characteristics of those working with students with autism in Ireland, and to examine their knowledge and use of EBPs. Study 4 analysed factors which impact mainstream teachers use of EBPs. Finally, Study 5 drew on the information collected in the previous studies, to develop a protocol for increasing the implementation of EBPs.

Results: The results of the scoping review suggest that barriers and facilitators to implementation exist across three inter-related levels, the macro, school and individual levels, as suggested in the conceptual framework (Domitrovich et al., 2008). Study 2 identified that teachers perceive many issues with their training and preparedness for educating students with autism, and noted a lack of emphasis on EBP use in the educational culture in Ireland. The findings of Study 3 provide data to support the lack of preparedness of teachers to educate students with autism, with 65% of teachers receiving less than 3 hours of autism specific training in their initial teacher education, and 33% of teachers receiving no autism specific continuous professional development. Furthermore, teachers differed significantly on use and knowledge of EBPs, with mainstream class teachers, those with less experience, less training and less access to support professionals reporting lowest use and knowledge of EBPs. In Study 4, we found that training, knowledge, and attitudes towards EBPs were significantly associated with EBP use. Finally, in Study 5 the findings of all studies was collated, and a contextually driven protocol rooted in implementation science theory was developed to provide a blueprint for increasing teacher's use of EBPs.

Conclusion: Overall, the findings provide an important insight into autism EBP use in Ireland, and identified a number of factors which impact autism EBP use in school settings, significantly contributing to the state-of-the-art. In particular, the findings suggest that Irish teachers are under-prepared to educate students with autism that teachers lack knowledge and rarely use EBPs, and significant implementation support is needed to overcome the barriers to implementing EBPs in mainstream school settings.

Declaration

I hereby declare that this thesis is the original work of the author and where necessary due acknowledgement has been made to the work of others. No part of this thesis has been submitted to this or any other higher education institution in candidature of any degree.

Signed: Lorna Barry

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Lorna Barry (Candidate)

Date:

Statement of Candidate's Contribution

The five studies included in this thesis have been written up for publication. The candidate is fully responsible for the research presented in this thesis, however, as the papers in Chapters 2-6 are all designed as stand-alone empirical papers, the use of the word "we" is used to reflect the collaborative research process guiding the preparation of these papers for publication. As each manuscript was designed as a "stand-alone" paper, some relevant information may be repeated throughout.

The candidate under the supervision of Dr. Jennifer McMahon, Dr. Jennifer Holloway and Professor Stephen Gallagher was responsible for designing the five papers that comprise this thesis. The candidate undertook data collection in the form of literature reviews, conducting interviews and distributing the online survey. With supervisory support from Dr. Jennifer McMahon, Dr. Jennifer Holloway and Professor Stephen Gallagher, the candidate conducted qualitative and quantitative analyses, interpreted results, and wrote up the articles for publication.

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Lorna Barry (Candidate)

Statement of Supervisors Contribution

The substantial contribution to the co-authored papers included in this thesis was made by the candidate, as outlined in the candidate's statement. The candidate was responsible for completing reviews of the literature, designing studies, analysing and interpreting results, and writing up the articles for publication. Supervisory support was provided to the candidate on the production of these articles through advising on relevant literature, analysis and interpretation, and writing style. Through discussion between the candidate and supervisors, the framing and arrangement of these papers was derived.

Dr. Jennifer McMahon ______________________

Dr. Jennifer Holloway _____________________

Professor Stephen Gallagher _____________________

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To my family, thank you from the bottom of my heart for the never-ending support and belief in me through many, many years of full-time education! Having studied psychology and behaviour for over 10 years now, I have gained a significant appreciation of how early experiences shape a child for life. To that end, I owe everything I am to my unbelievable parents, and I dedicate this Ph.D. to both of you. Statistically speaking, as I am the first person in our family to finish school, I should not be where I am today. But my love of learning and curiosity of the world were undoubtedly nurtured by you both over the course of my formative years, answering my endless “but why?!” questions, and as I grew older, teaching me how to defend my point of view through various heated debates with you Dad (sorry for the stress Mom!). Most importantly, you instilled in me a mantra of “you can be anything you want to be, you just have to work hard at it”, which solidified the foundations of ambition and work ethic which have been necessary to get me to where I am today. I love you and owe you both everything, and I hope I can continue to make you both proud as I finally come out the other end of education and enter the real world.

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Peer Reviewed Publications

Barry, L., Holloway, J., & McMahon, J. (under review). 'It's up to the teacher': A qualitative study of teacher's use of autism EBPs.

Barry, L., Holloway, J., Gallagher, S., & McMahon, J. (2021). Teacher characteristics, knowledge and use of evidence-based practices in autism education in Ireland. *Journal of Autism and Developmental Disorders,* 1-11. https://doi.org/10.1007/s10803-021-05223-1

Barry, L., Holloway, J., & McMahon, J. (2020). A scoping review of the barriers and facilitators to intervention implementation in autism education. *Research in Autism Spectrum Disorders, 78,* 1-12. https://doi.org/10.1016/j.rasd.2020.101617

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Barry, L., Holloway, J., Gallagher, S., & McMahon, J. (2021). General Education Teachers Use of Evidence-Based Practices with Students with Autism: The role of Training, Knowledge, Attitudes and Barriers to EBP Use. *Advance Preprint.* https://doi.org/10.31124/advance.14166839.v1

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Barry, L., Holloway, J., Gallagher, S., & McMahon, J. (2021, May). General Education Teachers Use of Evidence Based Practices: The role of training, knowledge and barriers to EBP use. Oral presentation at International Society for Autism Research (INSAR) 20th Annual Conference (online).

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presentation at Autism Thesis in Three Competition, hosted by Trinity College Dublin (online).

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List of Abbreviations

ABA: Applied Behaviour Analysis

AIF: Active Implementation Frameworks

ASC: Autism Special Class

ASCT: Autism Special Class Teacher

CPD: Continuous Professional Development

DES: Department of Education and Skills, Ireland

EBP: Evidence Based Practices

ITE: Initial Teacher Education

MC: Mainstream Class

MCT: Mainstream Class Teacher

NCSE: National Council for Special Education

NIRN: National Implementation Research Network

SET: Special Education Teacher

USP: Unsupported Practices

Chapter 1 **Introduction**

Over the last 40 years, autism spectrum disorder research has grown exponentially, as awareness and prevalence of the disorder has increased (Odom et al., 2021). Autism spectrum disorder (henceforth autism[1]) is a neurodevelopmental disability which affects an individuals' communication and social functioning (Diagnostic and Statistical Manual of Mental Disorders- Fifth Edition [DSM-5], American Psychological Association [APA], 2013), meaning that individuals with autism present with deficits in communication and social behaviours, along with restricted and repetitive patterns of interest. These difficulties persist across the lifespan (Henninger & Taylor, 2013; Howlin et al., 2013), however, research has shown that targeted intervention can have a significant impact on functioning and outcomes in individuals on the autism spectrum (Odom et al., 2021). As a result, a significant proportion of research has been dedicated to evaluating the effectiveness of interventions designed to improve outcomes for students with autism, with interest in this area increasing in the 1980s and 1990s following the landmark outcomes of early Applied Behaviour Analysis (ABA) intervention studies (Lovaas, 1987; McEachin, et al., 1993). What has followed since then, is a contentiously and passionately debated argument on the quality of autism intervention research, and the effectiveness or ineffectiveness of interventions designed to improve core difficulties associated with a diagnosis of autism, including social, communication, sensory, academic and adaptive living skills. This thesis aims to address a small portion of this debate, concerned with the implementation of evidence-based practices (EBPs) in school settings.

[1] As a researcher working in the area, I am aware of arguments for and against using person-first language when describing the disorder, as this debate has not yet been settled, I have chosen to use mostly person-first language as this is most often required by academic journals.

Autism and Evidence Based Practices

At the centre of the argument about education provision for individuals with a diagnosis of autism, is the question of "what constitutes effective education?". Much research has concentrated on the application of psychological interventions to improve educational outcomes, and as such, the disciplines of psychology and education are significantly intertwined when discussing autism education. The field has been particularly influenced by interventions derived from the science of ABA, as ABA-based interventions were the first to demonstrate significant skill acquisition (Lovaas, 1987; McEachin et al., 1993). Recent years have also seen an increasing emphasis placed on the use of developmental psychological interventions and theories, particularly in early intervention settings with the application of Naturalistic Developmental Behavioural Interventions (NDBI; Schreibman et al., 2015).

As a result of the decades of research conducted on psychological interventions with students with autism, autism education has become somewhat synonymous with the application of interventions to teach skills (McMahon & Cullinan, 2016). However, not all interventions are created equal, and the autism education field has been significantly marred by the proliferation of "fads" or unsupported practices (USPs), which insidiously prey on the vulnerabilities of families and stakeholders by employing emotive marketing techniques and making disingenuous claims of effectiveness (Foxx & Mulick, 2015; Paynter et al., 2019). Fads may continue to persist despite research evidence de-bunking claims of effectiveness, for example, facilitated communication, which stakeholders continue to adopt despite many studies clearly demonstrating no evidence to support any claim of effectiveness (Foxx & Mulick, 2015). The persistence and continued adoption of USPs puts individuals with autism at risk of negative outcomes, as USPs are at best ineffective, and at worst potentially physically and mentally harmful (Foxx & Mulick, 2015; Paynter et al., 2019).

To combat the continuing popularity and development of USPs, recent years have seen an increasing emphasis placed on the use of EBPs. EBPs are defined as practices which have been identified as being scientifically effective and robust by multiple research teams, and widely recommended and mandated for use with students with autism (Odom et al., 2010). Interventions meet criteria as an evidence-based practice when the intervention has demonstrated efficacy across a sufficient number of empirical studies in high-quality peer-reviewed publications, and these results have been replicated by other independent research groups (Odom et al., 2010; Steinbrenner et al., 2020a; Wong et al., 2015). EBPs in the autism education field can be categorised as *focussed intervention practices* (FIPs) or *comprehensive treatment models* (CTMs) (Hall, 2017). FIPs are interventions which target a specific skill and are usually incorporated within wider educational programmes, for example, visual supports, modelling, reinforcement, and prompting (Hall, 2017). CTMs describe programmes which usually have a curriculum and target a broad range of skills in a systematic manner, and usually target multiple skill domains in conjunction (Odom et al., 2010). Examples of CTMs include Treatment and Education of Autism and Communication Handicapped Children (TEACCH; Mesibov et al., 2005), the Early Start Denver Model (ESDM; Vismara & Rogers, 2008), and Learning and Experiences for Autism Pre-schoolers and their Parents (LEAP; Strain & Bovey, 2011). As the primary school curriculum is considered the core curriculum for autism education in primary schools in Ireland, this thesis will focus on FIPs as these are most likely to be incorporated within wider educational programmes (Hall, 2017), and so from this point forward FIPs and EBPs are synonymous.

Some debate can arise when discussing EBPs for autism due to different criteria applied by different research teams in defining EBPs. Many prominent researchers in the area call for the inclusion of single subject research design studies (SSRDs) in systematic reviews (Odom et al., 2005; Cook et al., 2013), while others posit for the exclusion of SSRDs and examining only group designs and randomised control trials (RCTs), as these are the reported gold standard of interventions (Sandbank et al., 2020). However, a proliferation of research in autism has been conducted using SSRDs, due to a number of reasons which are hard to overcome in the field of special education (see Odom et al., 2005), including the complexity of special education, ethical issues with delaying treatments related to RCTs, the diversity of students, and the fact that when SSRDs are conducted appropriately, they demonstrate valid experimental control. Therefore, to exclude these studies narrows the scope of the field, and leads to potential exclusion of practices which have well-established efficacy (Odom et al., 2005). As a result of the quality of evidence collated when including all available studies including SSRDs, this thesis will refer to EBPs which have been identified by the National Clearinghouse for Autism Evidence and Practice (NCAEP) and National Professional Development Centre on Autism Spectrum Disorders (NPDC) (Wong et al., 2015; Steinbrenner et al., 2020a). During the development of this thesis, the most up-to-date report on EBPs was the Wong et al. (2015) paper on EBPs, however, this has recently been updated by Steinbrenner et al. (2020a), and the table below provides an overview of the similarities between both.

Table 1.1

Evidence-based practices identified in the NPDC and NCAEP systematic reviews.

Practice	Wong et al., 2015	Steinbrenner et al., 2020
Antecedent-Based Interventions (ABI)	+	+
Augmentative and Alternative Communication (AAC)	-	+*
Behavioural Momentum Intervention (BMI)	-	+*

Cognitive Behavioural Interventions/ Cognitive Behavioural/ Instructional Strategies (CBI/CBIS)	+	+
Differential Reinforcement of alternative, incompatible or other behaviour (DRA/I/O)	+	+
Direct Instruction (DI)	-	+*
Discrete Trial Teaching (DTT)	+	+
Exercise/ Exercise and Movement (ECE/EXM)	+	+
Extinction (EXT)	+	+
Functional Behaviour Assessment (FBA)	+	+
Functional Communication Training (FCT)	+	+
Modelling (MD)	+	+
Music-Mediated Intervention (MMI)	-	+*
Naturalistic Interventions (NI)	+	+
Parent-Implemented Interventions (PII)	+	+
Peer Mediated Instruction and Interventions/ Peer-Based Instruction and Intervention (PMII/ PBII)	+	+
Picture Exchange Communication System (PECS)	+	-* amalgamated under AAC
Pivotal Response Training (PRT)	+	-* amalgamated under NI
Prompting (PP)	+	+
Reinforcement (R+/R)	+	+
Response Interruption/Redirection (RIR)	+	+
Scripting (SC)	+	-*amalgamated under VS
Self-Management (SM)	+	+
Sensory Integration	-	+
Social Narratives (SN)	+	+

Social Skills Training (SST)	+	+
Structured Play Groups (SPG)	+	-*amalgamated under PBI
Task Analysis (TA)	+	+
Technology Aided Instruction and Intervention (TAII)	+	+
Time Delay (TD)	+	+
Video Modelling (VM)	+	+
Visual Supports (VS)	+	+

* Denotes new EBPs identified in the latest systematic review conducted by Steinbrenner et al. (2020a).

Due to the scientific evidence and efficacy demonstrated by EBPs in improving many of the core deficits associated with autism including social skills, communication skills, adaptive living skills and academic skills (Steinbrenner et al., 2020a; Wong et al., 2015), many educational contexts have adopted guidelines which recommend the use of EBPs when educating students with autism. In the United States of America (USA) for example, the No Child Left Behind act, mandates that teachers should use scientifically supported practices (United States Department of Education, 2008). In Europe, some countries have now begun to endorse the use of EBPs in schools with students with autism by developing guidance for teachers (Health Council of the Netherlands [HCN]- The Netherlands, 2009; National Council for Special Education [NCSE]- Ireland; 2016; National Institute for Health and Care Excellence [NICE]- United Kingdom, 2013). In Ireland, the NCSE's policy advice paper (2016) recommends that teachers are knowledgeable of and use EBPs, and this policy recommendation has been adopted into guidelines developed by the Department of Education and Skills (DES) for the educational provision of students with Special Educational Needs

(SEN) in Ireland, stating that “teachers should be mindful that the interventions and approaches that they are using are evidence-informed”. (DES, 2017, pg. 19).

The Research to Practice Gap

Although EBPs have been identified and recommended for use in classrooms with students with autism, a “research to practice” gap has been identified in autism education, whereby teachers continue to use USPs and fail to adopt EBPs with fidelity (Cook et al., 2013). This is comparable to issues in the broader special education literature, whereby adoption of EBPs for students with SEN in areas such as classroom management, positive behaviour support and mental health interventions by clinicians and school personnel continues to be less than optimal (Brookman-Frazee et al., 2020; Cooper et al., 2018; Connors et al., 2019).

The failed adoption of EBPs into routine practice, and the continued widespread use of USPs has been identified as one of the critical issues in autism education as USPs can distract and detract from efficacious practices and waste time and resources (Metz et al., 2005), and can therefore impact on outcomes for students and teachers alike given that the level of implementation of EBPs is strongly associated with outcomes (Durlak & DuPre, 2008). This is all the more important considering that autism intervention has been dogged with a history of “fad” treatments as described above (Foxx et al., 2018; Paynter et al., 2019). Although significant movements have been made towards the identification of EBPs (Odom et al., 2010; Steinbrenner et al., 2020a; Wong et al. 2015), it is still evident that teachers fail to adopt EBPs, or adopt EBPs and USPs together which can impact the efficacy of EBPs (Burns & Ysseldyke, 2009; Carter et al., 2011; Cook et al., 2009; Dingfelder & Mandell, 2011; Hess et al., 2008; Metz et al., 2005). For example, recent research has shown that special education teachers of students with autism and intellectual disability in the USA reported using a variety of EBPs, for example, modelling which was used by over 70% of teachers at least daily. However, teachers reported using a number of USPs frequently, with 17% of teachers using Rapid Prompting Method and 18% using Facilitated Communication daily (Knight et al., 2018). Furthermore, when designing IEPs and goals for students, special educators and general educators reported using an EBP for only half of the goals they identified for their students with autism (Brock et al., 2019). This mixed adoption of EBPs and USPs has also been demonstrated in Australia, with Sulek et al (2019) finding that general education teachers reported using EBPs more frequently than USPs, however, teachers still used USPs such as music therapy and touch therapy frequently. Therefore, even though significant efforts have been made to delineate and recommend EBPs over the past decade, it appears that teachers and education personnel continue to adopt USPs at high rates.

Of further issue to understanding the research-to-practice gap in autism EBP implementation is the lack of data available to inform our understanding of EBP use in European settings. While EBP guidance has been developed in several countries in Europe (e.g. HCN, 2009; NCSE, 2016; NICE, 2013) there is a significant lack of data available on the prevalence of autism EBP use in European schools. Research by Carter et al (2012) found that special educators educating a variety of students with SEN in the Czech Republic used EBPs infrequently, while in the UK, research has demonstrated that educational psychologists have also reported poor knowledge and use of EBPs when working with students with autism (Robinson et al., 2018). In Ireland, no evidence could be found of research which explicitly examined use of autism EBPs, but other research which has examined teachers' adoption of autism practices more broadly has suggested that teachers use USPs alongside EBPs. Finlay and colleagues (2019) surveyed autism special class teachers' (ASCTs) use of 19 interventions which included a mix of USPs and EBPs. They found that the teachers reported using EBPs such as visual supports, prompting and reinforcement, PECs, exercise, and social stories, but also reported frequently using USPs such as Floor Time/DIR, Intensive Interaction and Hanen-More than Words. Given that many European educational contexts adopt an eclectic approach to educating students with autism (Keenan et al., 2015), which is in contrast to the behavioural philosophy underpinning most EBPs (Hall, 2017; McMahon & Cullinan, 2016), establishing the prevalence of autism EBP use in these settings is important to inform our understanding of steps that need to be taken to bridge the research-to-practice gap in this context.

The above research has demonstrated that teachers appear to be using some EBPs, however, gaps remain in our understanding of teachers' knowledge and the prevalence of adoption of EBPs in European countries, and of particular interest for this thesis, Ireland. Furthermore, what has emerged since this EBP movement began is that the translation of EBPs from research to practice is unlikely to happen through the identification of EBPs alone. Researchers have acknowledged the need to move from letting implementation happen to making it happen (Cook & Odom, 2013), with identifying factors that impact EBP implementation being identified as a crucial first step in enhancing implementation.

Theoretical Framework: Implementation Science

To identify factors which impact the implementation of autism EBPs in school settings, this thesis will employ the theoretical framework of implementation science. Implementation science developed from a need to understand why effective interventions are not adopted by their intended audiences. Eccles and Mittman (2006, pg. 1) define implementation science as "the scientific study of methods to promote the systematic uptake of research findings and other evidence based practices into routine practice", and implementation science has previously been used to examine the uptake of autism EBPs (Odom et al., 2020).

According to Nilsen (2015), implementation science approaches to understanding implementation can be delineated across five theoretical approaches: (1) process models, (2) determinant frameworks, (3) classic theories, (4) implementation theories, and (5) evaluation frameworks. The purpose of determinant frameworks is to delineate specific factors which act as barriers or facilitators to the implementation of interventions, which aligns with the aims of this thesis and will therefore be applied as the overarching theoretical framework (Nilsen, 2015, pg. 3). The determinant framework chosen for this thesis is the Active Implementation Frameworks (AIF; NIRN, n.d.), which has previously been applied as a theoretical framework to understand the adoption of autism EBPs in school settings (Odom et al., 2013; Odom et al., 2014; Steinbrenner et al., 2020b).

The AIF were developed following Fixsen et al (2005) monologue synthesizing implementation research. Ongoing research and development of the AIF falls under the remit of the National Implementation Research Network (NIRN) of the Frank Porter Graham Child Development Institute. Information about the AIF is available freely online at the Active Implementation Hub (NIRN, n.d.), providing an important resource for researchers and educators looking to incorporate implementation science in their adoption of EBPs. The AIF encapsulates many implementation theories, including Diffusion of Innovation Theory (Rogers, 2003), Organisational Readiness (Weiner, 2009) and Implementation Climate (Klein & Sorra, 1996) among others.

The AIF conceives that implementation can be impacted by five elements which all interact to enable optimal implementation of interventions, these are: (1) Usable Innovations, (2) Implementation Stages, (3) Implementation Drivers, (4) Implementation Teams and (5) Improvement Cycles. Usable innovations are identified through examining the evidence for practices (e.g., NCAEP, Steinbrenner et al., 2020a). Adaptations necessary to support the implementation of innovations in context are the responsibility of Implementation Teams, which are a group responsible for supporting the implementation and scale-up of interventions, through ensuring key implementation drivers are available, and through integrating the use of the implementation stages, and improvement cycles to scale-up intervention use. Implementation Drivers include key components of infrastructure that support competency and describe organizational and systems changes needed to support implementation. These include factors such as knowledge, and access to training, as well as supports within the system. Implementation Stages describe how implementation unfolds over time and can provide a guide of the steps for implementation teams to take to increase EBP use in a systematic manner. Lastly, Improvement Cycles involve the continuing data collection of the efficacy of innovations, and adaptations necessary within the environment to ensure sustained implementation.

Of particular importance for this research are two of these elements- Implementation Drivers and Implementation Stages. Please see Figures 1.1 & 1.2 below for an overview of implementation drivers and implementation stages.

Figure 1.1.

Implementation Drivers, Active Implementation Frameworks (NIRN, n.d)

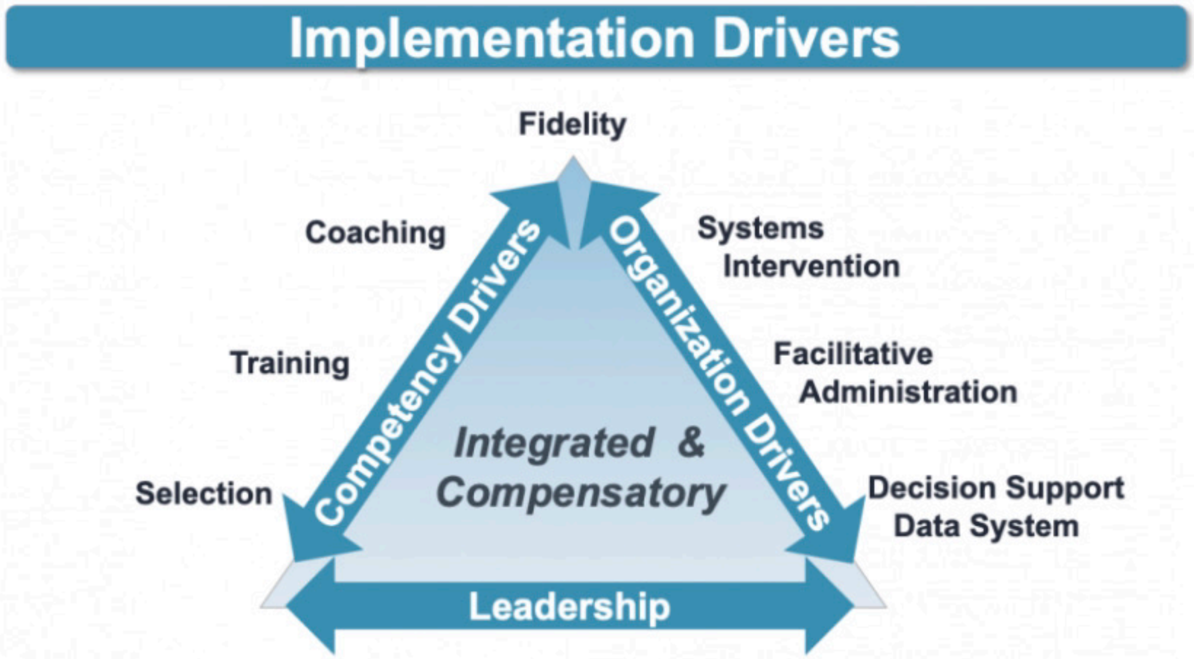
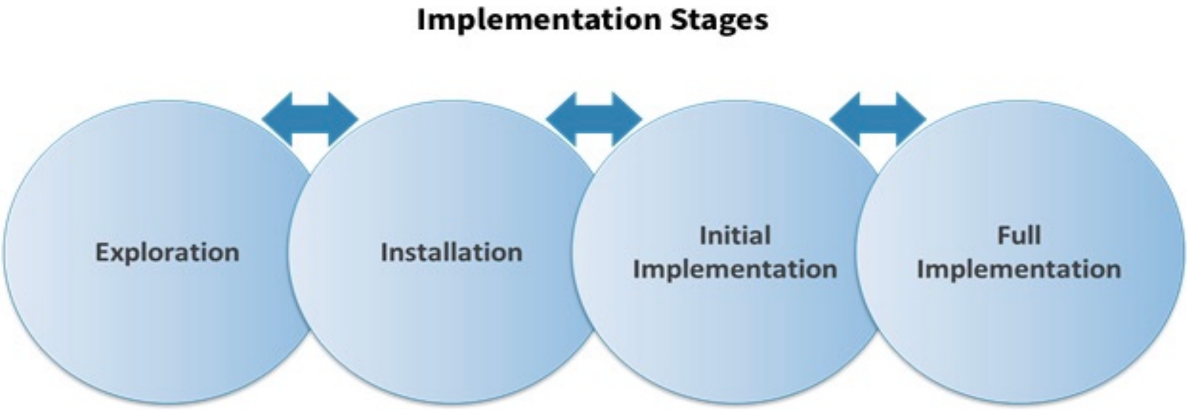


Figure 1.2.

Implementation Stages, Active Implementation Frameworks (NIRN, n.d.)



The Exploration Stage of the Implementation Stages places importance on the identification of barriers which may impact the implementation of practices (NIRN, n.d.), and ties in with an implementation strategy "assessing readiness" (Cook et al., 2019). Assessing readiness is achieved through assessing the school context to examine barriers and facilitators to implementation, and to determine the degree to which school personnel are ready to implement interventions. These barriers and facilitators can fall under "Implementation Drivers" which as described above are key components of infrastructure that drive the implementation of interventions, and can be integrated across multiple levels, such as the teacher's individual competence, the provision of in-school resources and training, and the broader educational system which provides funding to schools and teachers to build competency (NIRN, n.d.).

The information identified through this exploration of readiness can then be used to inform the implementation efforts within the system going forward (Cook et al., 2019), and embedded within larger frameworks to inform the upscaling of implementation in school contexts. For example, assessing readiness can determine the stage of implementation extant in Ireland, and can examine key implementation drivers such as barriers and facilitators which may help or hinder implementation of EBPs. In determining readiness, it is important to gain an understanding of factors which may act as barriers or facilitators to implementation, and of the research context, so these will be discussed in the following sections.

Factors Influencing EBP Implementation

As mentioned above, an important strategy when examining the implementation of interventions is to identify drivers of implementation and factors that can act as barriers or facilitators to implementation (Cook & Odom, 2013; Fixsen et al., 2013; NIRN, n.d.). Some conceptual frameworks have overlaid these factors across three inter-dependent levels- the macro context, school context, and individual-level context (Domitrovich et al., 2008) which can prove useful when examining the multi-layered nature of school environments. The macro context is said to consist of factors related to policies, financing, school-university partnerships, and leadership in the form of expert and qualified professionals. School level factors which are said to impact implementation include factors such as school policy alignment with the intervention, decision structures, resources, personnel expertise, and school culture and climate, are said to impact intervention adoption. Lastly, individual level factors consist of teacher characteristics such as their training and experience, psychological characteristics such as their attitudes, self-efficacy and stress levels, and intervention characteristics such as the ease of implementation and adaption of the intervention to the school context (Domitrovich et al., 2008)

While these factors have been proposed, there is a lack of data on school-based, autism-specific barriers and facilitators which need to be identified in order to develop a pathway to overcoming the research-to-practice gap specific to autism education. Previous research examining shared and unique implementation factors between the implementation of a mental-health intervention and a classroom-based intervention have identified that while some factors are shared across contexts, there are unique contextual factors which impact dependent on context (Brookman-Frazee et al., 2020), highlighting the need for exploration of school-specific factors.

Evidence gathered from examining barriers and facilitators to implementation within the broader special education field reveal a variety of barriers and facilitators which may help or hinder the use of interventions, including support for implementation, knowledge, training, leadership and organisational issues (Chitiyo & May, 2018; Forman et al., 2009) When examining the use of autism specific EBPs in clinical and early intervention settings, barriers and facilitators such as time, multi-disciplinary support, training, knowledge and leadership and organisational support have also been identified (Paynter & Keen, 2015; Paynter et al., 2017; Paynter et al., 2018). However, it is not clear if these factors are directly transferable to understanding barriers and facilitators to implementation in school settings. Recent research in school settings has suggested that teachers have mixed knowledge of autism EBPs (Borders et al., 2015; Brock et al., 2014; Morin et al., 2020) and that training, knowledge and type of classroom are related to differing levels of EBP implementation (McNeill, 2019; Sulek et al., 2019), yet this area warrants further investigation due to the limited research conducted on implementation factors to date. As the efficacy of many EBPs has been established in 1:1, small group settings (Steinbrenner et al., 2020a), it is likely that teachers in inclusive education settings will encounter context specific factors which may help or hinder their adoption of autism EBPs (Kasari & Smith, 2013). If we are to move towards realising the potential of implementing EBPs in inclusive education settings, then delineating factors which may impact implementation in these settings is crucial, and is a gap in our current understanding which needs to be addressed.

Research Context

Autism Education

Over 20 years have passed since the *Education Act* (Government of Ireland, 1998) recognised that students with autism meet the criteria of a special educational need (SEN) and are therefore entitled to special educational provisions, and represented a shift in focus that has resulted in the steadily increasing numbers of students with SEN and autism educated in mainstream schools. Recent research has identified that up to 28% of students in Irish primary schools now have a diagnosis of an SEN (McCoy et al., 2014), and 1.55% of the student population have a diagnosis of autism (NCSE, 2016). Thus, Irish primary school teachers are responsible for differentiating the curriculum to meet the needs of a wide variety of learners, alongside helping students with autism to learn important social, communication and adaptive skills (McMahon & Cullinan, 2016).

Identifying appropriate and effective education is made more difficult by the fact that autism is a heterogenous “spectrum” disorder, meaning that each individual presents with a different combination of strengths and difficulties (NCSE, 2016). In order to meet the needs of this diverse group of learners, autism education can occur across three settings at a primary school level in Ireland- mainstream classrooms (MCs), autism special classes (ASCs), and special schools (NCSE, 2016). In Ireland, the Educating Persons with Special Educational Needs (EPSEN) Act (DES, 2004) posits that students with SEN including autism, be educated in mainstream classrooms alongside their neurotypical peers, unless this in not in the best interests of the student. As a result, the majority (86% of students with autism) are educated in mainstream primary schools, in either MCs (63% of all students with autism) or in ASCs (23% of all students with autism).

In MCs, students with autism are educated alongside their neurotypical peers, following the course of the Irish primary school curriculum. In MCs, students with autism can access some supports to enable them to access the full curriculum, but the ultimate responsibility for educating these students lies with the mainstream class teacher (MCT; DES, 2017). Students with autism in mainstream classes can receive support from a special needs assistant (SNA) whose responsibility it is to provide essential care for part of, or the full school day. However, SNAs do not provide any educational support (NCSE, 2016). Furthermore, students can also access individualised educational support from a learning support or resource teacher, which typically takes place in a segregated classroom in a 1:1 format for up a maximum of 4.25 hours per week, meaning that students with autism spend upwards of 75% of their day in large group instruction in the MC (NCSE, 2016). Therefore, the MCT has multiple responsibilities to juggle, in providing individualised, differentiated support to students with autism and other SEN, in classrooms that typically have student teacher ratios of upwards of 25:1; among the highest in Europe (Kelleher & Weir, 2016).

In mainstream schools for students with autism for whom inclusion in MCs is not appropriate, education provision can be provided in ASCs attached to mainstream schools. ASCs have pupil-teacher ratios of 6:1, with the provision of two SNAs to support students' care needs in the class also. Thus, the ASC provides a small-group teaching setting, in which students receive individualised education. Autism special class teachers (ASCT) are not required to have any certification in autism, nor any specialised training in autism or SEN (NCSE, 2016). A further purpose of ASCs is to facilitate integration of students with autism into MCs for certain subjects or classes during the day, thus promoting some inclusion for students with autism whilst also allowing for individualised small-group format education which may better meet their individualised needs (NCSE, 2016). The number of children with autism educated in ASCs is relatively small in comparison with MCTs (NCSE, 2016) and so the primary focus of this thesis will be on the MC.

The paradigm shift towards inclusive education has necessitated the need for mainstream schools to provide appropriate education to a wide variety of students with varying educational needs, and to promote inclusive education practices in schools (DES, 2017). Education provision is delivered across a continuum of support for students with SEN, and incorporates support across three levels: whole school approaches for inclusion incorporating all students with SEN, classroom approaches to facilitate a small number of students with SEN, and individualised approaches to facilitate few students with SEN. Due to recent changes in educational provision moving from a diagnosis based provision to a needs based provision (DES, 2017), the differentiation of these provisions and assessment of educational needs in mainstream schools is now under the remit of the school principal and SEN teams. However, no formalised structures supplement the development of SEN teams and principal capacity, and therefore, students with autism can receive ad-hoc provision in their education.

Research and Irish educational policy (DES, 2017) has consistently determined that quality of teaching is the most important factor in improving outcomes for students with autism and SEN (Guldberg, 2017; NCSE, 2016; Ravet, 2018). However, questions have been raised about the extent to which Irish teachers have the skills to appropriately teach students with autism and SEN in inclusive education settings (McCoy et al., 2014). Appropriate training to develop competencies in autism have been found crucial to increasing teacher capacity for delivering the effective educational interventions students with autism may require (Alexander et al., 2015, Parsons et al., 2009). Alongside this, the DES has outlined the importance of access to continuous professional development (CPD) for all teachers, including MCTs (DES, 2017). However, research in Ireland has consistently demonstrated a lack of teacher preparation and a lack of teacher training in SEN and autism, with this being identified as one of the key issues in SEN provision (McCoy et al., 2014).

Teacher Training in Ireland

To become a primary school teacher in Ireland, individuals must complete an initial teacher education (ITE) course, which are delivered at undergraduate and postgraduate levels. All teachers graduate from their ITE courses with a qualification as a MCT. Teachers working in a special education role (learning support teachers, resource teachers and special education teachers) are not required to have any specialist additional qualifications in special education before commencing their post, and so this differs somewhat from educational contexts such as the USA where specialisations are needed to work as a SET (McCormack, 2019).

The ‘Teacher Education for Inclusion’ project conducted by the European Agency for Special Needs and Inclusive Education (EASNIE, 2012) identified core competencies for inclusive education. This has resulted in the Teaching Council of Ireland changing its requirements for ITE courses, making it compulsory for all Higher Education Institutes to run a module of inclusive education (Hick et al., 2018). Despite this positive step, research into ITE inclusive education courses in Ireland indicates that teachers receive inconsistent SEN preparation in their ITE degrees (Hick et al., 2018). This research, which was commissioned by the NCSE to evaluate ITE provision, found that there was significant variation in content delivered between SEN courses in third level institutions, and differences in approaches, with some taking a broader sociological approach, and others focusing on teaching about individual SENs and strategies to support specific SENs (Hick et al., 2018).

This inconsistent approach to preparing student teachers for inclusive education in their ITE degrees has had some negative outcomes. The evaluation of ITE provision (Hick et al., 2018) found evidence of a “reality shock” in newly qualified teachers (NQTs). They measured student teachers’ attitudes, knowledge and skills associated with inclusive education when they were in the final year of their ITE courses, and measured these again one year later when these student teachers were now working as NQTs. The data showed that there was a significant decrease in positive attitudes towards inclusive education, and a decrease in the participants self-rated knowledge and skills of inclusive education in the year following their commencement as NQTs. This indicates that teachers lived experiences with inclusive education significantly decreased their positive attitudes and perceived self-efficacy in delivering inclusive education practices. As a result, NQTs reported experiencing feelings of disappointment due to being unsuccessful at engaging students with SEN in the classroom. NQTs also reported that they felt unprepared for implementing inclusive education in the classroom, and faced particular challenges in the area of managing challenging behaviour and being able to allocate time to differentiate lessons to facilitate inclusion. A separate study by Finlay et al (2019), examining special education teachers (SET)'s preparedness for educating students with autism, has supported these findings, with 82% of SETs in this sample reporting that they were dissatisfied with the level of training and preparation for teaching students with autism provided in their ITE.

Alongside teacher preparation in ITE courses, access to quality continuous professional development (CPD) courses is a crucial element in developing teacher capacity for delivering effective educational practices when working with students with SEN and autism (Department of Education and Skills [DES], 2017), and the need for an autism-specific CPD framework for teachers has been highlighted in numerous policy recommendations (NCSE, 2009; NCSE, 2016; Task Force on Autism, 2001). At present, there are no requirements for teachers to complete CPD, and completing CPD does not lead to any certification for teachers (McCormack, 2019).

Since the first Task Force recommendations (2001), the Middletown Centre for Autism (MCA) and NCSE were set up to address a gap in service provision, and provide training to teachers amongst other duties, which has constituted a substantial investment by the DES. The MCA is a collaboration between the Department for Education in Northern Ireland and the DES in the Republic of Ireland, which is tasked with conducting research and developing policy, and also provides a specialist hub from which autism consultation and training is offered to the community. The NCSE is also responsible for research and policy advice, and provides training to teachers in the Republic of Ireland. However, in contrast with the autism-specific MCA, the NCSE's remit is SEN and inclusive education in general. The training provided by the MCA and the NCSE consists mostly of stand-alone short courses or workshops whose efficacy remains undetermined, and, furthermore, some of the CPD courses on autism interventions offered are not established EBPs (Fennell & Dillenburger, 2018; McCormack, 2019). Furthermore, very little research has been conducted on both the quantity and quality of CPD received by teachers from the MCA and NCSE, constituting a substantial gap in our understanding of the effectiveness of this training. As such, there remains a dearth of information on both teachers' access to autism specific CPD, and the effectiveness of this CPD in an Irish context, despite a number of policy papers, reports and independent research highlighting teachers' CPD needs in the area of autism and SEN (DES, 2017; NCSE, 2016; Fennell & Dillenburger, 2018; McCormack, 2019; O'Gorman & Drudy, 2010). Furthermore, no evidence could be found of EBP specific teacher training (in identifying and utilising EBPs for autism or SEN), and so there appears to be a lack of emphasis on developing teacher capacity for EBP implementation as a whole.

Arising from issues with teacher preparation, teachers have reported that they lack confidence in preparing lessons for students with SEN and autism (Anglim et al., 2018; Mahony, 2016), they are apprehensive to educate students with autism (Anglim et al., 2018), they lack skills to manage challenging behaviours in students with autism and SEN (O'Gorman & Drudy, 2010; Anglim et al., 2018; Finlay et al., 2019), and they lack knowledge of autism specific teaching strategies (Anglim et al., 2018; Daly et al., 2016). Although research in Ireland has suggested that teachers perceive many issues with their SEN and autism training in ITE and CPD, no data have been collected to determine the numbers of teachers accessing CPD for autism, which is a current gap in our understanding of teachers' training needs.

Aims and Thesis Outline

As identified in the above literature, a number of gaps have been identified in understanding the use of EBPs with students with autism, both in Ireland and in the broader implementation science literature. These include (1) a lack of understanding of the barriers and facilitators school personnel experience when implementing EBPs for students with autism in school settings, (2) a lack of empirical data on factors which are associated with autism EBP use in schools, (3) a lack of data on teacher training and preparation in autism and EBPs, and (4) a lack of data on autism EBP use in Europe and Ireland.

The primary aim of this thesis is to assess Irish teacher's readiness to implement autism EBPs by:

(a) Identifying extant levels of knowledge and use of EBPs,

(b) Identifying extant levels of teacher training,

(c) Assessing barriers and facilitators to implementation, and

(d) Examining factors which are associated with autism EBP use

To address these aims, the following studies were undertaken to answer the following research questions:

Chapter 2: What barriers and facilitators do school personnel experience when implementing EBPs with students with autism in school settings? To gain an understanding of the extant literature on barriers and facilitators to EBP implementation specific to autism education in school settings, a scoping review of the literature was conducted.

Chapter 3: What are teachers' perceptions of their preparation in autism and their perceptions of autism EBPs? A qualitative study was conducted with 14 teachers in mainstream schools to explore this.

Chapter 4: What are the characteristics of teachers educating students with autism in Ireland, and how are these characteristics associated with knowledge and use of EBPs? As there is a dearth of research in autism education in Ireland, this study was conducted to (a) examine the types of training and support teachers receive, and (b) examine the differences in knowledge and use across teacher type, teacher training, education level, years of experience and access to support professionals. An online survey was completed by 369 mainstream school teachers to address this question.

Chapter 5: As MCTs educate 63% of students with autism in Ireland, what barriers do they experience in educating students with autism, and what factors influence their use of EBPs? This study was conducted to examine MCTs in more detail. A subset of the online survey collected for study 3 were studied in more detail to identify their extant levels of knowledge and use of EBPs, barriers they may experience in implementing EBPs, and how use of EBPs was impacted by knowledge, training, attitudes towards EBPs and barriers to EBP use.

Chapter 6: What steps need to be taken next to begin to scale-up teachers use of EBPs in Ireland? Based on the findings of the previous studies and informed by the AIF and the broader literature, a protocol for developing teacher capacity for using EBPs is described- The Evidence-Based Practice for Autism, Implementation in Mainstream schools (EBP-AIM) protocol.

Chapter 7: The final chapter of the thesis provides a general discussion of the overall findings of the five studies, and provides implications for research and practice, alongside the strengths and limitations of the thesis.

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Chapter 2 **Study 1**

A scoping review of the barriers and facilitators to the implementation of interventions with children with autism.[2]

[2] This chapter has been published with minor editorial modifications. Barry, L., Holloway, J., & McMahon, J. (2020) A scoping review of the barriers and facilitators to the implementation of interventions in autism education. *Research in Autism Spectrum Disorders, 78*, 1-12. https://doi.org/10.1016/j.rasd.2020.101617

Abstract

Background: Evidence-Based Practices (EBPs) have been associated with improved outcomes for individuals with Autism (Eldevik et al., 2009). However, school personnel have been found to implement classroom practices that have little scientific support (Hess, Morrier, Heflin & Ivey, 2008). Factors that may affect implementation of EBPs have been theorised to include staff training and buy-in (Forman et al., 2009), however, these factors have not yet been delineated in the autism education setting.

This study aims to synthesise and analyse the extant literature related to the barriers and facilitators of implementing EBPs in autism education using a multi-level framework (Domitrovich et al., 2008) examining macro, school and individual factors of implementation.

Methods: The Joanna Briggs Institute (JBI) Scoping review guidelines were followed to complete the current scoping review. Papers were extracted from the following databases: PsycInfo, Academic Search Complete, ERIC and Education Source. A total of 4,682 papers were returned and screened by abstract and title. Forty-nine papers were included for full text review. From these, six qualitative studies and one mixed-methods study were included for data synthesis and analysis.

Results: Included studies found evidence for barriers and facilitators at the macro, school, and individual level (Domitrovich et al., 2008). Key barriers included resources, time, and intervention characteristics.

Conclusions: The barriers and facilitators in the implementation of autism EBPs by school personnel remains poorly understood. This review provides an important overview of the extant literature, however, further rigorous research is needed in this area. Recommendations for future research are proposed.

Key words: barriers, facilitators, implementation, autism education, evidence-based practices

With diagnoses increasing globally (Baio et al., 2018), researchers have placed increasing importance on identifying interventions and practices that are best-placed to improve quality of life for individuals diagnosed with autism. Autism is a lifelong neurodevelopmental disorder which causes difficulties with communicative and social functioning (American Psychiatric Association, 2013). Research consensus is that most children with autism will have poorer education, health and life outcomes than their neurotypical peers (Henninger & Taylor, 2013). Academically, children with autism may struggle due to executive functioning difficulties, such as problems with shifting attention, working memory, self-control and impulsivity, and also difficulties with mental flexibility and initiating tasks (McLean, Harrison, Zimak, Joseph & Morrow, 2014). Children with autism may engage in high rates of challenging behaviour (Mazurek et al., 2013), and this can affect their relationship with both other students and their teachers (Sigafoos, Arthur & O'Reilly, 2003). Furthermore, up to 63% of children with autism present with a co-occurring language disorder (Levy et al., 2010), and this can have an impact on the child's ability to follow classroom directions, interact with their peers and crucially, access the curriculum.

Evidence-based practices (EBPs) are established treatments that have demonstrated efficacy at changing target behaviours across multiple methodologically sound studies, conducted by multiple independent research teams (Reichow, 2011). EBPs have been recommended for use in the education of children with autism, and have been identified as a key factor in improving social and communicative outcomes (Eldevik et al., 2009). At present, between 28 and 34 interventions meeting EBP criteria have been identified, and some examples of these are token economies, positive reinforcement, and self-management programmes (Bond et al., 2016; Wong et al., 2015). EBPs have also been found to ameliorate the stress and burnout typically experienced by teachers of children with autism (Boe, Bobbitt, Cook, Whitener & Weber, 1997; Jennet, Harris, & Mesibov, 2003).

As children with autism over the age of five spend the majority of their time in formal education, the school setting has been identified as a critical context for employing effective EBPs (Brookman-Frazee et al., 2009). Recognising the importance of the school context and the potential of EBPs to improve outcomes, increasing emphasis is being placed on using interventions that are evidence-based when teaching children with Autism (Cochran-Smith, 2004). Some countries such as the USA have introduced legislation which posits that teachers are "legally required to implement scientifically proven practices" (US Department of Education, 2001), and other countries such as England (Coldwell et al., 2017) and Ireland (National Council for Special Education, 2013) have developed policy recommendations recognising the importance of adopting EBPs.

Despite much research dedicated to identifying and classifying EBPs (Bond et al., 2016; Eldevik et al., 2009; Odom, Collet-Klingenberg, Rogers & Hatton, 2010), and the acknowledgement of the importance of EBPs by educational bodies, the translation of research into practice has consistently been found lacking. Research has suggested that school-based interventions are being implemented with low fidelity (Oliver, Wehby, & Nelson, 2015), with only 25-50% of interventions being implemented in the classroom at the levels recommended in the literature (Gottfredson & Gottfredson, 2002). Furthermore, teachers have been found to implement practices with little scientific support (Carter, Stephenson & Strnadova, 2011; Cook & Schirmer, 2006), and use EBPs less frequently than desired (Hess, Morrier, Heflin & Ivey, 2008, McNeil, 2019). A possible barrier to the effective implementation of EBPs is the transferability of interventions from controlled intervention environments to real-world classroom settings (Kasari & Smith, 2013). Contributing to this, researchers have often failed to consider social validity as an important outcome of their interventions, with Callahan and colleagues (2017) finding that only 26.7% of papers measured social validity as an important outcome. Social validity refers to consumer satisfaction with the goals and outcomes of procedures or interventions (Callahan et al., 2017; p. 2), and thus is an important factor to consider when analysing implementation, as satisfaction with an intervention can play a significant role in its' implementation (Kazdin, 1977).

Issues with the implementation of EBPs in schools has led to the identification of a "research to practice" gap (Cook, Tankersley & Landrum, 2009; Fixsen, Blasé, Metz & VanDyke, 2013; McMahon & Cullinan, 2014), and although this research to practice gap has been identified as early as 1997 (Carnine, 1997), the factors influencing implementation of EBPs are still poorly understood. Implementation science provides a framework for considering these factors. Implementation is generally defined as a specified set of planned and intentional activities designed to integrate evidence-based practices into real-world settings (Mitchell, 2011), and implementation science is "the scientific study of methods to promote the systematic uptake of research findings and other evidence-based practices into routine practice" (Eccles & Mittman, 2006). Implementation science has been used to investigate barriers to implementation in healthcare settings (Schoenwald, McHugh & Barlow, 2012) and has been applied to the education literature (Domitrovich et al., 2008) to provide a framework for analysing the barriers and facilitators to interventions in education settings.

A conceptual framework rooted in implementation science, which has been developed for understanding implementation of interventions in schools was designed by Domitrovich and colleagues (2008).Their model proposes that the implementation of EBPs in schools is dependent on three interdependent contextual factors- the macro level, the school level and the individual level. They proposed that these factors interact to inhibit implementation of EBPs, providing a basis for analysis of specific barriers and facilitators that school personnel may encounter. Macro level factors include community factors that may impact the implementation of EBPs in schools, including policies and financing; community capacity for leadership and human capital availability of external professionals and trainers; professional development allowances for school personnel; district level administrative support and community-university partnerships. School levels factors are factors specific to the school context, and these include mission-policy alignment; decision structures in schools; resources; personnel experience in the school; administrative or principal leadership and support; school culture; school climate; organisational health; school characteristics like school size and mobility; and classroom climates such as student-teacher relationships. Lastly, individual level factors pertain to the school personnel's ability to implement EBPs, and include factors such as professional characteristics such as training level and philosophies; psychological factors such as self-efficacy and stress; and finally, perceptions of and attitudes towards EBPs.

Current review

Although many EBPs for autism have been identified in the literature (Bond et al., 2016, Wong et al., 2015), research has shown that implementation of these practices in education settings continues to be lacking (Brookman-Frazee et al., 2009; McMahon & Cullinan, 2014). The reasons for this research-to-practice gap remain poorly understood and it is undoubtedly linked to the wider issue of EBPs in the field of education (Oliver, Wehby & Nelson, 2015). However, given the unique challenges of educating children with autism, for example the specific behaviour challenges associated with autism (Mazurek et al., 2013), and the increased stress teachers who educate students with autism experience (Boe et al., 1997), research is needed to explore the barriers and facilitators to the implementation of EBPs in autism education in particular. Furthermore, the stakes are arguably higher for children with autism than for typically developing children, and access to EBPs has led to better outcomes for students with autism (Henninger & Taylor, 2013). Using Domitrovich and colleagues (2008) conceptual framework, this study aims to review the literature related to the barriers and facilitators to EBP implementation in autism education using a scoping review format. Scoping reviews can be used to explore research gaps and synthesise research findings (Pham et al., 2014), and due to the broad nature of this research field and the significant gap identified by previous research outlined above, a scoping review is likely to return the greatest amount of rich information. The purpose of this scoping review is to (a) summarise the types of study designs and study characteristics informing the research on barriers and facilitators; (b) synthesise the barriers and facilitators in the extant literature according to the proposed conceptual framework (Domitrovich et al., 2008); and (c) highlight the gaps and limitations in this research field.

Method

Study Design and Protocol

A scoping review method was employed, as scoping reviews can be used to identify gaps in the research (Pham, 2014). The protocol for this study was developed using the Joanna Briggs Institute Reviewers Manual (Chapter 11; Peters et al., 2017). The Preferred Reporting Items for Systematic Reviews and Meta-analysis extension for Scoping Reviews (PRISMA-ScR) was used when reporting results, and a copy of this is reported in Appendix A. The protocol was not registered.

Information sources and search strategy

Searches were conducted up to October 2019, and no date restrictions were placed on the searches. The search strategy was determined by following the JBI guidelines for scoping reviews. The JBI Guidelines recommend a preliminary search of two databases. Preliminary searches of the Education Source and PsycInfo databases were conducted. Searches included combinations of the following terms:

1. Barriers OR obstacles OR challenges OR difficulties OR issues AND Implementation OR adoption OR acceptance AND Intervention OR program* OR strateg* AND School* OR Teach* AND Autis* OR ASD
2. Facilitators OR enablers AND Implementation OR adoption OR acceptance AND Intervention OR program* OR strateg* AND School* OR Teach* AND Autis* OR ASD
3. Research to practice AND Teach* OR School* AND Autis* OR ASD
4. Research gap AND Teach* OR School* AND Autis* OR ASD

Following JBI Guidelines, the titles and key words of returned papers were screened and analysed for inclusion in the second search. As scoping reviews follow an iterative process the modification of search terms is recommended to be as comprehensive as possible (Chapter 11; Peters et al., 2017). Search terms were modified and the following combinations of search terms were applied across the four databases: Academic Search Complete, Education Source, ERIC, and PsycInfo.

1. Barrie* OR issue* OR challeng* AND implementation OR application AND *intervention OR *practice AND school* OR teach* AND autis* OR ASD
2. Facilitator* OR enabler* AND implementation OR application AND *intervention OR *practice AND school* OR teach* AND autis* OR ASD
3. Research to practice AND teach* OR school* AND autis* OR ASD
4. Research gap AND teach* OR school* AND autis* OR ASD

A literature search of google scholar was also conducted using the second tier search terms. The reference lists of all papers were also screened for inclusion.

Eligibility criteria

The eligibility criteria for this study were conceptualised using a Population, Exposure/Intervention and Outcome (PEO) as follows:

Population

To be eligible for inclusion, the participants of the studies had to be school personnel. These school personnel had to work directly with children with autism, and had to be responsible for implementing the interventions for which they were reporting their perceived barriers and facilitators to implementation. School personnel did not include consultants to the school, or district teams who provided remote supervision to the school, these were excluded as we were interested in the barriers and facilitators experienced by those directly responsible for implementing EBPs with children with autism in school settings.

Exposure/Intervention

Included studies had to meet the following criteria:

1. A primary aim of the study was school personnel's perspectives to barriers and/or facilitators the experienced when implementing an intervention.
2. The intervention of interest was an evidence-based practice. Evidence-based practices were included on the basis of a recent review by Wong and colleagues (2015).
3. Only studies which had been conducted in the school setting were eligible for inclusion.

4. Any type of empirical study (e.g. quantitative or qualitative methods) was suitable for inclusion.
5. Papers that contained theoretical proposals or barriers identified by individuals not directly involved in implementing the EBPs were excluded.

Outcome

The first outcome of interest in the studies were descriptive characteristics of the included studies such as the analysis type, the measures used, and interventions employed. The main outcome variable of interest in the studies was the barriers and facilitators experienced by the school personnel. Thus, for inclusion, the study had to report barriers and facilitators experienced by school personnel implementing an EBP. For the purposes of this review, only papers published in peer-reviewed English language journals were included, in line with other scoping reviews in the autism research field (Tint & Weiss, 2016).

Study selection process

Papers identified from each tier of the search were exported to an EndNote file for screening. A total of 4,682 papers were eligible for screening following the removal of duplicates. The first author screened all 4,682 returned papers for inclusion by abstract and title. Inter-rater reliability (IRR) for inclusion was conducted by a trained research assistant on 10% (451) of papers at the abstract and title screening phase (Matter, Harniss, Oderud, Borg & Eide, 2017). This research assistant had a masters qualification in research methods. The research assistant was given the PEO information included in the eligibility criteria, and the EndNote file to complete the screening. IRR was (92.8%). Disagreements were resolved using a third party external to the screening process.

Following the abstract and title screening, 49 papers remained for full-text screening, which was again conducted by the first author. IRR was also conducted on 10% of papers (3 papers) at this screening phase. Inter-rater reliability was 100%. Papers (*n*= 42) were excluded for the following reasons: 6 were dissertations which were not peer-reviewed literature; 18 papers did not include an empirical measure of EBPs, they were position papers or reviews; 6 papers included barriers to interventions which were not EBPs; 6 papers were not concerned with students with autism; 2 studies were study protocols; and 4 studies did not include school personnel.

Data items and extraction process

Data on article characteristics (e.g. reference, country of origin, the experimental methodology used in the study, and participant information) were extracted by the first author. The first author and an independent coder extracted information about the barriers and facilitators reported in the studies. A research assistant with a masters qualification in research methods served as the second coder in the study. The coder was given the protocol to follow and the codebook for extraction. The barriers and facilitators from the qualitative studies were identified by extracting the themes and subthemes presented in the data. The barriers and facilitators in the quantitative study were extracted along with the means and standard deviations reported in the literature. These data were extracted to a codebook independently by each coder and the independent coder was blinded to the data extracted by the first author.

Synthesis of results

The identified barriers and facilitators were synthesised according to common themes. These were then further synthesised into barriers and facilitators individual and common to each type of intervention. The first author and independent coder categorised the reported barriers and facilitators according to the framework posited by Domitrovich and colleagues (2008). The independent coder was blinded to the data of the first author. Results were assigned as macro-level factors, school-level factors or individual factors. The agreement between the coders was 91%. All disagreements were resolved through discussion with the third author.

Results

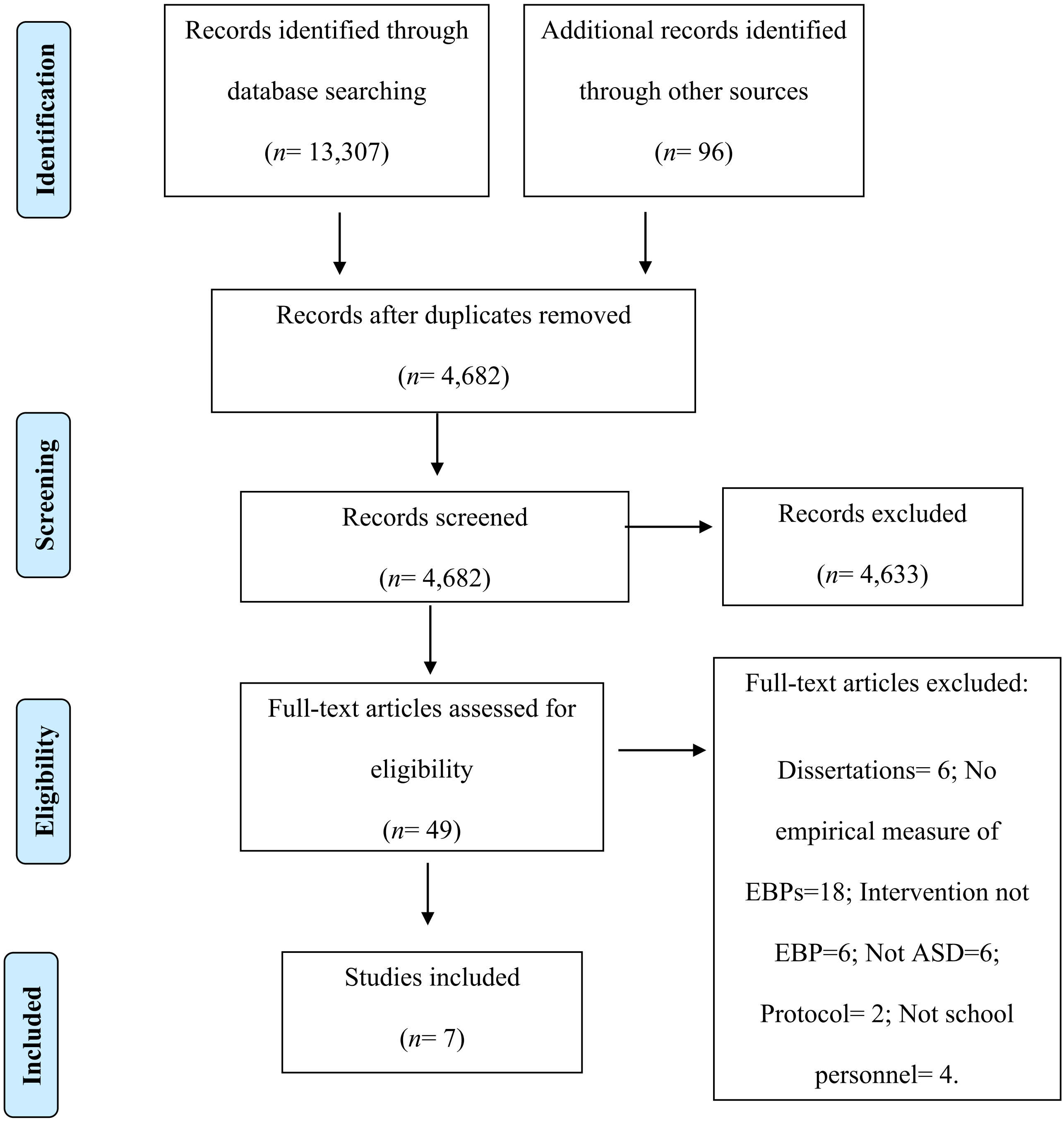
The following are reported in the results section in line with the aims of the study. First, the results of the literature search are explained and supplemented with a PRISMA diagram. Second, the characteristics of the included studies are reported, and lastly, the barriers and facilitators identified in the included studies are categorised according to Domitrovich and colleagues (2008) framework.

Literature search

Please see the PRISMA diagram (Figure 2.1) for flow diagram of literature searches. From the preliminary searches, 5,599 papers were identified. These papers were extracted from the online databases, and the computer software EndNote was used to manage these references. From the second refined search of the four databases, a total of 7,708 papers were identified. These papers were extracted and placed in the EndNote datafile. A grey literature search of google scholar returned a further 96 papers. A total of 13,307 papers were returned. Following removal of duplicates, 4,682 papers were screened by title and abstract. Reference lists were also screened, however, this did not return any novel papers. After abstract and title screening, 49 papers remained for full-text screening. Following full-text screening, 7 papers met inclusion criteria and 42 papers were excluded as outlined in the "study selection process" section above. These seven included papers were then analysed.

Figure 2.1.

PRISMA Diagram



Characteristics of included studies (*n*= 7)

Please see Table 1 for an overview of the characteristics of the included qualitative studies, and table 2 for the included quantitative study. As study 5 (Silveira- Zalvidar &

Curtis, 2019) was a mixed-methods study, qualitative elements are included in table 1, and quantitative in table 2.

Table 2.1.

Characteristics of included qualitative studies

#	Reference	Country of Origin	Methodology and Analysis	EBP Type	Setting	Participant Type & Years of experience	Barriers Identified	Facilitators Identified
1	Alotaibi, Dimitriadi & Kemp (2016).	Saudi Arabia	Semi-Structured Interview; Thematic Analysis (Braun & Clark, 2002)	Social Stories	Special School	Teacher/Educator, n=15 3-13 years' experience with children with autism.	(a) Resources- access to materials and technology (b) Differences in culture	(a) Diversification of the intervention (b) Appropriateness of the resources for the student

2	Donato, Shane & Hemsley (2014).	Australia	Focus Groups; Analysis guided by Saldana (2013) coding manual.	Visual Supports	Early Education	Teacher/Educator n= 4; average of 21.5 years' experience as an educator	(a) Lack of access to multi-disciplinary teams (b) Lack of consistency across settings (c) Lack of awareness of visual supports leading to stigmatising (d) Language restrictions by the use of visual supports. (e) Difficulty implementing in group setting (f) Resources (g) Time	(a) Access to multi-disciplinary teams (b) Consistency of use across settings (c) Time to develop resources (d) Use of mobile technologies
3	Locke et al. (2015).	USA	Field note analysis; Grounded Theory (Glaser & Strauss, 1967)	Social Skills	NA	One-to-one assistants= 5; noon-time aides= 3; bus attendant= 1	(a) School policies surrounding the intervention environment (b) Staffing due to fiscal changes (c) Training (d) Prioritization of competing demands (e) Lack of respect and support for the intervention (f) Lack of resources	

						0-18 years' experience with children with autism		
4	Locke et al., (2017).	USA	Semi-structured interviews; Inductive approach (Bradley et al., 2007)	Social Skills	Elementary school	School administrators- n=15; teachers/educators- n=10; other personnel n=14 0-38 years working with children with autism.	(a) Time for planning and implementation (b) Competing demands (c) Lack of resources (d) Lack of training	(a) Principal and teacher support (b) Student progress (c) Positive feedback from colleagues

5	Silveira-Zaldivar & Curtis (2019)	USA	Mixed-methods- Focus group & Interviews	Social skills	Elementary school	Focus group- school psychologists, n=2, special education teachers, n=3 Interviews- teachers n=2 5-29 years' experience	(a) Lack of training (b) Lack of time (c) Lack of support staff (d) Lack of staff buy-in (e) Lack of materials (f) Lack of administrator/district support (g) Prioritization of needs	
6	Stahmer, Suhreinrech, Reed & Schreibman (2012).	USA	Focus groups; grounded theory (Glaser & Strauss, 1967)	Pivotal Response Training	Children aged 3-8	Teachers/educators n= 13 1-34 years' experience with children with autism	(a) Difficult to implement (b) Lack of prescribed curriculum (c) Difficult to use in group settings.	(a) Increased generalisation (b) Fit well with concepts of good teaching (c) Easy to implement

7	Wilson & Landa, (2019)	USA	Verbal and written feedback analysis; Grounded theory (Strauss & Corbin, 1990)	Naturalistic behavioural intervention	Preschool	Special education teachers and instructional assistants, n=8 5.5-30 years' experience	(a) Lack of training/ experience (b) Lack of experience with materials (c) Hesitation to be observed (d) Lack of support staff (e) Difficulty implementing (f) Difficulty with data collect (g) Lack of time (h) Resistance to change (i) Teachers ability to train support staff (j) Discontinuity of intervention implementation across providers (k) Student characteristics (l) Large classes (m) Lack of materials (n) Lack of admin support and understanding of autism. (o) Lack of alignment with curriculum (p) Lack of supervisor training.

Table 2.2

Characteristics of included quantitative studies

#	Reference	Country of Origin	Methodology and Analysis	EBP Type	Setting	Participant Type & Years of experience	Barriers (ranked most to least serious)	*M, SD*	Frequency of rating as "significant barrier"
5	Silveira-Zaldivar & Curtis, 2019	USA	Survey- likert scale; Analysis- means and standard deviations	Social skills	Elementary school	Educators, n=32 5-29 years' experience	(a) Lack of training in EBPs (b) Lack of staff (c) Prioritization of demands (d) Lack of time (e) Lack of materials (f) Cost of implementation (g) Administrative Support	*M*= 2.73. *SD*= .63 *M*= 2.67, *SD*= .65 *M*= 2.61, *SD*= .66 *M*= 2.54, *SD*= .75 *M*= 2.48, *SD*= .71 *M*= 2.18, *SD*= .77 *M*= 2.10, *SD*= .95	65.6% 57.6% 53.1% 53.1% 43.8% 21.9% 31.2%

Given the variation in education contexts worldwide, context was an important consideration in reporting these findings. Context is the environment or setting in which the intervention is to be implemented, and understanding context is critical for understanding implementation (Daivadanam et al., 2019). All papers included information on the country of origin. Five (72%) of the studies were published in the USA, one (14%) in Saudi Arabia, and one (14%) in Australia. The types of EBPs included in these studies were: social stories (*n*= 1), visual supports (*n*= 1), social skills (*n*= 3) pivotal response training (*n*= 1), and naturalistic behavioural intervention (*n*= 1). School personnel included in the studies were: teachers/educators (*n*= 42), school administrators (*n*= 15), and other school staff including special education aides (*n*= 23).

In synthesising the available research, it is also important to understand the types of methodologies used to explore this area. Six papers used qualitative methodologies, and one paper used a mixed-methods approach to explore the barriers and facilitators to intervention implementation. A variety of qualitative analysis methods were used. One study used thematic analysis (Braun & Clark, 2006); two used grounded theory (Glaser & Strauss, 1967), one used an inductive approach (Bradley et al., 2007), and one used a coding manual for qualitative researchers by Saldana (2013).

Barriers and facilitators categorised according to conceptual framework

Factors were assigned to macro level, school level or individual level factors based on the conceptual framework proposed by Domitrovich and colleagues (2008). Most barriers were reported at the school level (10), followed by the individual level (9) with least barriers reported at the macro level (4). Most facilitators were reported at the individual level (6), followed by the school-level (3) with the least facilitators reported at the macro level (2). A total of 23 barriers and 11 facilitators were reported by the papers in this review. Table 2.3

illustrates the categorisation of barriers and facilitators to interventions reported in the included studies.

Table 2.3.

Categorised barriers and facilitators to interventions

Macro Level Factors		School-Level Factors		Individual Level Factors	
Barriers	**Facilitators**	**Barriers**	**Facilitators**	**Barriers**	**Facilitators**
1. Cultural differences (1) 2. Lack of access to Multi-Disciplinary teams (2) 3. State budgets (4) 4. Lack of consistency of use across settings and providers (2) (7)	1. Multi-Disciplinary practice (2) 2. Consistency of use across settings (2)	1. Lack of resources (1) (2) (4) (5) (7) 2. Lack of time (2) (4) (5) (7) 3. Lack of awareness of the intervention (2) 4. Staffing (3) (5) (7) 5. Lack of school personnel support (3) (4) (5) (7) 6. Leadership prioritisation of competing demands (3) (4) (5) 7. School Policies (3) 8. Large classes (7) 9. Supervisor lacking training (7)	1. School personnel support (4) 2. Increased awareness of the intervention (2) 3. Availability of resources (2)	1. Lack of training/ experience (3) (4) (5) (7) 2. Competing demands (5) 3. Difficult to implement (6) (7) 4. Restrictions placed by intervention (2) 5. Difficult to implement in group settings (2) (6) 6. Staff buy-in and resistance to change (5) (7) 7. Hesitation to be observed (7) 8. Student characteristics (7)	1. Positive outcomes for the student (2) (4) (6) 2. Positive feedback from colleagues (4) 3. Diversifying the materials (1) 4. Appropriateness of the materials (1) 5. Fit of the intervention with concepts of good teaching (6) 6. Ease of implementation (6)

	10. Cost of implementation (5)	9. Lack of alignment with curriculum (6) (7)

Key: (1) Alotaibi, Dimitriadi & Kemp (2016); (2) Donato, Shane & Hemsley (2014); (3) Locke et al., (2015); (4) Locke et al., (2017); (5) Silveira-Zaldivar & Curtis (2019); (6) Stahmer et al., (2012); (7) Wilson & Landa (2019).

Barriers and facilitators by type of intervention

Table 2.4 illustrates the barriers and facilitators reported by school personnel when implementing each type of intervention, and the total number of barriers and facilitators experienced by school personnel when implementing each type of intervention.

Table 2.4.

Barriers and Facilitators by intervention type

Intervention & Reference	**Definition**	**Barriers**	**Facilitators**	**Total**
Social Skills (a) Locke et al 2015 (b) Locke et al 2017 (c) Silveira-Zaldivar & Curtis (2019)	Group or individual instruction designed to teach learners with autism to appropriately interact with peers, adults and other individuals (Wong et al., 2015)	1.School policies (a) 2.Budget restrictions on staff (a) 3.Training (a)(b)(c) 4.Prioritisation of demands (a) (b) 5.Lack of support (a) 6.Lack of resources (a)(b)(c) 7.Time (b)(c) 8.Lack of support staff (c) 9.Staff buy in (c)	1.Principal and teacher support (b) 2.Student progress (b) 3.Positive feedback (b)	Barriers- 13 Facilitators- 3

		10.Lack of support (c) 11.Prioritisation of needs (c) 12.Cost of implementation (c) 13.Admin support (c)		
Social Stories Alotaibi, Dimitriadi & Kemp (2016).	Stories that describe social situations in some detail by highlighting relevant cues and offering examples of appropriate responding (Wong et al., 2015).	1.Resources 2.Differences in culture	1.Diversification of the intervention 2.Appropriateness of the resources for the students	Barriers- 2 Facilitators- 2
Visual Supports	Any visual display that supports the learner engaging in a desired behaviour or skills	1.Lack of access to multi-d teams 2.Lack of consistency across settings	1.Access to multi-d teams 2.Consistency of use	Barriers- 7 Facilitators- 4

Donato, Shane & Hemsley (2014).	independent of prompts (Wong et al., 2015).	3.Lack of awareness 4.Language restrictions of the intervention 5.Difficulty implementing 6.Resources 7.Time	3.Time 4.Use of technology	
Pivotal Response Training Stahmer, et al., (2012)	Pivotal learning variables guide intervention practices that are implemented in settings that build on learner initiative and interests (Wong et al., 2015).	1.Difficulty implementing 2.Lack of curriculum 3.Difficult in group settings	1.Increased generalisation 2.Fit well with concepts of good teaching 3.Easy to implement	Barriers- 3 Facilitators- 3

Naturalistic Behavioural Interventions Wilson & Landa (2019).	Intervention strategies that occur within the typical settings/routines in which the learner participates (Wong et al., 2015).	1.Lack of training 2.Lack of experience 3.Hesitation to be observed 4.Lack of support staff 5.Difficult to implement 6.Difficult to complete data collection 7.Lack of time 8.Resistance to change 9.Teachers ability to train support staff 10.Continuity of implementation	Barriers- 16 Facilitators NA

11.Student characteristics

12.Large classes

13.Lack of materials

14.Lack of admin support

15.Lack of alignment with curriculum

16.Lack of supervisor training

A total of 5 types of interventions were identified and analysed in this review; social skills, social stories, visual supports, pivotal response training (PRT) and naturalistic behavioural interventions (NBI). A brief definition of each intervention is provided in the table. The highest number of barriers (16) were experienced by school personnel implementing NBI, followed by social skills interventions (13), visual supports (7), PRT (3) and social stories *(*2),

Barriers and facilitators common across interventions

The following barriers were common across at least two intervention types: resources, time, lack of consistency of use across settings, staff, lack of support from other school personnel, leadership, lack of training, implementation difficulties, group implementation difficulties, and staff buy-in. The facilitator that was common across intervention types was positive outcomes for the student. Lack of resources was the most common barrier cited across interventions with 80% of intervention types reporting this. Lack of time was the second-most common barrier experienced across interventions, cited by 60% of the types of interventions. All other common barriers were shared by 40% of the types of interventions. Positive outcomes for the student were a shared facilitator for 60% of the interventions.

Resources

The resources required to implement social stories was a barrier due to lack of access to technology to assist in delivering the intervention, and also lack of access to appropriate materials and resources (Alotaibi, Dimitriadi & Kemp, 2016). The lack of materials for implementation was a significant barrier in both studies examining the barriers to implementing a social skills intervention (Locke et al., 2015; Locke et al., 2017; Silviera-Zalvidar & Curtis, 2019), and in implementing NBI (Wilson & Landa, 2019).

Time

Time was another significant barrier to the implementation of EBPs. Four papers cited lack of time as a barrier to implementation (Donato, Shane & Hemsley, 2014; Locke et al., 2017; Silviera-Zalvidar & Curtis, 2019; Wilson & Landa, 2019). Time to develop materials was a barrier to the implementation of a visual support intervention (Donato, Shane & Hemsley, 2014) and time for planning and implementing activities was the most frequently described barrier in implementing a social skills intervention (Locke et al., 2015). Lack of time for implementation of a social skills intervention was cited as a significant barrier by 53% of respondents in a survey examining barriers to EBP use (Silviera-Zalvidar & Curtis, 2019), with the qualitative measure in this study finding that lack of time was the second most coded barrier. Time in this study encompassed planning time, implementation time, training time and time for collaboration with other staff. Lastly, Wilson and Landa (2019) reported that insufficient time to plan and create materials was a barrier to implementation, in addition to challenges with working outside of school hours.

Lack of consistency of use across settings

Lack of consistency of use of the intervention across multiple settings and providers (i.e. home, natural environment, speech and language therapy) was a barrier to the implementation of visual supports (Donato, Shane & Hemsley, 2014) and NBI (Wilson & Landa, 2019). For these interventions, maintenance and generalisation to different environments was important.

Lack of support from school personnel

Lack of support from administrators, principals and colleagues was a barrier identified in four studies. Lack of support from fellow teachers and administrators was a barrier to the implementation of a recess-based social skills intervention (Locke et al 2015; Locke et al 2017), and in another social skills intervention (Silveira-Zalvidar & Curtis, 2019). Lack of support from administrators was also a barrier in implementing NBI (Wilson & Landa, 2019). In particular, in this study, administrator's lack of knowledge of autism and EBPs was a barrier to implementation.

Staffing

Staffing was a barrier to the implementation of social skills interventions (Locke et al., 2015; Silviera-Zalvidar & Curtis, 2019) and NBI (Wilson & Landa, 2019). Staffing was a barrier in Locke and colleagues (2015) as there were absences and inconsistencies with staff implementing the intervention, and this was common with the NBI intervention, with the variability of support staff impacting on implementation (Wilson & Landa, 2019). In the quantitative measures of the social skills intervention, lack of staff was rated a "significant barrier" by 57.6% of respondents (Silviera-Zalvidar & Curtis, 2019).

Leadership

School leadership's prioritization of competing demands was a barrier in implementing two types of social skills intervention, as staff members reported that they often had multiple responsibilities that changed frequently during the time allocated for the intervention (Locke et al., 2017; Silveira-Zalvidar & Curtis, 2019).

Training

Training was a barrier to implementation in both social skills interventions (Locke et al., 2015, Locke et al., 2017; Silveira-Zalvidar & Curtis, 2019), as staff often had little training in working with children with autism intervention strategies (Locke et al., 2015; Locke et al., 2017). Training regarding EBPs for social skills interventions was very lacking and quantitatively, lack of training was rated as a significant barrier by 65% of staff (Silveira-Zalvidar & Curtis, 2019). Lack of training was also a barrier to implementation in the implementation of NBI (Wilson & Landa, 2019).

Implementation Difficulties

The difficulty of implementation was a barrier in the implementation of PRT (Stahmer et al., 2012), and NBI intervention (Wilson & Landa, 2019), as school personnel found it difficult to implement the intervention and take data at the same time. The difficulty of implementing the intervention in a group setting was a barrier for both the visual supports intervention (Donato, Shane & Hemsley, 2014) and the PRT intervention (Stahmer et al., 2012). Both studies reported that the intervention was easier to implement when one-to-one with a student, and more difficult in a classroom or group setting.

Staff Buy-in

Lack of staff buy-in and motivation to change was identified as a barrier in two studies implementing social skills interventions and NBI (Silveira-Zalvidar & Curtis, 2019; Wilson & Landa, 2019). Staff were reported by participants to maintain the status quo (Silveira-Zalvidar & Curtis, 2019), thus impeding on implementation.

Lack of alignment with curriculum

Both PRT (Stahmer et al., 2012) and NBI (Wilson & Landa, 2019) cited the lack of alignment of the interventions with a curriculum as a barrier to implementation. Educators reported that because PRT was not tied to a specific curriculum it was difficult to determine what goals to follow (Stahmer et al., 2012), and the NBI study found that there was a need for further alignment of the intervention with mandated curriculums to make the intervention easier for educators to adapt (Wilson & Landa, 2019).

Barriers and facilitators specific to interventions

Naturalistic behavioural interventions (NBI) reported the highest number of barriers (5) specific to this intervention, followed by social skills interventions (4), visual supports (3) and social stories (1). Pivotal response training reported no barriers specific to this intervention.

Visual supports reported the highest number of facilitators specific to the intervention (4), followed by social stories, social skills and pivotal response training (2). The paper for NBI did not report any facilitators.

Social Stories

Cultural differences were a barrier to the implementation of social stories. The teachers in this study perceived that the social stories developed for mainstream use were not culturally appropriate for the students in their school in Saudi Arabia. The facilitators of this intervention were being able to use appropriate materials with the students. Furthermore, being able to diversify the materials by culture and also being able to adapt materials easily using technology was a facilitator in this study.

Visual Supports (Donato, Shane & Hemsley, 2014).

The barriers specific to visual supports included lack of access to multi-disciplinary teams, lack of awareness of visual supports and restrictions placed by the intervention. Educators felt that multi-disciplinary approaches to EBPs enabled better implementation through training and collaborating with different professionals, and lack of access to this type of support made it more difficult to implement. Educators also felt that visual supports may cause restrictions to the development of language. In contrast, facilitators of this intervention type included multi-disciplinary practice, consistent use across settings, and increased awareness of visual supports.

Social Skills

Staffing shortages due to reduced state budgets were identified as a barrier to the implementation of a social skills intervention designed to be delivered at recess (Locke et al., 2017). The implementation of this intervention was dependent on the availability of school personnel at recess, and due to the changes in budget, staff were not always available at the required time

School policies around the allocation of recess time and also the school policies around staff allocation at recess were a barrier to implementation in another study (Locke et al., 2017) as the intervention lacked consistency due to the policies. The cost of implementation was identified as a barrier by Silveira-Zalvidar and Curtis (2019).

The facilitators for social skills interventions included school personnel receiving both emotional and instrumental support from principals and teachers, and collaborating with other teachers which facilitated the implementation of this intervention (Locke et al., 2015). Furthermore, positive feedback from colleagues enabled the continued implementation of the intervention.

Naturalistic Behavioural Interventions (*Wilson and Landa, 2019).*

Large classes and lack of appropriately trained supervisors was identified as a barrier to NBI. They also reported that staff were hesitant to be observed and supervised while implementing procedures, and this study found that student characteristics were a challenge to implementing NBI. Core difficulties associated with autism such as lack of engagement and need for sameness impacted on staff's willingness to implement a NBI.

Pivotal Response Training (Stahmer et al., 2012).

The PRT intervention was found to be a good fit with teacher's concepts of good teaching practices which enabled implementation, as it made sense to them. They also cited that the ease of implementation was a facilitator, as it felt natural to use in an education context.

Discussion

This scoping review synthesised the available research on the barriers and facilitators in this area, and used a conceptual framework to group these according to macro, school and individual level factors. Closing the research-to-practice gap evident in autism education is a pressing need. The identification of the barriers and facilitators experienced by school personnel in delivering EBPs to children with autism is critical in understanding why EBPs are not being implemented widely. Seven papers were included in this review, three papers identified barriers and facilitators to social skills interventions, and the other papers identified barriers and facilitators to social stories, visual supports, pivotal response training and naturalistic behavioural interventions, resulting in the analysis of five different intervention types.

Five of the seven included papers originated from the USA, one from Saudi Arabia and one from Australia. We could not find evidence of papers published in Europe, highlighting a research gap that needs to be addressed due to differences in educational contexts. Of the 27 to 34 EBPs identified in the literature for use with children with autism (Bond et al., 2016; Wong et al., 2015), only four of these were included in this review, representing less than 10-15% of the EBPs recommended for use with children with autism. This highlights a significant gap in the research of employing EBPs and understanding the implementation factors impacting their use with children with autism in school settings.

There were several barriers common across intervention types, suggesting that there are universal issues that can addressed when implementing EBPs with children with autism in school settings. Lack of resources was the most common barrier experienced across interventions types (social stories, social skills, visual supports and naturalistic behavioural interventions), followed by lack of time (social skills, visual supports, NBI). This suggests that the availability of resources for the intervention, and time for the training, preparation and implementation of EBPs may be key implementation factors. This is line with prior research on implementing EBPs from the broader educational literature (Kincaid, Childs, Blasé & Wallace, 2007; Strickland-Cohen et al., 2019). Thus, to enhance implementation, principals, school administrators, and teachers should reflect carefully on their workload, the availability of resources and the time available to implement interventions when introducing them for children with autism. Furthermore, a common barrier was also staff-buy-in, staffing issues and lack of support for school personnel, indicating that at a school-level, planning, preparation and whole-school support need to be fostered for interventions to be effectively implemented.

Other barriers common to intervention types but more specific to the autism educational community were lack of consistency of use across settings, lack of training in autism and EBPs, and difficulties implementing the intervention- both individually and at a group level. Lack of consistency of use across settings impacts on the generalisation of interventions to maximise their success (Lord & McGee, 2001) and also highlights the need to involve multiple stakeholders in providing EBPs to children with autism. Thus, collaboration efforts between all key stakeholders involved in the child's care may help to overcome this. Whilst lack of training is a key barrier identified in many other studies that are not autism-specific (McGoey, et al., 2014) autism researchers should be aware of the need for the development of adequate training to support the implementation of novel autism interventions. Lastly, implementation difficulties related to the intervention, such that they are difficult for teachers to implement, or difficult to implement in a group setting, highlights a key concern raised by researchers related to the social validity and transferability of interventions into classroom settings (Kasari & Smith, 2013; Callahan et al., 2017). Interventions for use with children with autism are traditionally tested for efficacy in controlled, rigid environments that are not reflective of the nature of typical classrooms (Kasari & Smith, 2013), and thus a key issue with EBPs may be that they are being developed independently of the consideration of classroom difficulties. This is further reflected in research which demonstrated that only 26% of interventions published on EBPs had considered social validity of these interventions an important outcome (Callahan et al., 2017). Thus, we need to consider that the interventions designated best-practice for children with autism may be designed to fail in school settings due to the nature in which we assess the efficacy of them. There appears to be a pressing need for robust testing of EBPs in classroom settings, implemented by school personnel.

There were several barriers found to be specific to the intervention type. For example, all three social skills studies (Locke et al., 2015; Locke et al., 2017; Silveira-Zalvidar & Curtis, 2019) cited school leadership considering competing demands when allocating staff to the intervention, as a barrier to implementation but this was not cited as a barrier for other interventions. Lack of awareness of the intervention was cited as a barrier in the implementation of visual supports (Donato, Shane & Hemsley, 2014), and school policies were cited as a barrier in the implementation of a social skills intervention (Locke et al., 2017). This variation in barriers and facilitators makes sense when one considers that implementation factors potentially differ across EBPs, for example some EBPs require more material preparation (e.g. visual supports and social stories), than others (e.g. prompting). This difference in barriers across interventions is something that has not been explored in the literature thus far. As there were only four types of EBP included in this review- social stories, visual supports, social skills interventions and naturalistic behavioural interventions, the generalisability of these findings to other types of EBPs is limited, and therefore, the identification of barriers and facilitators specific to each EBP is a pressing research need. Our findings suggest that a tool for assessing the implementation of EBPs should be developed and reported on across any intervention studies to allow for comparison of implementation factors, especially where there are multiple EBPs that claim to target similar issues. At present, the barriers and facilitators identified by each study may be due to differences in the way researchers presented their questions or different approaches, therefore, a common measure to examine implementation factors would overcome this. Furthermore, clear identification of implementation factors using this tool would enable school personnel to better determine what EBP they should choose to align with their available resources.

This review also identified the potential for context-specific barriers and facilitators to implementation. It is interesting to note that the paper which cited culture as a barrier to implementation (Alotaibi, Dimitriadi & Kemp, 2016) was published in Saudi Arabia, where the culture is vastly different to that of Western society where much of the research on EBPs is conducted. Furthermore, the paper that cited access to multi-disciplinary teams (Donato, Shane & Hemsley., 2014) was published in Australia, which does not have the same legislative support for EBPs as the USA, and thus, may have less access to multi-disciplinary teams (Productivity Commission, 2016). In line with prior research, this highlights the importance of considering the context for intervention implementation (Daivadanam et al., 2019), particularly the importance of considering barriers that may be country or culture specific. Given that education systems are dramatically different worldwide (Black & William, 2005) it is prudent that research into the adoption of autism EBPs would pay considerable attention to the context of the implementation. As such, it would appear from this review that researchers and practitioners should be cautious when generalising findings from studies, as context may influence how barriers and facilitators are experienced by school personnel.

Some barriers and facilitators appeared to be autism specific and may need to be considered by school personnel before implementation. Lack of experience and training in working with children with autism and EBPs was cited by four papers (Locke et al., 2015; Locke et al., 2017; Silveira-Zaldivar & Curtis, 2019; Wilson & Landa, 2019), highlighting that despite increased efforts at training school personnel, training in EBPs and children with autism remains a key factor in improving implementation efforts. Furthermore, one study cited that the characteristics of students with autism was a barrier in implementing natural behavioural interventions (Wilson & Landa, 2019), due to the lack of engagement and insistence on sameness displayed by the students. Furthermore, lack of multi-disciplinary teams was also identified as a barrier, highlighting that the multi-disciplinary nature of autism education is key to implementing EBPs.

Barriers and facilitators at all three levels of Domitrovich and colleagues (2008) framework were identified, highlighting the interdependence of factors on the implementation of EBPs for children with autism. For example, in the Alotaibi and colleagues study (2016) the implementation of the intervention was dependent on the appropriateness of the intervention (individual level) which was dependent on the availability of materials and technologies (school level) which was further dependent on cultural differences (macro level). Furthermore, in the Locke and colleagues study (2015) the implementation of the intervention was dependent on staff availability (school level) which was dependent on state budget allocations (macro level). This provides some evidence for the use of models considering multiple interdependent levels of factors when analysing implementation factors. It was interesting to note that many factors affecting EBP implementation were cited at the macro and school level, which indicates that efforts aimed at increasing the capacity of educators in implementing EBPs may be quite limited if systemic issues are not taken into account.

Limitations

For the purposes of identifying the barriers and facilitators experienced by school personnel in education settings, this review only included papers which had been conducted on this topic with school personnel who had experience in delivering these interventions. This in turn led to the loss of many papers which gave an overview of the barriers from an external perspective (Forman, Fagley, et al., 2009; Forman, Olin, et al., 2009) and papers from directors of interventions which did not include the perspectives of those directly involved in implementing the intervention (Koenig, Feldman, Siegel, Cohen & Bleiweiss, 2014). However, it is also a strength of this paper that we have reviewed the perspectives of people who are ultimately responsible for implementing these interventions in school settings with children with autism and whom, based on the low number of studies available for inclusion in this study, have not been adequately researched to date.

Papers were not included that did not explicitly have the identification of barriers and facilitators as a main aim of the study (Locke et al., 2019), and those which included special education but not autism specifically (Goodman-Scott, Carlisle, Clark & Burgess, 2016). Furthermore, this review only included peer-reviewed literature which may have reduced the number of included studies, however, this decision was undertaken to ensure the robustness of included studies. The strict nature of the inclusion and exclusion criteria excluded many papers, however, this enabled the clear identification of barriers and facilitators in autism education alone. It also allowed for the perspectives of people who are directly responsible for employing EBPs, which addresses a key gap in our understanding in this field. As the main aim of this review was to provide an overview of the extant literature in this area, no quality control indicators were applied to the included studies. The lack of consistency of approach and analysis across papers in this field is a potential limitation of this study, due to the difficulty in synthesising and analysing qualitative and mixed methods research. This paper attempted to overcome this by following a scoping review protocol published by the Joanna Briggs Institute. While scoping reviews are relatively new to the field, conducting this scoping review allowed for the identification of nuanced information to inform further development of research which would have been lost if a systematic review had been attempted.

Six papers included in this review were qualitative in nature, and one was mixed methods. All papers reviewed used different analytic methods, different interview questions and approaches, and different populations. Thus, it is extremely difficult to form a coherent picture of the barriers and facilitators present in the education of children with autism. This paper attempted to overcome this by using a conceptual framework designed by Domitrovich and colleagues (2008) to categorise and structure the identified barriers and facilitators. Furthermore, this review has provided rich qualitative information which could be used as a basis to develop quantitative measures of the barriers and facilitators to school personnel using EBPs with children with autism. For example quantitative measures which have been used in the health sciences such as the “Evidence-Based Practice Attitude Scale” (Aarons, 2004) could be adapted to identify potential barriers to implementing practices in the autism education field with samples of broader magnitude.

Implications

This review provides an important overview of the extant literature; however, it also highlights the scarcity of research conducted in this area, which is evidenced by the inclusion of only seven peer-reviewed papers in this review. This was surprising considering the volume of research identifying the research-to-practice gap in autism education. A scarcity of robust research on the implementation of EBPs for students with autism hinders efforts to increase their use, as interventions designed to increase adoption are likely to fail if adequate consideration of the factors affecting implementation are not taken into account. This review has outlined the existing research, but also highlights the need for further, rigorous study of the barriers and facilitators school personnel experience in intervention implementation as well as the need for the identification or development of a common measure to explore implementation factors in applied autism intervention studies.

This review shines a spotlight on the lack of clarity and understanding of the barriers and facilitators that school personnel experience in implementing EBPs with children with autism, which is crucial to address in developing our understanding of why EBPs are not being implemented consistently. This review is thus providing the basis and rationale for further, rigorous, quantitative research on this subject. The study also highlighted that key aspects of the area remain poorly understood and difficult to synthesise due to the scarcity of robust research on the topic. Given the pressing need to ensure effective education provision for students with autism further research employing quantitative, replicable methods is critical to develop a more complete understanding of the barriers and facilitators affecting the adoption of education practices that work.

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Chapter 3 **Study 2**

‘It’s up to the teacher’: A qualitative study of teachers’ use of autism EBPs.

Abstract

Teachers are responsible for providing effective education for students with autism and a range of evidence based practices (EBPs) have been linked to better outcomes. Teacher perspectives on the implementation of EBPs are essential in understanding why a research to practice gap in the field of autism education persists. This study examines mainstream teachers perspectives through one-to-one semi-structured interviews with 14 mainstream teachers in the South of Ireland. Thematic analysis (Braun & Clark, 2006) was used to identify themes resulting from the data. Four main themes emerged, and key issues reported by teachers included lack of knowledge and training, and an educational culture that lacked in placing importance on EBP use. Teachers reported a strong system of teacher collaboration which they employed to learn about "what works." Teacher collaboration could be better utilised to increase teacher knowledge and capacity for implementing EBPs, and overcoming resource restraints.

Key words: autism, evidence-based practice, teacher preparation.

Autism is a neurodevelopmental disorder characterised by social and communicative difficulties, that is first identifiable in early childhood (American Psychiatric Association, 2013), and has a prevalence rate of 1 in 54 children in the USA (Baoi et al., 2018) and 1 in 89 children across Europe (Autism Spectrum Disorders in the European Union [ASDEU], 2018). Individuals with autism experience difficulties with verbal and non-verbal communication, forming friendships, social relationships, and can have heightened sensory needs, all of which can impact on their daily functioning. In line with international movements towards inclusive education, children with autism are increasingly educated in inclusive settings alongside their neurotypical peers (Hehir et al., 2016; National Council for Special Education [NCSE], 2016), and as a result, education has become synonymous with intervention (McMahon & Cullinan, 2016). School-based interventions for autism are critical to help students with autism overcome school-related challenges such as difficulties navigating the social world of school (Schroeder et al., 2014), attention difficulties (McLean et al., 2014), sensory difficulties (Fernandez-Andres et al., 2015), and language difficulties (Levy et al., 2010).

Interventions that have proven efficacy at improving outcomes for individuals with autism have been designated the status of an "evidence-based practice" (EBP), with the most recent systematic review of EBPs identifying 28 EBPs (Steinbrenner et al., 2020). Yet, a research-to-practice gap exists in the autism education field, whereby teachers continue to implement practices with little to no scientific evidence (Hess et al., 2008; Morrier et al., 2011; Sulek et al., 2019), and lack knowledge of EBPs (Morin et al., 2020; Ravet, 2018; Segall & Campbell, 2012; Stahmer et al., 2015). This is reflective of issues in the field of education generally, as teachers are expected to be adept at selecting and implementing EBPs, whilst also juggling multiple other responsibilities including teaching academic subjects, and teaching larger groups of students (Brownell et al., 2013; Kasari & Smith, 2013). Recent contributions to the field of autism acknowledge that to bridge the autism research-to-practice gap, the voice of key stakeholders (i.e., students, parents and teachers) are needed to mediate the conversation on "what works" (Guldberg, 2017). This is indicative of the "fatal flaw" in educational research, whereby research is often not conducted in school settings, nor is educational practice or the teacher's voice used to inform the development of research questions and research design (Hargreaves, 1996; McGann et al., 2020). This is evidenced by the fact that an overwhelming majority of autism EBP research has been conducted in one-to-one, clinical research settings with researchers implementing the interventions (Kasari & Smith, 2013). Therefore, the lack of transference of EBPs from research to practice may be attributable to barriers which occur in school contexts that have not been identified due to a lack of alignment between the contexts in which autism EBP research is conducted, and the contexts in which they are expected to be adopted. This highlights the importance of gaining insights from a school context on why EBPs for students with autism may not be adopted.

Preliminary research has identified some factors which may impact the implementation of autism EBPs in school settings. Implementation factors identified in a scoping review of the area include lack of knowledge, training, difficulties in implementing the EBP in school settings, class size, and principal and staff support (Barry et al., 2020). However, this review found only seven studies examining the barriers and facilitators specific to autism EBP implementation in schools, and none of the studies were conducted in Europe. In general, few empirical studies have examined the uptake and use of interventions for children with autism in Europe (Carter et al., 2012; Salomone et al., 2016), and no evidence could be found of studies that examine factors which may help or hinder the adoption of autism EBPs in schools in European contexts (Barry et al., 2020). Considering that educational policy can differ across jurisdictions, for example, in the USA teachers are required to use scientifically based practices (U.S. Department of Education, 2008), no such requirement exists elsewhere. The exploration of autism EBP adoption and factors which impact this adoption in a variety of educational contexts is a pressing research need in overcoming the research-to-practice gap.

In sum, given the improved outcomes associated with implementing EBPs with children with autism (Steinbrenner et al., 2020), the lack of knowledge of autism EBP use in European settings (Salomone et al., 2016), the compounding lack of information about factors influencing autism EBP use in school settings (Barry et al., 2020), and the importance of the teacher voice in improving our knowledge of autism education (Guldberg, 2017), this paper aims to qualitatively explore the following:

(1) Teachers' perspectives on their preparation for teaching students with autism.
(2) Teachers' perspectives of evidence-based practices in autism education.

Method

Design and Participants

Interviews were conducted with 14 teachers from five mainstream primary schools in the South of Ireland and were recruited using snowball sampling due to a poor response rate (0%) of a random sampling attempt of 100 schools. A designated contact from schools known to the researchers were contacted to assess interest in participating. This contact then forwarded on the invitation to other potentially interested teachers for the project, and all participants were previously unknown to the interviewer (author 1). Participants were included if they were, (a) qualified mainstream primary school teachers working in a general education school for children between the ages of 4 years and 12 years, and (b) had experience teaching children with autism for a minimum of one year. Participant demographics are presented in Table 3.1 below.

Table 3.1

Participant demographics

Teacher	**Gender**	**Position**	**Classroom Size**	**Years' Experience**
Anna	Female	Mainstream Classroom Teacher	Large Group (25+)	10 years
Brendan	Male	Mainstream Classroom Teacher	Large Group (25+)	5 years
Ciaran	Male	Mainstream Classroom Teacher	Large Group (25+)	4 years
Diane	Female	Mainstream Classroom Teacher	Large Group (25+)	6 years
Ellen	Female	Special Education Teacher	1:1/ Small group	12 years
Fiona	Female	Learning Support/ Resource	1:1/ Small group	16 years
Gary	Male	Mainstream Classroom Teacher	Large Group (25+)	16 years
Hilary	Female	Learning Support/ Resource	1:1/ Small group	17 years
Ian	Male	Learning Support/ Resource	1:1/ Small group	35 years
John	Male	Teaching Principal	Large Group (25+)	15 years
Karen	Female	Mainstream Class Teacher	Large Group (25+)	2 years
Laura	Female	Mainstream Class Teacher	Large Group (25+)	15 years
Maura	Female	Mainstream Class Teacher	Large Group (25+)	6 years
Niamh	Female	Mainstream Class Teacher	Large Group (25+)	2 years

Data Source and Procedure

Participants were provided with information sheets and those willing to participate gave informed consent for participation (Appendix B). One-to-one semi-structured interviews were conducted in a classroom in each school set aside for the purpose of interviews. The first author conducted the interviews which lasted approximately 12 minutes, and followed a set of pre-designed set of questions. The interview schedule (Appendix C) was developed between the first and third author based on their knowledge of the existing area, and consisted of open ended and close ended questions designed to answer the aims of the research, including questions related to participants' knowledge of EBPs, and their experience teaching children with autism. Data collection continued until data saturation had been achieved, which was defined according to previous literature as occurring when the ability to collect new information had been achieved, and further coding was no longer necessary due to the two primary questions of the study being answered (Fusch & Ness, 2015).

Interviews were audio-recorded, and transcribed verbatim by the first author. Pseudonyms were assigned to the participants to ensure confidentiality and any identifiable information was removed from the data. Upon completion of the interviews, all participants were given contact information for the first and last authors, and the university's ethics committee. Ethical approval for the study was granted by the Education and Health Sciences Research Ethics Committee (EHSREC) prior to interviews taking place.

Data Analysis Process

Thematic analysis (Braun & Clark, 2006) was used to analyse the data. This approach, which involves the repeated analysis and comparison of data across six distinctive cycles was used to allow the identification of patterns and themes in an inductive manner. As this study was designed as a novel examination of Irish teachers' perspectives of EBPs, this was felt best to ensure the identification of nuanced information. Some questions were designed to answer a priori questions, e.g. related to levels of training received, but all information was analysed in an inductive manner according to the data analysis procedure. Thematic analysis consists of a six-step framework for analysis (Braun & Clark, 2006), and the first and third author were responsible for independently coding the data, to enhance reliability and validity of the analysis. A codebook is included in Appendix D. The following steps were completed.

Step 1: To begin, the coders became familiar with the data through reading the data and forming initial ideas. Step 2: Initial codes were identified and NVivo software was used to help collate similar data. Line by line coding of the transcripts was conducted. Step 3: At the third step, the coders independently searched for themes in the data and collated the codes in NVivo to reflect these potential themes. For example, where a teacher spoke of issues with accessing training on time, this was coded into a theme called "Lack of Training", and related data were collated with this. Step 4: The coders met to review the themes they had identified to ensure they were aligned to the entire data set, and some codes were collated. According to Braun and Clark (2006), a theme was defined as a set of related ideas that represented some patterns within the data. For example, the coders had identified "Lack of Training" and "Lack of Knowledge" as distinct themes, but these were grouped together as subthemes under a major theme of "Teachers feel unprepared to support students with autism", as lack of knowledge and training appeared related. Step 5: Discussions were held between the first and last author to resolve any differences in interpretation and agreed on the final themes and subthemes emerging from the data. Step 6: Lastly, a written report of the analysis was produced. Four main themes were identified and agreed between the researchers as being important in representing teacher's knowledge and perceptions of evidence based practices.

Trustworthiness

To enhance the credibility of the analysis, investigator triangulation and persistent observation were used. Investigator triangulation was employed by involving two researchers in the data analysis process. The data arising from the interview transcripts were coded and analysed by the two researchers separately and then interpretations of the data were compared. Where differences arose, discussions were held to ensure the most suitable interpretation of the data was being represented. The researchers also engaged in persistent observation, whereby they constantly read and reread the data when developing the codes. They then analysed, revised and continuously theorised about the codes and concepts, and re-labelled codes if necessary until a thorough understanding of the data was gained.

Reflexivity

One of the important considerations when completing qualitative analysis is the views, perspectives and experiences the authors brought to the study (van Schalkwyk & Dewinter, 2020). All authors are experienced researchers and clinicians in the field of autism. The first author is a doctoral student examining Irish teacher's use and understanding of EBPs as part of her thesis. The second author is a lecturer of applied behaviour analysis, and the third author a lecturer of psychology. We brought an awareness to our potential biases and assumptions when coding the data, coded the data independently and discussed these codes with the second author to do our best to reflect the data in a true manner.

Results

First, strategies described by teachers are reported, to provide an overview of the types of practices teachers are currently using. Secondly, the major themes that emerged are presented. Four major themes were identified: (1) Teacher's Feel Unprepared to Support

Students with Autism; (2) Sources of Information; (3) Systems Culture; (4) School-Based Influences on Implementation.

Teacher's Use of Interventions with Children with Autism

Teachers were found to use a variety of interventions with students with autism. The interventions are categorised into EBPs or USPs in accordance with EBPs from the most recent review of the literature (Steinbrenner et al., 2020). Teachers reported using 18 different types of interventions. The most frequently reported intervention that they used was visual supports (n = 10), which encompassed visual timetables, and traffic light systems aimed at emotional regulation. Teachers reported using four EBPs in total- visual supports, cognitive behavioural interventions, reinforcement, and discrete trial teaching (Steinbrenner et al., 2020). The majority of practices (n = 14) teachers reported using were USPs. These included breathing techniques, movement breaks, sensory toys/sensory box, structure/routine, brain breaks, Go Noodle, and speech and language programmes such as Shape Coding, Black Sheep Press, and No Glamour Language. One teacher reported using Treatment and Education of Autistic and related Communications Handicapped Children (TEACCH) programme which is a comprehensive treatment model (CTM). One teacher reported using ABA (applied behaviour analysis), which is categorised as a scientific approach rather than an intervention and some teachers reported using social groups and pair work, however, when probed the teachers were unable to describe these interventions in line with defined descriptions of social skills interventions and peer-mediated interventions (Steinbrenner et al., 2020), therefore it was decided following discussion between the first and third author that these interventions would be placed in the unsupported category as they were not examples that adhered to specific EBPs.

Themes and Subthemes Identified

Following analysis, four major themes and nine subthemes were identified. The major themes identified were (1) Teacher's Feel Unprepared to Support Students with Autism; (2) Sources of Information; (3) Systems Culture; (4) School-Based Influences on Implementation. The themes and subthemes are presented below.

Theme 1: Teachers Feel Unprepared to Support Students with Autism

Overall, this theme represents teachers' feelings of unpreparedness due to lack of knowledge of autism and EBPs. Teachers had a number of perceptions about autism education, including the importance of their role as teachers, as well as issues in their training and knowledge of autism and EBPs. Lack of knowledge, lack of training, professional development needs and the teacher's role are the subthemes identified under this theme.

Lack of Knowledge. Teachers perceived that they lacked knowledge of EBPs. Of the 14 teachers asked "are you familiar with the term evidence based practice", three replied that they did not know the term, and the remaining eleven teachers were unsure of what constituted evidence based practices, For example, these teachers were unable to give satisfactory descriptions of EBPs: "I'm not sure is it to do with .. researching different teaching methods and then seeing the results and then implementing them in classrooms with advantages and disadvantages?" (Ciaran); and "That basically you back up kind of what I would feel myself with actual evidence" (Diane).

Lack of Training. Related to lack of knowledge, teachers reported relatively low levels of autism-specific training. Of the fourteen teachers, only one reported receiving autism specific training before teaching a child with autism. Four teachers reported that learning mainly occurred on the job, with Diane remarking that "it's hard to prepare you for something until you're in the classroom" and Laura adding "there's only so much can happen in college." Others perceived that very little time was allocated to autism in their initial teacher education (ITE) "In six weeks I had one lecture in SEN, I didn't have a clue" (Diane). Ellen and Maura felt that their ITE programme did not equip them for working with children with autism, with Ellen feeling "very anxious" about teaching a child with autism, and Maura perceiving that it was "very daunting."

Professional Development. Six teachers reported that they had received some continuous professional development (CPD) since beginning to teach a child with autism, and one teacher had completed a postgraduate special education course. Some teachers perceived that the current model of CPD was inadequate, as teachers complete most of their CPD during the summer, with Laura remarking that many teachers are "in holiday mode" at that point which may impact on the effectiveness of the courses. Furthermore, Anna and Laura noted that access to these courses can be limited, Brendan felt that the current courses could be "quite weak," with Diane also feeling that "the summer course for autism is online- I don't think you're going to learn much." The structure of CPD courses was of issue for Niamh, who felt that full-day courses could lead to teachers being bombarded with information:

> *It's very different implementing that into a class where you have 20, 30, 35 students who don't all have the same needs .. it can be hard to juggle all the tactics or the skills learned in that course day.*

Laura felt that it would be useful to get CPD throughout the year, so "you know you'd actually be going into the classroom the next day using it in your practice," rather than having a gap between accessing information and putting it into practice.

Ellen and Laura felt that accessing CPD on a continuous basis would be of more benefit to teachers, with Laura in particular reporting an extraordinary length of time to access CPD for a child in her class "it's no use really when a teacher applies for something in October and the teacher doesn't get it for years later." Laura also felt that whole school training would be of benefit to teachers because "we're all going to be coming across these things," however, John felt that whole school training might not be applicable for his school as it was a rural school, and that courses for staff should be chosen on "what's of benefit to the majority of teaching staff."

Teachers' Role. Brendan recognised the teacher's role as extremely important in educating children with autism "Teachers have more contact time with the child than any other professional, so have a very important role and has a stronger influence over the child's education than external factors." Other teachers also remarked that it was important for teachers to identify areas for professional development, such as Karen, Laura and Maura, who felt that "it's up to the teacher" to educate themselves, with Niamh stating that "the onus (is) on the teacher I feel to find out what works for the child." However, Diane and Laura perceived that sometimes teachers were expected to perform duties outside of their scope of practice, with Diane commenting "teachers aren't psychologists they aren't OTs (Occupational Therapists) or anything like that," and Laura also felt that sometimes "things come into schools that parents expect us to do them but actually it's not our job."

Theme 2: Sources of Information

Teachers reported accessing information on autism and EBPs from a variety of sources. Teachers reported receiving most information from collaboration with other teachers, and there appeared to be strong communities of collaboration within the teaching profession. Teachers also used web-based resources frequently, including official government sites as well as social media platforms. Lastly, teachers felt that advice from experts in the education and health fields was crucial to their understanding of autism, however, they perceived lack of timely and appropriate access to these avenues of support.

Collaboration. In general, there was a strong culture of teacher collaboration reported, with six teachers describing how they turn to fellow colleagues for information about autism and EBPs. Laura, Maura, and Fiona reported using the resource and learning support teachers within their schools as specialists. Three teachers also described talking to and visiting teachers from special schools for more information and training in autism. As John reported "I would very often go to teachers who teach in special schools who would have would be highly trained specifically to teach children with autism to ask for help as well," and he felt that networking between teachers was very important. Ciaran described how talking to other teachers was of benefit as they "might have a more valuable experience than you," and another teacher, Hilary explained that she would be more likely to use interventions based on other teachers' recommendations: "I don't actually source them based on evidence, I source them based on other people's experience and what they have used."

Using Web-based Resources. Other teachers reported using the internet and websites to keep abreast of recent developments in autism. Four teachers reported looking at official government websites to find information on autism and keep up to date with research. These included the Professional Development Service for Teachers (PDST) website, and the Teaching Council of Ireland website, where they were able to access journal articles. John also described social media platforms as helpful, as there are pages where "you can put up a post anonymously to ask for help" from other teachers.

Seeking Expert Advice. Teachers recognised collaborating with expert professionals in the field of autism from the education and health services as important, with six teachers reporting collaboration with psychologists, speech and language therapists, occupational therapists and autism specialists. Ian felt that “people working with autistic children are at the coalface.. they know what they’re saying,” underlining the importance of sharing expertise, and Ciaran felt that “you need a full circle of all different professions” to fully understand and support the student with autism, as different disciplines had different expertise to offer. Niamh also remarked that “it would be nice to have maybe a professional then that could give proper guidance on what students need from the get go.”

Theme 3: Systems Culture

Two subthemes emerged from this main theme, school culture and the broader Irish educational culture. School cultures were perceived as important in facilitating the transfer of knowledge between teachers, and school leaders seemed very important in fostering this culture within schools. The broader Irish educational culture seemed to place little emphasis on the importance of EBPs, and the lack of access to experts due to funding issues appeared to be an issue.

School Culture. The school culture was found to be important, with teachers from one school in particular, Anna and Brendan, describing a culture of collaboration in which all teachers would meet and discuss what they will try to implement, and feed back to the group afterwards on its utility. Anna best described this process as below:

> *We’ll meet together as a standard and we’ll discuss what we’re going to teach so that could work, that if I implement one thing that could be me for this month and I’ll feedback with the others and then somebody else could do it the next month so then we’re not all losing out on time.*

Gary added further information on this initiative: “we’ve implemented, I suppose, our own personal personalised system of collaboration where we’ve observed each other we’ve planned together, and it’s been a much deeper level of collaboration.”

Furthermore, Anna, Brendan, Ellen, and Gary described how their school principal and vice-principal were very encouraging of research, and disseminated research to teachers and encouraged critical thinking and discussion around these topics. The principal and vice-principal in this school also actively suggested appropriate courses for teachers to attend: “(principal) will often send us on emails .. relevant research so we’ll look at it and I think if I feel that it would work I’ll use it” (Anna).

John, from a different school, also reported “very often in teaching, two or three people from a school go, learn how to implement stuff and then they’re teaching the other teachers about it,” however, he cautioned this, as “it’s kind of second-hand knowledge.”

Interprofessional Culture. Broader systems issues of the educational and health services was also identified by teachers. Anna reported a very positive experience working collaboratively with a psychologist, however she reported this as a once off, commenting that psychologists are generally too busy to provide individualised support to teachers and students:

> *I had huge support from that psychologist, she brought me out to the centre that she worked in and went through loads of stuff with me and she came out to the classroom several weeks later she said “oh put these into practice and I’ll come and then we’ll have a discussion on what worked what didn’t work how can we adapt them” and it was brilliant but I’ve never had that experience since.*

Brendan also commented on the lack of collaboration between the health service and education system:

> *It's almost like there's a divide between the health side of things (and the education side). Whether it be speech and language, occupational therapy, whether it's access to psychologists, it's all done away from the school environment so there's very little communication with the teacher.*

Laura perceived some differences between the Irish education system, and European countries where they have more access to outside professionals: "in other European countries they have systems where there is an in-school educational psychologist available, there's way more access to speech therapists, all of these things .. we don't have those resources available."

Furthermore, related to the education system in Ireland, teachers felt that the evidence base for an intervention or strategy was not always an important factor in adoption, with Fiona commenting that "the use of evidence based, it wasn't something that was highlighted for us" in teacher training, and Gary reporting that "a lot of the time we are told these are evidence based but we don't really research it." Hilary further added that evidence based practices are "not a big thing in Ireland you have to use so it's never really something that you question in a programme."

Theme 4: School Based Influences on Implementation

This theme is related to other factors that teachers described which impacted their adoption or understanding of EBPs. Teachers perceived a variety of factors that impacted on their ability to implement interventions with children with autism in their classrooms, and these included curriculum overload, lack of time, lack of resources, large class sizes and a variety of needs. Parent support and positive outcomes for the students were positive influences reported by teachers.

Anna and Brendan identified curriculum overload as a huge issue, with three other teachers acknowledging that lack of time for teachers to try out new things was a big challenge: “time is the key element to it I mean already you’ll find that teachers .. they’ll identify curriculum overload as a huge issue” (Brendan).

Lack of resources were identified as a challenge by four teachers, whereby access to certain resources such as sensory toys and rooms would make the implementation of interventions easier: “I think resources is a big thing for mainstreams that are not special schools to have the funding basically to be able to set up these resources and to have them readily available” (Karen).

Large class sizes were an issue identified by three teachers, who reported that there were a variety of different learning needs in their classrooms, for example: “you’ve got 30 other children to you know think about as well so I suppose … it’s hard to factor in all the needs when there’s only one of you” (Diane). Teachers identified parent support as important in supporting their students with autism, for example, Diane reported that “I’ve had most of my information from the parent of the child.”

Teacher buy-in and fear of change was identified as a challenge by two teachers. Lack of teacher training, knowledge of research and EBPs, and having the time to keep up to date with research was identified as an issue by four teachers “we need to know how to research programmes effectively” (Fiona).

Conversely, positive outcomes of the intervention on the child were reported to enhance implementation, as “teachers would be more likely to implement programmes if the programme was having positive results on the children intended" (Emma). Furthermore, teacher characteristics such as adaptability, patience and self-directed learning were perceived by the teachers as important in the adoption of interventions with students with autism, with teachers reporting "you always have to be researching" (Ciaran), and needing a "willingness to adapt what you're doing" (Diane).

Discussion

Given the importance of including perspectives from school personnel in overcoming the research-to-practice gap, the findings from this study provide a nuanced view of teacher perceptions of EBPs and preparedness to teach students with autism. While teachers reported a general lack of knowledge and use of autism EBPs, this appeared to be reflective of the broader education system, with teachers perceiving that EBPs in general were not that important in the educational sphere in Ireland. Of the 28 evidence based practices identified by Steinbrenner and colleagues (2020), four of these were reported to be used by teachers in this sample, with visual supports the most frequently used EBP.

Teachers perceived that they were ill-prepared and it was "daunting" to teach children with autism due to their lack of knowledge and training. Of the 14 teachers interviewed, only one teacher had received autism training before beginning to teach children with autism. Teachers remarked that their ITE programme was inadequate at preparing them for educating students with autism, which corroborates international findings (Ravet, 2018), with most teachers reporting very little SEN education in their ITE. The current model of CPD also appears to hinder teacher's efforts to upskill in autism as it was reported as mainly consisting of summer courses, which teachers perceived as inadequate. This was also compounded by lack of timely access to appropriate CPD which hindered teacher efforts to help their students with autism, as some CPD courses may not be run every year, or may be oversubscribed. The importance of specialist training in implementing autism EBPs cannot be under stated, with lack of training identified as a barrier in previous research (Barry et al., 2020). Recent research by Stahmer and colleagues (2015) reports that extensive training and coaching is key to supporting educators to implement autism EBPs with fidelity.

Even though teachers lacked adequate training in implementing autism EBPs, they reported accessing information on autism and interventions from a variety of sources including other teachers, professional supports, websites and through taking their own initiative to research how best to support the student. The teachers rely strongly on cultures of collaboration within their schools which has also been noted elsewhere (Daly et al., 2016; Trembath et al., 2019). In one school, the school cultures of collaboration were supported by school management, with the principal and vice-principal encouraging the dissemination of research and promoted teachers uptake of interventions. The importance of school leadership in facilitating the implementation of EBPs with children with autism has been highlighted in previous literature (Locke et al., 2017). Furthermore, cultures of collaboration can play an important role in upskilling teachers in autism EBPs. For example research by Shire and Kasari (2014) demonstrated that a peer-to-peer model of CPD was a cost-effective, high quality in-service training.

Theme four explored a number of school-level factors that influenced teachers their implementation of interventions with children with autism. Factors such as the presence of parent support and achieving positive child outcomes when using an EBP positively impacted teachers' use of interventions. Factors such as lack of time, lack of resources, inadequate training and poor knowledge were identified as potential barriers to implementing interventions. These appear to be common barriers and facilitators experienced by teachers implementing autism EBPs (see Barry et al., 2020) and proper planning by school leaders prior to implementation of an EBP could greatly assist in overcoming such barriers.

A broader educational system issue of concern is the lack of emphasis on the implementation of autism EBPs in the educational context of this study, and teachers perceived that “EBPs are not a big thing in Ireland”. Teachers also reported that whether an intervention is evidence based is not a primary consideration, and that they would be more likely to implement an intervention based on somebody else’s recommendation, rather than the scientific evidence for this intervention. While the NCSE has recommended that teachers use EBPs (2016), our research suggests that the objectives of these guidelines have not yet been fully realised, and a culture of implementing EBPs is not yet widespread. This is perhaps linked to issues of legislation whereby access to EBPs is legislated for in the USA but not in European settings. Another contributing factor may be the misalignment between the philosophy underpinning many EBPs (Applied Behaviour Analysis), and the policy advice given by the NCSE (2016) in which no approach or intervention for autism is favoured. Our findings also suggest that a greater focus on autism EBPs, and the importance of scientific evidence for interventions during ITE would support more widespread use in classrooms.

Limitations

This paper has a number of limitations, a small sample size and the concentration of teachers in one geographical area means that the findings from this study may not be generalisable to the wider teacher population. However, the study includes a mix of teacher types with a wide spread of years of experience. Furthermore, the findings of this study are in line with previous research in finding that teachers’ lack knowledge of EBPs (Hess et al., 2008) and extends our knowledge of how teachers identify, select and implement interventions with students with autism. This is also the first European study conducted with mainstream teachers of children with autism, and provides an insight into factors not previously identified that may affect implementation of autism EBPs. One important limitation is the potential that teachers are using these practices, yet unable to name what they specifically are. However as naming and following protocol when implementing an EBP is an important aspect of implementing them with fidelity it is prudent to err on the side of caution when identifying EBPs in use in this study. A final limitation is that this research did not explore whether the teachers in our study are using named EBPs with fidelity which would be central to their successful implementation as per EBP systematic reviews such as Steinbrenner and colleagues (2020). Future research would benefit from additional quantitative research, or observational studies of teachers in mainstream classrooms to explore this aspect.

Conclusion

This paper enhances our understanding of teachers' perceptions of educating students with autism, and their knowledge and use of EBPs when educating children with autism. Importantly, this study has addressed a gap in our understanding of the adoption and implementation of EBPs in an Irish setting, and is the first to be conducted in a European setting. Additional research is urgently needed to expand our knowledge in this area. Future research should explore on a wider scale the knowledge and training needs of European teachers, and also the barriers and facilitators that may be experienced in implementing autism EBPs. Promisingly, teachers appear to rely on strong cultures of collaboration, which could potentially be harnessed to upskill teachers in autism and evidence-based practice. Future research should examine the value of using these channels already available to teachers to promote the implementation of EBPs in mainstream schools with children with autism.

Overall this study suggests there is much to be done in promoting the use of autism EBPs within the mainstream teaching community. Given the complex needs of students with autism, addressing this gap should be a priority for all educators if we are to succeed in efforts to promote best practice in teaching and learning while achieving the best possible outcomes for these students.

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Chapter 4 **Study 3**

Teacher Characteristics, Knowledge and Use of Evidence-Based Practices in Autism Education in Ireland.[3]

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Abstract

Evidence-based practices (EBPs) improve outcomes for students with autism across a range of skill areas yet issues persist in adopting these to classroom settings. This research aimed to identify teacher training, years of experience, access to support professionals and knowledge and use of EBPs in Ireland.

Three hundred and sixty-nine mainstream primary school teachers reported their characteristics and their knowledge and use of EBPs. Results indicated that the majority of teachers receive little initial teacher education training in autism, almost no continuous professional development (CPD) before educating a child with autism and receive little support from professionals. Knowledge and use of EBPs differed significantly across teacher characteristics, with findings discussed in relation to teacher training.

Key words: autism, evidence-based practice, research-to-practice, teacher preparation.

In the field of autism education, a research-to-practice gap has been identified, whereby practices proven efficacious in the literature fail to be implemented in educational settings (Cook et al., 2009). Autism is a neurodevelopmental disorder, where individuals with the diagnosis present with deficits in social and communicative functioning (American Psychiatric Association, 2013). Children with autism often find it difficult to make friends and navigate the social environment of school (Rowley et al., 2012), may struggle academically due to challenges with language and concentration (Levy et al., 2010; McLean et al., 2014), and may not be able to keep abreast of the curriculum (Anglim et al., 2018). Students with autism are increasingly educated in mainstream classrooms (MCs) alongside their neurotypical peers, supported by teachers who may not specialise in autism (National Council for Special Education [NCSE], 2016). As the majority of students with autism are now educated in inclusive education settings (Hehir et al., 2016), this necessitates that teachers be able to flexibly meet the needs of a variety of students. The extent to which the teacher is able to provide individualised quality education has been found to be one of the most important factors influencing the outcomes of students with autism (NCSE, 2016; Kasari & Smith, 2013), and students with autism often require individualised support in the form of specific interventions (McMahon & Cullinan, 2016).

These interventions can typically be separated into evidence-based and unsupported practices (Paynter et al., 2017). Evidence-based practices (EBPs) have been identified through rigorous reviews of the literature, National Clearinghouse on Autism Evidence and Practice (NCAEP) in the United States identifying 28 practices (Steinbrenner et al., 2020). These practices have been associated with improved outcomes for students with autism across social, communicative and academic functioning domains among others (Odom et al., 2010; Steinbrenner et al., 2020; Wong et al., 2015); and the use of EBPs with fidelity may also reduce teacher burnout (Ouellette et al., 2019). Furthermore, in education settings, the adoption of EBPs is particularly important considering school-age children spend the vast majority of their time in school (Brookman-Frazee, et al., 2009; Kasari & Smith, 2013).

Though there are positive outcomes associated with using EBPs, a research-to-practice gap in the autism EBP field has been identified (Cook & Odom, 2013). This is reflective of issues within the broader educational field, whereby no framework exists to support the translation of research into practice, and whereby there is discordance between the development of practice-based research and research-based practice (McGann et al., 2020). However, while there are broader issues of the contextual appropriateness of evidence-based practice undoubtedly at play, autism EBP research is unique in that a clear, defined set of EBPs has been developed by researchers over the last decade (Odom et al., 2010; Steinbrenner et al., 2020; Wong et al., 2015). Therefore, some framework of reference exists for practitioners to choose and employ EBPs, and yet this research-to-practice gap persists.

With regard to autism EBPs, the research-to-practice gap has been demonstrated in mental health, early intervention, and allied health professionals working with young people with autism (Brookman-Frazee et al., 2020; Stahmer et al., 2019; Paynter et al., 2017; Paynter & Keen, 2015). The adoption of autism EBPs in school settings may be further impacted due to the complex nature of schools (Kasari & Smith, 2013), as paradoxically, many interventions designed to work in the school setting are developed and tested in clinical/1:1 settings. Thus, the school context where teachers have to teach larger groups of children, and where teachers typically already have an academic curriculum to implement means that EBPs may be more difficult to adopt (Kasari & Smith, 2013). This is demonstrated in recent research which has found American special educators were knowledgeable of all EBPs, and over 90% of teachers used EBPs such as reinforcement and modelling daily, but only 20% of teachers used EBPs such as video modelling and extinction daily (McNeill, 2019). Furthermore, Australian research examining general educators use of EBPs found that teachers use only one EBP every day (visual supports), six EBPs "some of the time" and the remaining 20 EBPs were used "rarely" or "never" (Sulek et al., 2019). Other research has found that special education teachers lack confidence in implementing EBPs with their students with autism and they can find it difficult to select which practices to use (Brock et al., 2014; Anglim et el., 2018; Finlay et al., 2019).

To overcome the research-to-practice gap evident in the implementation of EBPs, it is important to identify factors that can increase teachers' use of autism EBPs (Barry et al., 2020a). Studies have found that special educators in self-contained classrooms typically use EBPs more frequently than those in inclusive classrooms (McNeill, 2019), potentially due to fewer competing demands in smaller classrooms. Other research has identified that teacher knowledge and training in EBPs is key to implementing EBPs with students with autism (Sulek et al., 2019), which is reflective of the broader autism EBP literature (Stahmer et al., 2009; Paynter et al., 2016). An important facilitator of the implementation of EBPs may be support from professionals such as psychologists, speech and language therapists and occupational therapists (Barry et al., 2020a), but this needs to be explored further. Furthermore, there is a dearth of information available to inform our understanding of autism EBP adoption in Europe (Salomone et al., 2016), and we could identify no studies examining autism-specific EBP use nor the factors which may impact their use. This remains a pressing research need, as contextual influences may influence the adoption of EBPs.

In sum, considering that outcomes for students with autism can improve through the use of EBPs (Steinbrenner et al., 2020), it is imperative that we gain a deeper understanding of the research-to-practice gap in this area. Preliminary evidence exists to support differences in EBP adoption by teachers based on a number of factors such as knowledge, training and support, but in order to gain a deeper understanding of these factors further research is a pressing need. Furthermore, relatively few studies examining teachers' adoption have been conducted outside of the USA (Barry et al., 2020a), meaning that contextual differences may exist which need to be explored further. To address the gaps in our knowledge, this paper aims to do the following:

(1) Provide an overview of teacher characteristics in autism education in Ireland such as types and intensity of training received, years' experience, levels of education, levels of professional support received and knowledge and use of evidence-based practices.
(2) Examine if knowledge and use of EBPs are impacted by teacher characteristics.

Method

Inclusion and Exclusion criteria

Participants were first screened for inclusion, and if they met the criteria of, (a) being a mainstream primary school teacher, and (b) had experience teaching at least one child with autism, they were permitted to proceed through the online questionnaire.

Participants Characteristics and Context.

Participants were 369 mainstream primary school teachers from all 26 counties in the Republic of Ireland. In Ireland, all teachers graduate from their initial teacher education (ITE) courses with no specialisation in special education or autism. Teachers working in special education roles such as learning support teachers, resource teachers and special education teachers are not required to have specialist certification for these posts. At present, there are also no mandatory professional development requirements in Ireland.

Please see table 4.1 for further participant characteristics.

Table 4.1.

Participant demographics

Characteristic	**Number (%)**
Gender	
Male	44 (12.2%)
Female	311 (86.1%)
Prefer not to say	6 (1.7%)
Age Range	
20-25	35 (9.7%)
26-30	62 (17.1%)
31-35	66 (18.2%)
36-40	81 (22.4%)
41-45	47 (13%
46-50	21 (5.7%)
51-55	28 (7.7%)
56-60	18 (5%)
60+	4 (1.1%)
Disadvantaged School*	65 (33%)
Rural School	135 (52.7%)

*Designated as a Delivering Equality of opportunity In Schools (DEIS) School- typically low socio-economic area.

Sampling Procedures

Recruitment took place online via email and social media. Using the Department of Education and Skill's school registry, 3,105 schools were contacted to participate in the study by following an anonymous link to the survey provider Qualtrics. The anonymous link was also shared on the social media platforms Teachers' Research Exchange (t-rex.ie), Facebook and Twitter. The response rate for those who access the survey though the link provided was 69%: 536 began the survey but 167 were excluded due to inclusion criteria not being met, and therefore 369 teachers went on to complete the survey. Due to the nature of anonymous online data collection, it is not possible to determine the complete response rate as we have no way of measuring how many people had access to the survey link.

Design

This was a cross-sectional study. The dependent variables in this study were teachers' use of EBPs and knowledge of EBPs. Independent variables included teacher position, education level, years of autism experience, autism specific training, school characteristics and support from external professionals.

Measures

A self-report online survey was used to collect data (Appendix E). The first part of the survey collected demographic information as reported in Table 4.1, and information on teachers' position and education level were also collected. Teachers were then asked questions related to their autism teaching experience and training, including their years of experience, training in their initial teacher education (ITE) programme and continuous professional development (CPD). Finally, teachers were asked about the support they had received from professionals and the number of times per year they had received support.

Knowledge and Use of EBPs

Teacher's knowledge and use of EBPs was measured using an adapted version of the *Early Intervention Practices Scale* (Paynter & Keen, 2015). Some minor changes were made to this scale to make it contextually appropriate, for example, "parent-mediated interventions" and "pivotal response training" were removed, and speech and language therapy programmes and traditional teaching methods were added. A total of 37 interventions were included in the survey instrument. 27 of these interventions were designated EBP status, whilst 10 were unsupported practices (USP). Participants rated their knowledge and use of interventions when educating students with autism on a five-point Likert scale from "very little" to a "very great extent" of knowledge, and from "never" to "frequently" use. Internal reliability for the scales remained high following minor amendments, Cronbach's α for knowledge of EBPs scale= .97, Cronbach's α for use of EBPs scale= .94.

Procedure

Prior to distribution of the survey, two teachers took part in user experience testing of the survey, and a number of contextual adaptations were made to make the survey more aesthetically pleasing and socially valid. For example, the description of each EBP was removed from the survey and only the name of the practice was included. Once the survey was finalised, it was distributed via an anonymous survey link. Teachers who met the inclusion criteria could proceed to complete the survey which took an average of 12 minutes to complete.

Data Availability and Data Analysis

The dataset analysed during the current study is available in the Zenodo repository (Barry et al., 2021). To address the first research question, descriptive statistics were conducted to identify teacher position, education level, years' of experience with children with autism, autism specific training, school characteristics and support from external professionals. To address the second research question, a series of One-Way Analysis of Variance (ANOVAs) and Independent samples t-tests were conducted, comparing teachers' knowledge and use of EBPs across a number of teacher characteristics.

Results

Data Screening

Data were collected online via Qualtrics software and downloaded to IBM SPSS Statistics for Windows, Version 26 for analysis. Prior to analysis, the data were screened for survey completion, outliers and normality. Data were distributed normally and no outliers were identified. Missing value analysis conducted on the individual items revealed variable non-completions at the item level (4.3-43.6%). Data were missing completely at random (Little's MCAR test: χ^2 (42) = 27.33, p =.96), and thus list-wise deletion was used.

Teachers' Knowledge and Use of EBPs

Teachers were most knowledgeable (M = 4.00, SD = 1.20) about traditional teaching methods, and this was the only practice in which teachers scored "a great extent" of knowledge. Other practices which teachers had a moderate extent of knowledge of included visual supports (M = 3.96, SD = 1.10), social stories (M = 3.59, SD = 1.09), exercise (M =3.29, SD = 1.14), modelling (M = 3.16, SD = 1.38), prompting (M = 3.02, SD = 1.30), reinforcement (*M* = 3.36, *SD* = 1.19), social skills training (*M* = 3.18, *SD* = 1.28) and sensory rooms (*M* = 3.33, *SD* = 1.27). In agreement with Steinbrenner et al., (2020), the data indicates that teachers are knowledgeable to a moderate extent of a number of EBPs including visual supports, social stories, exercise, modelling, prompting, reinforcement, and social skills training. Overall, teachers' knowledge of autism practices, both EBPs and unsupported practices appeared low, with 28 of 37 practices falling in the "very little" or "slight" category of knowledge.

Participants reported using six practices at least some of the time (mean score of 3 or above); exercise (*M* = 3.34, *SD* = 1.24), modelling (*M* = 3.16, *SD* = 1.33), reinforcement (*M* = 3.41, *SD* = 1.28), sensory rooms (*M* = 3.18, *SD* = 1.42), social stories (*M* = 3.44, *SD* = 1.21) and traditional teaching methods (*M* = 3.35, *SD* = 1.34), with four of these practices (exercise, modelling, reinforcement and social stories) meeting criteria for EBP (Steinbrenner et al., 2020). The most used practice was social stories (*M* = 3.44, *SD* = 1.21). Only two EBPs were used by over half of the teachers daily- reinforcement and social stories.

There were 14 rarely used practices (1= rare); ABA, DRI/A/O, discrete trial training, extinction, facilitated communication, functional behaviour assessment, functional communication, intensive interaction, music therapy, naturalistic interventions, scripting, sign language, time delay and video modelling, of which 10 were EBPs.

Table 4.2 demonstrates teachers' mean knowledge and use of practices which has been ranked according to mean use (EBP= evidence-based practice; US= unsupported practice). For knowledge, above 3 indicates "some" knowledge of the practice, and for use, above 3 indicates using the practice one or two times per week.

Table 4.2.

Overview of teacher's knowledge and use of practices, ranked by mean use of EBPs.

Practice	**EBP Status***	**Rank**	**Use of EBPs** *M (SD)*	**Knowledge of EBPs** *M (SD)*	**% Use Daily**
Social Stories	EBP	1	**3.44 (1.21)**	**3.59 (1.09)**	50.5
Reinforcement	EBP	2	**3.41 (1.28)**	**3.36 (1.19)**	51
Traditional Teaching	US	3	**3.35 (1.34)**	**4 (1.20)**	48
Exercise	EBP	4	**3.34 (1.24)**	**3.29 (1.14)**	43.7
Sensory Rooms	US	5	**3.18 (1.42)**	**3.33 (1.27)**	42.8
Modelling	EBP	6	**3.16 (1.33)**	**3.16 (1.38)**	41.4
Prompting	EBP	7	2.99 (1.37)	**3.02 (1.30)**	37.5
Social Skills	EBP	8	2.93 (1.37)	**3.18 (1.28)**	36
Structured Play Groups	EBP	9	2.84 (1.37)	2.99 (1.30)	33.2
Sensory Integration	EBP	10	2.81 (1.36)	2.87 (1.30)	33.2
Response Interruption	EBP	11	2.77 (1.35)	2.88 (1.34)	32.3
Cognitive Behavioural Interv.	EBP	12	2.59 (1.26)	2.85 (1.13)	23
Developmental Interventions	US	12	2.59 (1.26)	1.75 (1.01)	23
Speech and Language Therapy	US	14	2.47 (1.38)	2.63 (1.36)	26.9
Self-Management	EBP	15	2.41 (1.26)	2.52 (1.30)	19.7
PECS	EBP	16	2.39 (1,33)	2.93 (1.30)	20.7
Antecedent Interventions	EBP	17	2.37 (1.37)	2.52 (1.32)	19.7
Technology	EBP	18	2.25 (1.25)	2.49 (1.28)	19.7
Visual Supports	EBP	19	2.14 (1.28)	**3.96 (1.10)**	24.1
Peer Mediated Interventions	EBP	20	2.07 (1.17)	2.17 (1.24)	13

TEACCH	NA	20	2.07 (1.37)	2.32 (1.43)	17.8
Play Therapy	US	22	2.03 (1.14)	2.52 (1.14)	10.6
Task Analysis	EBP	23	2.00 (1.24)	2.17 (1.29)	14.9
Video Modelling	EBP	24	1.97 (1.22)	2.25 (1.31)	15.8
Scripting	EBP	25	1.95 (1.08)	2.20 (1.22)	9.1
Facilitated Communication	US	26	1.93 (1.15)	2.05 (1.17)	11
Time Delay	EBP	27	1.94 (1.23)	1.97 (1.17)	16.8
Intensive Interaction	US	28	1.92 (1.20)	1.93 (1.22)	12.5
Functional Behaviour Assess.	EBP	29	1.90 (1.15)	2.09 (1.25)	11
Music Therapy	EBP	30	1.88 (1.10)	2.07 (1.09)	11.1
ABA	NA	31	1.82 (1.09)	2.23 (1.20)	8.7
DRI/A/O	EBP	32	1.78 (1.13)	1.88 (1.19)	8.7
Functional Communication	EBP	33	1.75 (1.02)	1.85 (1.12)	8.1
Sign Language	US	34	1.68 (1.16)	2.10 (1.27)	9.6
Naturalistic Interventions	EBP	35	1.67 (1.05)	1.71 (1.07)	8.7
Extinction	EBP	36	1.49 (.90)	1.62 (1.07)	4.3
Discrete Trial Teaching	EBP	37	1.41 (.90)	1.51 (.99)	5.3

* ABA= Applied Behaviour Analysis, DRI/A/O= Differential Reinforcement of Incompatible/Alternative/Other Behaviour, PECS= Picture Exchange Communication System, TEACCH= Treatment and Education of Autistic and related Communications Handicapped Children.

** Bolded scores indicate scores above 3, “somewhat knowledgeable” and use “some of the time”

Differences in Knowledge and Use of EBPs based on Teacher Characteristics

Teacher characteristics and the differences in knowledge and use of EBPs across teacher characteristics are displayed in Table 4.3. The data suggests that teachers' knowledge and use of EBPs differed across a number of factors including teacher position, years' experience with students with autism, CPD training, hours of ITE and CPD received, and access to support professionals. For teacher position, those who were Autism Class Teachers had the highest knowledge and used EBPs most frequently, while Mainstream Class Teachers had the lowest knowledge and used EBPs least frequently. Teachers who had 12-15 years of experience with students with autism had the highest knowledge and use of EBPs, and teachers who had the most (21+ years) and least (less than 3 years) experience had similar low levels of knowledge and use. Teachers who received CPD before teaching children with autism and those who had received additional CPD had higher levels of EBP knowledge and use in comparison with those who had not received training, and those who had received the most amount of hours of ITE training and CPD training were most knowledgeable and used EBPs more frequently. Lastly, those who had access to support professionals more than 7 times per year had the highest levels of knowledge and used EBPs most frequently, and those who had no access to support professionals had the lowest knowledge of EBPs and used EBPs least frequently.

Table 4.3.

Teacher Characteristics and Group Differences in Knowledge and Use of EBPs.

		Knowledge of EBPs		Use of EBPs	
Characteristic	***n*, %**	**Mean (SD)**	**Group Differences**	**Mean (SD)**	**Group Differences**
Teacher Position			***F* (4, 203) = 6.20, *p* <.001**		***F* (4, 203) = 6.71, *p* <.001**
Mainstream Class Teacher	207 (57.8%)	2.31 (.75)		2.14 (.64)	
Special Education Teacher	62 (17.3%)	2.78 (.87)		2.51 (.73)	
Learning Support Teacher	18 (5%)	2.69 (.58)		2.41 (.57)	
Principal-Teacher	28 (57.8%)	2.82 (.84)		2.54 (.70)	
Autism Class Teacher	43 (12%)	3.02 (.98)		2.80 (.70)	
Education Level			*F* (3, 202) = 2.05, p =.11		*F* (3, 202) = 1.91, p = .13

Bachelors	140 (39.1%)	2.51 (.80)		2.37 (.71)	
Professional Masters in Education	35 (9.8%)	2.23 (.86)		2.01 (.65)	
Postgraduate Certificate/Diploma	117 (32.7%)	2.55 (.88)		2.33 (.71)	
Masters	66 (18.4%)	2.80 (.87)		2.50 (.71)	
Years Autism Teaching Experience			***F* (6, 200) = 3.46, *p* = .003**		***F* (6, 200) = 2.59, *p* = .019**
Less than 1 year	36 (10.3%)	2.31 (1.03)		2.11 (.84)	
1-3 years	123 (35%)	2.31 (.72)		2.18 (.64)	
4-7 years	84 (23.9%)	2.75 (.72)		2.52 (.62)	
8-11 years	46 (13.1%)	2.68 (.93)		2.41 (.72)	
12-15 years	35 (10%)	3.09 (1.03)		2.69 (.78)	
16-20 years	14 (4%)	2.48 (.66)		2.31 (.66)	
21+ years	13 (3.7%)	2.33 (.80)		2.19 (.86)	

Autism Specific Training					
Received ITE Training			t(185)=-1.47, *p*=.14		t(185)= -.36, *p*=.72
Yes	192 (60%)	2.63 (.84)		2.35 (.72)	
No	128 (40%)	2.44 (.87)		2.31 (.70)	
CPD Before Teaching a Child with Autism			***t*(206) = 2.58, *p* =.01**		***t*(206) = 2.58, *p* =.01**
Yes	77 (21.8%)	2.84 (.98)		2.58 (.78)	
No	276 (78.2%)	2.48 (.79)		2.28 (.67)	
Additional Autism Specific CPD			***t*(205) = 3.23, *p* =.001**		***t*(205) = 2.67, *p* =.008**
Yes	235 (67%)	2.69 (.83)		2.44 (.67)	
No	116 (33%)	2.28 (.83)		2.16 (.75)	
Hours of ITE training			***F* (2, 108) = 8.14, *p* = .001**		***F* (2,108) = 12.27, *p* <.001**
1-3	126 (65.6%)	2.45 (.84)		2.16 (.70)	

4-8	45 (23.4%)	2.79 (.70)		2.56 (.57)	
9+ hours	21 (10.9%)	3.32 (.59)		3.03 (.48)	
Hours CPD Received			***F* (4, 138) = 4.89, *p* = .001**		***F* (4,138) = 6.50, *p* <.001**
0-5	58 (25.7%)	2.27(.73)		2.08 (.55)	
6-10	38 (16.8%)	2.49 (.88)		2.31 (.71)	
11-20	50 (22.1%)	2.96 (.70)		2.71 (.58)	
21-30	31 (13.7%)	2.70 (.80)		2.30 (.64)	
30+	49 (21.7%)	2.97 (.84)		2.71 (.66)	
Support from Professionals					
HSE Psychologist*	101 (27.4%)				
Occupational Therapist	192 (52%)				

Speech and Language Therapist	196 (53.1%)				
Behaviour Support Specialist	67 (18.2%)				
NEPS Psychologist*	186 (50.4%)				
CAMHS*	60 (16.3%)				
SESS*	76 (20.6%)				
NBSS*	11 (3%)				
Private Consultants	37 (10%)				
Other	9 (2.4%)				
Access to Supports per Year			**F (4, 202) = 7.34, p <.001**		**F (4, 202) = 8.40, p <.001**
0 times	84 (25.4%)	2.24 (.80)		2.03 (.65)	
1-2 times	193 (58.3%)	2.55 (.84)		2.36 (.68)	
3-4 times	39 (11.8%)	2.87 (.65)		2,64 (.63)	

5-6 times	11 (3.3%)	3.43 (.61)	2.99 (.47)
7+ times	4 (1.2%)	3.79 (.51)	3.39 (.57)

*HSE= Health Service Executive, NEPS= National Educational Psychological Service, CAMHS= Child and Adolescent Mental Health Services, SESS= Special Education Support Service, NBSS= National Behaviour Support Service

Post-hoc tests

Bonferroni post-hoc tests were conducted to further examine significant differences in knowledge and use of EBPs in the following variables: teacher position, years of experience, hours of ITE and CPD training, and number of times teachers had received support from professionals per year.

For teacher position, there were significant differences between MCTs (M= 2.31, SD= .75) and SETs knowledge of EBPs (M= 2.78, SD= .87; p=.014), and ASCTs knowledge of EBPs (M= 3.02, SD= .98; p=.001). ASCTs had highest knowledge of EBPs, followed by SETs, with MCTs having least knowledge. There were no other significant differences between teacher position in knowledge. For use of EBPs, there were significant differences between MCTs (M= 2.14, SD= .64) and SETs use of EBPs (M= 2.51, SD= .73; p=.03), and ASCTs use of EBPs (M= 2.80, SD= .70; p<.001). ASCTs had the highest use of EBPs, followed by SETs and MCTs had the lowest use of EBPs.

For years of experience, there were significant differences in knowledge between those with 1-3 years of experience (M= 2.31, SD= ,72) and those with 12-15 years of experience who reported higher knowledge (M= 3.09, SD= 1.03; p=.005). There were no other significant differences between groups based on experience. There was no significant difference in use based on experience.

There was a significant difference in knowledge between those who had 1-3 hours of training in autism in their ITE (M= 2.45, SD= .84) and those who had 9+ hours who had more knowledge (M= 3.32, SD= .59; p<.001). There was also significant differences in use based on autism training in ITE, between those with 1-3 hours (M= 2.16, SD= .70) and those with 9+ hours who used EBPs more frequently (M= 3.03, SD= .48; p<.001).

For CPD hours, those who had received 0-5 hours (*M*= 2.27, *SD*= .73) differed significantly to those who had received 11-20 hours (*M*= 2.96, *SD*= .70; *p*=.006), and those who had received 30+ hours (*M*= 2.97, *SD*= .84; *p*=.002). Those who had received more than 30 hours of CPD had highest knowledge, followed by those who had received 11-20 and those who had received 0-5 hours had least knowledge. The same held true for use of EBPs, with significant differences between those who had received 0-5 hours (*M*= 2.08, *SD*= .55) compared to 11-20 hours (*M*= 2.71, *SD*= .58; *p*=.001), and those who had received 30+ hours (*M*= 2.71, *SD*= .66; *p*<.001). Teachers who had received 30+ hours and 11-20 hours of CPD had the same mean use, and those who had received 0-5 hours had least use.

In relation to receiving support from professionals, there were significant differences in knowledge between those who had received no support (*M*= 2.24, *SD*= .80) and those who had received support 3-4 times per year (*M*= 2.87, *SD*= .65; *p*=.021), those who had received support 5-6 times per year (*M*= 3,43, *SD*= .61; *p*=.003), and those who had received support 7+ times per year (*M*= 3.79, *SD*= .51; *p*=.003). The data showed that those who received more hours of support had higher knowledge of EBPs, with those who had received no support having least knowledge of EBPs. There was also significant differences between those who had received support 1-2 times per year (*M*= 2.55, *SD*= .84) and those who had received support 7+ times per year who had higher knowledge (*M*= 3.79, *SD*= .51; *p*=.026).

For use of EBPs, there was significant differences in use between teachers who had received no support (*M*= 2.03, *SD*= .65) and those who received support 1-2 times per year (*M*= 2.36, *SD*= .68; *p*=.023), 3-4 times per year (*M*= ,2.64 *SD*= .63; *p*=.003), 5-6 times per year (*M*= 2.99, *SD*= .47; *p*=.004), and 7+ times per year (*M*= 3.39, *SD*= .57; *p*=.001). The lowest levels of use were in those who had received no support. Significant differences in use were also found between teachers who received support 1-2 times per year (*M*= 2.36, *SD*= .68) and 7+ times per year (*M*= 3.39, *SD*= .57; *p*=.025), who used EBPs more frequently.

Discussion

This paper addresses an important gap in our understanding of how knowledge and use of autism EBPs can be impacted in school settings. The findings suggest that more experienced teachers, teachers in small group classrooms (ASCTs), teachers who have more training and rate their training higher, and who receive more support from multi-disciplinary professionals have more knowledge of EBPs and employ them more frequently, which has implications for our understanding of autism EBP implementation in inclusive school settings.

In relation to autism practices, teachers in this sample had low levels of knowledge and use of EBPs. Teachers were most knowledgeable of traditional teaching methods which was categorised as an USP, and knowledgeable to some extent of seven EBPs, including; visual supports, social stories, exercise, modelling, prompting, reinforcement and social skills training. This is reflective of previous Irish research (Barry et al., 2020b; Finlay et al., 2019) in which teachers reported using visual supports widely with students with autism. Teachers reported very little knowledge of six EBPs, including functional communication training, discrete trial teaching, peer-mediated instruction, time delay, technology aided instruction, self-management, parent-implemented interventions, and video modelling, representing over one-fifth of all EBPs identified by Steinbrenner et al., (2020). Similar findings were obtained for teachers' use of EBPs, with teachers reporting relatively low use of both EBPs and USPs. Four EBPs (exercise, modelling, reinforcement and social stories) were used at least some of the time, with social stories being used most frequently. These findings add to the broader literature, and suggest differences across educational contexts in regards to EBP knowledge and use.

In comparison with other contexts, teachers in this sample had very low levels of knowledge and use of EBPs, giving some preliminary evidence for the differences in EBP use across countries and contexts. The teachers in this sample reported using four EBPs "some of the time", which was less than the seven EBPs reported in an Australian study using the same measure (Sulek et al., 2019). Furthermore, half of the teachers in this sample reported using only two EBPs daily, in comparison with a study from the USA where half of the teachers reported using seven EBPs daily (McNeill, 2019). There were also differences in knowledge and use found between teachers working in different settings. Those working in small group settings- ASCTs used EBPs most frequently, and MCTs who work in large group settings used EBPs least frequently. This is similar to McNeill's (2019) study which found that SETs in self-contained classrooms used EBPs most frequently and those in inclusive education settings used them least frequently, which highlights that there may be issues with the contextual fit of autism EBPs in mainstream/ inclusive education settings in particular. This may be because teachers in these settings have more competing demands such as larger groups of students to cater for and other issues like time constraints or non-specialist training (Barry et al., 2020a; McNeill, 2019). As systematic reviews of EBPs have identified that 99% of implementers are SETs, researchers or clinicians, this finding highlights the need for autism EBP research in MCTs (Steinbrenner et al., 2020).

In relation to other factors impacting EBP use, the data showed that knowledge of EBPs and use of EBPs were significantly associated, consistent with previous research in school settings and the broader EBP literature (Paynter et al., 2017; Sulek et al., 2019). This adds to the growing support for knowledge as a key factor impacting EBP use which may be contextually independent. Teachers' knowledge and use of EBPs also differed based on their training and rating of training, and so the low levels of knowledge and use of EBPs in this sample is perhaps reflective of the low levels of training reported by teachers. Over 65% of teachers report receiving less than 3 hours of autism-specific training in their ITE, with 36% of teachers reporting receiving no ITE or CPD training at all. Furthermore, 78% of teachers reported receiving no autism-specific CPD training post-graduation from their ITE before beginning to teach a child with autism, and 33% of teachers report receiving no additional CPD training at all. While these findings highlight how lack of preparation to implement EBPs impact on autism EBP use, it is also reflective of the broader literature which finds that teachers in general receive minimal preparation for educating students with special educational needs (Hick et al., 2018), and professional development programmes are often not impactful in developing teacher's skills (Fennell & Dillenburger, 2018). This may be due to the design of training for teachers, primarily consisting of stand-alone workshops on specific interventions or topics. Efforts may be better placed on developing teacher capacity to critique research and their ability to identify appropriate interventions which they can implement and intensify if necessary.

Children with autism present with complex educational, emotional, and behavioural challenges that require not only educational support, but input from members of a multi-disciplinary team (NCSE, 2016). This study also finds evidence to add to the importance of professional supports in aiding teachers to develop capacity for implementing EBPs with students with autism, as those who had received more support reported more frequent use of EBPs. However, the results of this study also suggest that teachers receive very little support from other professionals, with 80% of teachers receiving support from professionals two or less times per year, and a quarter of all teachers reporting no access to professionals at all. As supports are crucial in facilitating the implementation of EBPs (Barry et al., 2020a; NIRN, n.d.), the lack of support may further contribute to teachers low levels of knowledge and use of EBPs. Previous research has found systems of collaboration can exist within Irish schools (Barry et al., 2020b; Daly et al., 2016), and this collaboration represents an important area of practical peer support, which may help to develop teacher capacity in the absence of training and multi-disciplinary support. Previous research has demonstrated the positive effects of train-the-trainer models (Shire & Kasari, 2014), whereby there is a designated expert in schools who then facilitates the training and upskilling of other teachers. Exploring the utility of this type of peer-support and collaboration may be an avenue worth exploring in contexts where teachers struggle to access support.

Limitations

This study was a cross-sectional study, and due to bias of responding whereby those with a stronger interest in responding are possibly more likely to partake in research, there is potential for this sample to be negatively skewed. However, the sample had geographical spread, with participants from all 26 counties in the Republic of Ireland, and the findings are broadly in line with prior Irish research which has indicated poor training and knowledge in teachers (Anglim et al., 2018; Finlay et al., 2019). There was also high levels of missing data reported for the scale measuring knowledge and use of EBPs (Paynter & Keen, 2014), and so the results are reflective of a smaller number of teachers who completed both demographic and scale measures.

Implications

This study has underscored the importance of appropriate teacher training in the area of autism. The data provided from this analysis provides the reader with novel information of teachers' levels of training, their access to professional supports, and highlights how use and knowledge of EBPs can differ across teacher characteristics. This is an important addition to the literature, and broadens our understanding of the implementation of EBPs in an international educational context. This is the first study of its kind to examine teachers' EBP use in Ireland, and finds that while the education system provides guidelines for EBP use (NCSE, 2016), teachers educating students with autism lack knowledge of these practices and rarely use the majority of EBPs. This is reflective of issues of implementation in the wider field, with the scaling up of EBPs needing targeted implementation support in order to translate EBPs from guidelines and research into everyday sustained practice (Cook et al., 2009). It is clear from this study that teachers lack access to professionals who support them and lack appropriate training, both of which are significant gaps that need to be addressed in order to improve both teacher and student outcomes. Policy makers should concentrate on increasing the supports available to teachers and rolling out effective training that is targeted at MCTs, as these teachers access less training than all other teachers but are increasingly responsible for educating students with autism. If MCTs are required to provide education to students with autism in their classes, it is necessary that they are given appropriate and timely access to training to support them and their students.

Conclusion

This paper adds significantly to our understanding of how teachers' knowledge and use of autism EBPs can differ based on teacher characteristics. Overall, it would appear that Irish teachers receive little training in their ITE, and have differential access to CPD. Access to additional CPD in particular was identified as significant in the use of EBPs, and as many mainstream teachers will now have a child with autism included in their classroom, access to timely and appropriate CPD is a pressing need for these teachers. Teachers could also benefit from receiving mentoring or training from special education teachers, and as strong systems of collaborative practice appear to be a feature in Irish autism education (Barry et al., 2020b; Daly et al., 2016), these could be capitalised upon by schools and professionals to provide an effective, evidence-based approach to teaching students with autism.

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Chapter 5 **Study 4**

Mainstream Class Teachers Use of Evidence-Based Practices with Students with Autism: The role of Training, Knowledge, Attitudes and Barriers to EBP Use.

Abstract

Evidence-based practices (EBPs) for students with autism have poorly translated into classroom settings, leading to a research-to-practice gap. Inclusive education policies mean that increasing numbers of students with autism are educated in mainstream classrooms (MCs), and as such, it is necessary to identify factors that may impact mainstream class teachers' (MCTs) adoption of EBPs. This paper aimed to explore the impact of training, knowledge, attitudes and barriers to EBPs on MCTs' use of EBPs.

An online survey measuring teachers' training, knowledge, attitudes, barriers and attitudes towards EBPs was completed by 112 MCTs in the Republic of Ireland. The data revealed that teachers used EBPs infrequently, received little training before teaching students with autism, and experienced some serious barriers in implementing EBPs including class size and lack of time.

Pearson's product moment correlation analyses revealed that teacher training, knowledge of EBPs, openness to EBP use and appeal of EBPs were all associated with EBP use, however no tested barriers were associated with EBP use. Hierarchical Multiple Regressions revealed that no barriers were associated with EBP use when controlling for other variables, however, knowledge and openness to EBPs were strong predictors of EBP use.

This study found that knowledge of EBPs and openness to EBPs are key factors impacting the use of EBPs in MCTs. Limitations and implications of the findings are discussed in relation to promoting the use of EBPs in MCs.

Key words: evidence-based practices, implementation, general education, autism

Autism is a neurodevelopmental disorder which presents educational challenges for schools and teachers (Morewood et al., 2011). Global movements towards the inclusion of students with disabilities in inclusive education settings (Hehir, et al., 2016) means that in most developed countries, more than half of children with autism are educated in mainstream classes (MCs); (63% Ireland (NCSE, 2016); 73% Australia (Autism Awareness 2014); 57.6% USA (US Dept of Education, 2014). Due to the length of time students spend in school, mainstream class teachers (MCTs) are well placed to facilitate the development of a wide range of skills for students with autism (Koegel et al., 2012). However, students with autism can experience difficulties which require specialised interventions, including: understanding the social environment of school, making friends, understanding and communicating with teachers and peers, and exhibiting higher levels of challenging behaviour (Mazurek et al., 2013; Morewood et al., 2011). Therefore, developing teacher capacity to support students with autism is key, particularly considering teachers may experience negative outcomes such as lower self-efficacy (Anglim et al., 2018; Ruble et al., 2013) and higher levels of stress and burnout (Ouellette et al., 2019). To overcome some of the aforementioned difficulties for students and teachers, it is widely recommended (NCSE, 2016) and legislated for in some countries (U.S. Department of Education, 2008) that teachers use practices that are best-placed to improve outcomes across a wide range of skills, practices known as "evidence-based practices" (EBPs).

EBPs can be defined as "practices that are supported by a number of high quality studies that utilise research designs from which causality can be inferred and that demonstrate meaningful effects on student outcomes" (Cook & Cook, 2011 pg 3). Systematic reviews have identified up to 28 interventions that meet criteria for EBP status, with examples of these including token economies, prompting, reinforcement and task analysis (Steinbrenner et al., 2020). Research has found that teachers lack confidence in selecting and implementing EBPs (Brock et al., 2014), and the implementation of unsupported practices (USPs) has continued across early intervention (Paynter & Keen, 2015), allied health (Paynter et al., 2018: Robinson et al., 2018) and special education fields (Hess et al., 2008). Special education teachers have been found to regularly use USPs in the USA (Brock et al., 2020; Burns & Ysseldyke, 2009; Hess et al., 2008), Australia (Borders et al., 2015; Carter et al., 2011), and the Czech Republic (Carter et al., 2012), highlighting that despite the scientific credentials of EBPs, teachers face serious challenges in implementing these practices in their classrooms.

Bearing in mind that the majority of students with autism are now educated in MCs, there is a scarcity of research on autism EBPs conducted in these settings. For example, MCTs comprise less than 1% of intervention implementers of EBPs included in Steinbrenner and colleagues' (2020) systematic review, and less than 20% of interventions were conducted in groups of seven students or more. There is also a lack of data surrounding MCTs' use of EBPs, with only one other study that we could identify explicitly examining this cohort of teachers (Sulek et al., 2019). This research found that while MCTs were knowledgeable of most EBPs, they only implemented seven EBPs "some of the time", with the remainder of EBPs used rarely or never.

The failed adoption of EBPs into school settings is reflective of broader issues within the educational literature, identifying a research-to-practice gap. Key to overcoming this gap is identifying determinants of implementation, which can act as barriers or facilitators to the adoption of autism EBPs in school settings (Barry et al., 2020a). Schools are typically complex in nature due to the many competing demands which can be placed on teachers (Barry et al., 2020a; Kasari & Smith, 2013), and teachers are likely to experience barriers and facilitators that interact across multiple levels, e.g. broader policies, school support systems, and teacher characteristics (Dingfelder & Mandell, 2011; Domitrovich et al., 2008). Lack of knowledge of autism and EBPs has been identified as a key concern, with previous research finding that school professionals such as administrators, special education teachers (SETs) and MCTs demonstrate a lack of knowledge of autism (Barry et al., 2020b; Segall & Campbell, 2012) and EBPs (Barry et al., 2021; Sulek et al., 2019). Lack of knowledge is also tied to issues with training, as teachers perceive that they are ill-prepared to support students with autism, and that their initial teacher education (ITE) training and continuous professional development (CPD) is inadequate (Barry et al., 2020b; Finlay et al., 2019; Hsiao & Sorensen Petersen, 2019; Morrier et al., 2011). However, knowledge of EBPs alone does not increase teachers' implementation. A study from North Carolina indicated that most SETs were aware of all EBPs, however, many used them infrequently (McNeill, 2019). Predictors of use from this study included a caseload comprising more students with autism, and a perception that the practice was feasible, acceptable and aligned well with the environment. This highlights the potential for the "fit" of the intervention with the context as a central factor.

Research has also shown that the use of EBPs can be further impacted by teacher attitudes (Paynter & Keen, 2015; Sulek et al., 2019). Attitudes towards EBPs are examined in relation to the EBPs' appeal, teachers' willingness to use the EBP, teachers' openness towards new practices and also the amount that the EBP diverges from the norm (Stahmer & Aarons, 2009). A study examining early intervention (EI) providers found more experienced EI providers perceived less divergence between their current practice and EBPs, indicating that they had higher usage of EBPs (Stahmer & Aarons, 2009). This was supported by Paynter et al. (2017) who identified that EI providers' use of EBPs was linked to willingness to use the EBP if required, and also openness to using EBPs. Another study by Locke et al. (2019) identified that SETs and support staff who perceived discrete trial teaching to be high in divergence (different from the norm) were less likely to use this EBP, whereas staff who perceived that the EBP was higher in appeal were more likely to use it. While it would appear that there is some support for education staff's attitudes towards EBPs as an important implementation factor, this has yet to be examined in mainstream settings.

Considering the proportion of students with autism now being educated in MCs (NCSE, 2016), it is important that we identify factors that may help or hinder the MCTs' adoption of autism EBPs. Factors previously identified as impacting on the use of EBPs include knowledge of EBPs, attitudes towards EBPs, and broader barriers such as time, resources and principal/administrator characteristics; however, their impact on autism EBP use in MCs is undetermined. Therefore this study aims to answer the following research questions:

(1) To explore MCT training, teacher knowledge and use of EBPs, attitudes to EBPs and barriers to EBP use.
(2) To examine the impact of teacher training, teacher knowledge, attitudes to EBPs and barriers to EBPs on EBP use.

Method

Study Design

The study employed an observational cross-sectional design, and is reported following the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) observational studies reporting guidelines (Von Elm et al., 2014). The STROBE checklist is available in Appendix F.

Participants and procedure

The sample consisted of MCTs from the Republic of Ireland. This sample was derived from a larger study which contained 369 participants that included both MCTs and SETs (please see Barry et al., 2021 for more information). As we were interested in MCTs in particular, these data were isolated and analysed. The survey was fully completed by 112 MCTs. Participants ranged in age from 20 to over 60, and included 15 male teachers and 96 female teachers. Over 60% of teachers had taught 5 or less students with autism, and 47% of teachers had 3 or less years of experience teaching students with autism. The majority of teachers (41%) had achieved a Postgraduate Certificate or Diploma. The race/ethnicity of teachers was not collected. Please find more detailed participant information in Table 5.1.

Table 5.1.

Participant demographics

Characteristic	Number (%)
Gender	
Male	15 (13.4%)
Female	96 (85.7%)
Missing	1 (0.9%)
Age Range	
20-25	11 (9.8%)
26-30	18 (16.1%)
31-35	23 (20.5%)
36-40	26 (23.2%)

41-45	16 (14.3%)
46-50	4 (3.6 %)
51-55	6 (5.4%)
56-60	5 (4.5%)
60+	3 (2.7 %)
Years' Experience Teaching Students with Autism	
Less than 1	11 (9.8%)
1-3 years	42 (37.5%)
4-7 years	25 (22.3%)
8-11 years	16 (14.3%)
12-15 years	8 (7.1%)
16-20 years	6 (5.4%)
21+ years	3 (2.7%)
Missing	1 (0.9%)
Level of Education	
Bachelors	44 (39.3%)
Professional Master of Education	8 (7.1%)
Masters	13 (11.6%)
Postgraduate Certificate/Diploma	46 (41.1%)
PhD	0
Missing	1 (0.9%)

Survey data were collected anonymously using the survey provider Qualtrics (please find the survey attached in Appendix E). Participants were invited to participate online through social media channels, and by emailing mainstream national school principals using the Department of Education's directory of primary schools which resulted in 3,105 principals being contacted. The survey was available to teachers between February and May 2020. Teachers were eligible for inclusion in this study if (a) they taught in a mainstream primary school, (b) if they had experience teaching children with autism and (c) if they identified as a MCT. This study received ethical approval from the Education and Health Sciences Research Ethics Committee (EHSREC). All participants gave informed consent prior to participation.

Measures

The online survey included questions which measured participant demographics such as their gender, age range, teaching position, teaching experience and school information, and scales to measure knowledge and use of EBPs, attitudes towards EBPs and perceived barriers to implementing EBPs. The survey took approximately 12 minutes to complete.

Teacher Training

Teacher training was measured across both ITE and CPD. Teachers chose the number of hours of ITE and CPD received from a fixed choice scale. Teachers also rated their perceptions of the extent of their ITE and CPD training on a scale from 1 (not at all trained) to 10 (very well trained).

Knowledge and Use of EBPs

Teacher's knowledge and use of EBPs was measured using the *Early Intervention Practices Scale* (Paynter & Keen, 2015). This scale requires participants to rate their knowledge (1= very little, 2= to a slight extent 3= to a moderate extent, 4= to a great extent, 5= to a very great extent), and use of interventions (1= never, 2= on rare occasions, 3= sometimes, 4= often, 5= frequently) on a five-point Likert scale. The original scale included 40 items, however, this was modified following consultation with community stakeholders (see Barry et al., 2021) and this resulted in the inclusion of 37 interventions, 27 of which were EBPs and 10 of which were unsupported practices.

This scale has good internal validity and has been used previously in research with educators of children with autism in early intervention settings (Sulek et al, 2019; Cronbach's α for knowledge of EBPs= 0.94, Cronbach's α for use of EBPs=0.90). The reliability and validity of this questionnaire in this study remained high following the changes made, with Cronbach's α in the knowledge subscale=.97, and in the use subscale= .94.

Attitudes to EBPs

Teachers' attitudes to EBPs was assessed using the *Evidence Based Practice Attitudes Scale (EBPAS)* (Aarons, 2004). The EBPAS is a brief 15-item measure that assesses attitudes towards evidence-based practice use across four subscales: appeal, requirements, openness and divergence. The appeal scale assesses the teachers' willingness to adopt an EBP based on its appeal and if it were recommended by a colleague. The requirements scale assesses the teachers' willingness to adopt an EBP if it was a requirement by the school or state. The openness scale assesses the teachers' general openness to trying new interventions. Lastly, the divergence scale looks at the teachers' beliefs about EBPs not being as useful as teaching experience. These scales are then scored and a total scale score represents a teacher's overall attitude towards using EBPs. Some language adjustments were made from the original scale based on feedback from community stakeholders to suit the Irish context, for example "it was a new policy required by the Department of Education?", with internal reliability remaining high, Cronbach's α= .81.

Barriers to EBP Use

The barriers teachers face when implementing EBPs was assessed using the *Barriers to Behavioural Interventions Scale* (McGoey et al., 2014). This survey was developed to measure specific barriers that participants experienced when implementing behavioral interventions in the classroom. The survey consists of 19 items that address potential barriers such as lack of training, lack of time, lack of materials, and beliefs about support from others, comfort level with students with behavior problems and efficacy of the intervention. Items are rated on a 6-point scale ranging from 1 (not a problem) to 6 (extremely serious barrier). Some minor adjustments were made to the language in the scale to reflect the Irish school context. and we added an extra question "support staff lacking training" as the pilot of the instrument revealed that support staff in the classroom (special needs assistants) may lack training in autism/interventions and this could be a barrier to the teacher being able to implement things effectively. The survey was found to be a reliable scale, with a Cronbach's α= .93.

Community Involvement

As part of the community involvement for this study, two teachers were invited and completed user experience testing to inform the development of the survey. The two teachers completed the questionnaires and provided feedback on the measures and aesthetics of the survey. This feedback was then incorporated into the survey and changes were made accordingly.

Data Availability and Analysis

The data that supports the findings of this study are openly available in Zenodo (Barry et al., 2020c). To achieve the first aim of the research, descriptive statistics were analysed to identify teacher's levels of training, their knowledge and use of EBPs, attitudes towards EBPs and their ratings of barriers to use. Secondly, Pearson's product moment correlations were conducted to assess the association between use of EBPs, and (1) training variables, (2) knowledge of EBPs, (3) attitudes towards EBPs, and (4) barriers to use. Following this, hierarchical multiple regressions (HMR) were conducted to analyse predictors of EBP use from the factors which had been significantly correlated in the previous analysis. In the first HMR, CPD hours, ITE rating, CPD rating, knowledge of EBPs, openness to EBPs and EBP appeal were entered into step 1, and all barriers from the *Barriers to Behavioural Interventions Scale* were entered into step 2. A second HMR was conducted to examine if knowledge of EBPs remained predictive when controlling for openness to EBP use, and a third HMR was conducted to examine if openness to EBP use remained predictive when controlling for knowledge of EBPs.

As knowledge of EBPs and openness to EBPs were independent predictors of the use of EBPs, these were explored further in sensitivity analyses. Pearson's correlations were conducted on the association between knowledge of EBPs, openness to EBPs, training and barriers to use.

Results

Data Screening and Analysis

Data were downloaded from Qualtrics for analysis in IBM SPSS Statistics for Windows, Version 26. Prior to analysis, data were screened for outliers using visual analysis of boxplots and no data were omitted. Data were screened for missing values before analysis, and it was identified that 95 GE teachers had not completed the scale measures so these participants' data were excluded from the dataset and a final sample of 112 participants was analysed. Missing values were further screened, data were missing at the item level from 0%-42%. Little's MCAR test was non-significant indicating that data were missing completely at random, χ^2 (329) =305.21, p =.823, thus listwise deletion for missing cases was used.

Teacher Training

Descriptive statistics related to teacher training are presented in Table 5.2. Overall, 39% of teachers had received no autism training in their ITE, while 41% of teachers had received no CPD. Additionally, teachers received more CPD training with 26% receiving "a lot" of CPD training in comparison with only 7% of teachers receiving "a lot" of ITE training. Teachers rated the extent of their ITE training poorly (M = 2.68, SD = 1.70), but rated the extent of their CPD as somewhat trained (M = 5.91, SD = 1.89).

Table 5.2.

Training received by mainstream class teachers.

Training	**Score**
ITE Hours	
None (0 hours) (*n*, %)	40, 39%
Some (1-8 hours) (*n*, %)	56, 54%
A lot (9+ hours) (*n*, %)	7, 7%
ITE Rating (*M, SD*)	2.68, 1.70
CPD Hours	
None (0 hours) (*n*, %)	45, 41%
Some (1-10 hours) (*n*, %)	36, 33%
A lot (10+ hours) (*n*, %)	29, 26%
CPD Rating (*M, SD*)	5.91, 1.89

Knowledge and Use of EBPs

Teacher's mean knowledge and use of practices and the percentage of teachers using practices daily are displayed in Table 5.3. Teachers were most knowledgeable of traditional teaching methods which was a USP, and indicated that they were somewhat knowledgeable of sensory rooms (USP) and five EBPs- visual supports, social stories, reinforcement, exercise and social skills interventions. Teachers reported using traditional teaching methods (USP) most frequently, and a further three practices which were EBPs- social stories, exercise, and reinforcement some of the time. Teachers were least knowledgeable of discrete trial training, an EBP, and used this the least. Two practices were used by more than 50% of teachers daily, these included reinforcement and social stories.

Table 5.3.

Overview of teachers' knowledge and use of practices.

Practice	**EBP Status**	**Knowledge**	**Use**	
		M (SD)	***M (SD)***	**% Daily**
Antecedent Interventions	EBP	2.26 (1.26)	2.12 (1.29)	21.2
ABA	US	2.01 (1.07)	1.71 (.98)	9.3
CBI	EBP	2.73 (1.09)	2.51(1.19)	23.8
Developmental Interventions	US	1.68 (.96)	2.51 (1.19)	23.8
DRI/A/O	EBP	1.63 (.93)	1.61 (.95)	8.3
DTT	EBP	1.31 (.70)	1.28 (.70)	5.7
Exercise	EBP	**3.11 (1.13)**	**3.22 (1.28)**	43.5
Extinction	EBP	1.46 (.86)	1.39 (.83)	4.2
Facilitated Communication	US	1.88 (1.08)	1.86 (1.18)	12.5
Functional Behaviour Assessment	EBP	1.87 (1.16)	1.72 (1.08)	11.4
Functional Communication	EBP	1.63 (1.02)	1.55 (.93)	8.9
Intensive Interaction	US	1.78 (1.15)	1.82 (1.13)	13
Modelling	EBP	2.88 (1.37)	2.92 (1.34)	40.9
Music Therapy	EBP	2.04 (1.05)	1.84 (1.03)	10.4
Naturalistic Interventions	EBP	1.58 (.98)	1.59 (.97)	9.3
Peer Mediated Interventions	EBP	2.08 (1.17)	2.05 (1.14)	13
PECs	EBP	2.66 (1.17)	2.20 (1.15)	21.2
Play Therapy	US	2.49 (1.12)	1.96 (1.03)	9.3

Prompting	EBP	2.79 (1.18)	2.75 (1.23)	36.3
Reinforcement	EBP	**3.22 (1.11)**	**3.20 (1.24)**	50.8
Response Interruption	EBP	2.69 (1.31)	2.63 (1.30)	32.2
Scripting	EBP	2.05 (1.18)	1.90 (1.09)	10.8
Self-Management	EBP	2.27 (1.16)	2.17 (1.12)	18.6
Sensory Integration	EBP	2.64 (1.28)	2.56 (1.27)	33.7
Sensory Rooms	US	**3.17 (1.33)**	2.95 (1.42)	44
Sign Language	US	1.89 (1.20)	1.51 (.97)	10.3
Social Stories	EBP	**3.48 (1.09)**	**3.37 (1.21)**	51.8
Social Skills	EBP	**3.08 (1.24)**	2.82 (1.36)	27.3
Structured Play groups	EBP	2.92 (1.30)	2.84 (1.39)	33.2
Speech and Language Therapy	US	2.41 (1.31)	2.14 (1.27)	27.4
Task Analysis	EBP	1.93 (1.12)	1.79 (1.10)	15.5
Technology	EBP	2.39 (1.20)	2.26 (1.22)	19.7
TEACCH	US	1.91 (1.17)	1.65 (.99)	17.6
Time Delay	EBP	1.86 (1.09)	1.80 (1.15)	16.1
Traditional Teaching	US	**3.91 (1.29)**	**3.51 (1.33)**	47.7
Video Modelling	EBP	2.03 (1.19)	1.75 (1.04)	15.5
Visual Supports	EBP	**3.79 (1.16)**	2.15 (1.23)	23.8

* ABA= Applied Behaviour Analysis, CBI= Cognitive Behavioural Interventions, DRI/A/O= Differential Reinforcement of Incompatible/Alternative/Other Behaviour, DTT= Discrete Trial Teaching, PECS= Picture Exchange Communication System, TEACCH= Treatment and Education of Autistic and related Communications Handicapped Children.

** Bolded scores indicate scores above 3, "somewhat knowledgeable" and use "some of the time"

Attitudes towards EBPs

Teachers' scores on the EBPAS subscales are displayed in Table 5.4. Teachers' scores indicated that they would be willing to implement an EBP based on its appeal and if it was recommended by colleagues, and that they would be open to trying new interventions. Teachers scored low on the requirements scale and highly on divergence, indicating that they would be less likely to adopt an EBP if it was a requirement by the state or policy, and they would be less likely to adopt an EBP if they believed it was not useful.

Table 5.4.

Teacher scores on the EBPAS subscales

EBPAS Subscale	***M (SD)***
Appeal	16.13 (3.29)
Openness	15.24 (3.37)
Divergence	16.13 (3.29)
Requirements	10.40 (2.60)

Barriers to EBP use

Teachers' mean ratings and percentage of teachers rating a barrier as a serious barrier are presented in Table 5.5. Teachers' mean scores placed five items as a serious barrier (score of 4 or above); class size, lack of training in interventions, lack of time to implement interventions, lack of time to research interventions, and lack of time to devise interventions. The most serious barrier was class size, which was rated as a serious barrier by 61% of GE teachers. Over 40% of teachers rated lack of training in interventions, lack of time to implement interventions, lack of time to research interventions, lack of time to devise interventions, support staff lacking training and lack of training in autism as serious barriers. The least serious barriers were lack of principal support, comfort in working with children with autism, and thinking the intervention will not work.

Table 5.5.

Teachers' ratings of barriers and percentage of sample rating as a 'serious' barrier.

Barrier	***M (SD)***	**% rate as serious barrier**
Class Size	4.58 (1.56)	61
Lack training in interventions	4.26 (1.41)	44.6
Lack of time to implement interventions	4.21 (1.44)	46.4
Lack of time to research interventions	4.08 (1.41)	47.3
Lack of time to devise interventions	4.02 (1.40)	44.6
Support staff lacking training	3.91 (1.63)	42.9
Lack of access to support professionals	3.77 (1.61)	36.6
Lack training in autism	3.95 (1.62)	41.1
Lack materials	3.62 (1.65)	33.9
Demand to perform non-teaching duties	3.71 (1.60)	23.9
Lack training in research procedures	3.39 (1.57)	28.6
Inability to follow regular classroom instruction	3.25 (1.55)	25
Autism Severity	3.21 (1.42)	22.3
Lack time to identify needs	3.11 (1.38)	20.5
Lack training in reading research	3.05 (1.59)	23.2
Lack of communication with parents	2.59 (1.53)	14.3

Ineffectiveness of previous interventions	2.57 (1.35)	10.7
Think the intervention will not work	2.21 (1.44)	8.0
Comfort in working with autism	2.25 (1.49)	12.5
Lack of principal support	2.03 (1.53)	11.6

Associations between Training and EBP Use

The results for the associations between training and EBP use are presented in Table 5.6. EBP use was positively correlated with teachers' ratings with their ITE training and CPD training, and positively correlated with the number of CPD hours received. This indicates that higher ratings of training and more hours of CPD training are associated with more frequent use of EBPs.

Table 5.6.

Associations between teacher training and use of EBPs.

	EBP Use	ITE Hours	ITE Rating	CPD Hours
ITE Hours	.17			
ITE Rating	.32*	.61**		
CPD Hours	.28*	-.13	.06	
CPD Rating	.58**	.11	.34*	.30*

*= p<.05, **= p<.001

Association between Knowledge of EBPs and Use of EBPs.

There was a significant, strong and positive correlation between knowledge of EBPs and the use of EBPs $r = .89$, $p < .001$, indicating that higher knowledge of EBPs was associated with higher use of EBPs.

Associations between Attitudes towards EBPs and Use of EBPs

EBP use was significantly positively correlated with openness to EBPs and appeal of EBPs, indicating that those who were more open to EBPs used them more frequently, and the greater appeal of the practice is associated with increased use of EBPs (please see Table 5.7).

Table 5.7.

Correlations between EBP use and EBPAS subscales

	EBP Use	Openness	Divergence	Appeal
Openness	.53**			
Divergence	-.07	-.10		
Appeal	.25**	.58**	-.04	
Requirements	.06	.36**	-.09	.64**

*= p<.05, **= p<.001

Associations between Barriers and Use of EBPs

No barriers were significantly associated with EBP use (Table 5.8), indicating that teachers' use of EBPs was not impacted by the barriers that teachers experienced.

Table 5.8.

Correlations between use of EBPs and Barriers to Behavioural Interventions items

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.
1. Use of EBPs	-																				
2. Lack of principal support	.17	-																			
3. Lack of Time to Devise Interventions	.05	.36**	-																		
4. Lack Time to Research Interventions.	.02	.27**	.88**	-																	
5. Lack of Training on Interventions	-.11	.26**	.69**	.76**	-																

6. Ineffectiveness of Previous Interventions	-.12	.08	.45**	.49**	.49**	-					
7. Lack of Materials	-.10	.19*	.52**	.54**	.48**	.57**	-				
8. Lack of Time to Implement Interventions	.08	.25**	.69**	.64**	.65**	.52**	.68**	-			
9. Demand to Perform Non-Teaching Duties	-.10	.19*	.45**	.49**	.49**	.44**	.51**	.52**	-		
10. Lack of Communication with Parents	.10	.46**	.28**	.19*	.23*	.31**	.43**	.41**	.37**	-	
11. Lack Training in Autism	-.11	.09	.40**	.47**	.70**	.34**	.43**	.51**	.53**	.37**	-

12. Comfort Working with Autism	-.03	.17	.14	.08	.25**	.25**	.22*	.34**	.31**	.39**	.41**	-						
13. Lack Support Profess.	.04	.29**	.45**	.44**	.54**	.41**	.44**	53**	.37**	.37**	.46**	.32**	-					
14. Think Intervention Won't Work	.06	.27**	.12	.16	.14.	.29**	.19*	.24*	.23*	.50**	.24*	.44**	.24*	-				
15. Lack Time Identify Needs	.04	.29**	.42**	.38**	.36**	.35**	.33**	.48**	.42**	.48**	.39**	.40**	.38**	.47**	-			
16. Level Autism Symptoms	.04	.14	.24*	.24*	.33**	.34**	.30**	.32**	.34**	.36**	.43**	.40**	.42**	.24**	.36**	-		
17. Lack Training Research Procedures	-.10	-.02	.39**	.39**	.41**	.27**	.44**	.35**	.41**	.38**	.59**	.18	.27**	.18	.44**	.48**	-	
18. Lack Training Reading Research	-.14	-.06	.33**	.38**	.42**	.25**	.37**	.31**	.41**	.28**	.58**	.24*	.25*	.14	.38**	.47**	.83**	-

19. Inability Regular Instruction	.03	.21*	.35**	.34**	.34**	.39**	.32**	.36**	.51**	.60**	.42**	.36**	.41**	.39**	.47**	.61**	.47**	.49**	-		
20. Class size	-.02	.22*	.42**	.45**	.47**	.38**	.36**	.46**	.39**	.40**	.46**	.24**	.30**	.28**	.36**	.33**	.28**	.26**	.56**	-	
21. Support staff lack training	.12	.31*	.53**	.52**	.54**	.36**	.48**	.52**	.41**	.49**	.50**	.26**	.42**	.33**	.45**	.34**	.47**	.42**	.46**	.51**	-

Impact of Training, Knowledge, Attitudes and Barriers on EBP use

As no barriers were significantly correlated with EBP use, a Hierarchical Multiple (HM) regression was conducted to examine if any barriers to EBPs were predictive of use of EBPs when controlling for training, knowledge of EBPs and attitudes to EBPs. In step 1, CPD hours, ITE rating, CPD rating, knowledge of EBPs, openness to EBPs and EBP appeal were entered. In step 2, all items from the Barriers to Behavioural Interventions scale were entered into the model. The results are displayed in Table 5.9.

Table 5.9.

Predictors of EBP use with 95% confidence intervals reported in parentheses

	b	SE B	Beta	R^2	*p*
Step 1				.86	<.001
Constant	.07 [-.37; .52]	.22			.74
Rating of ITE	.01 [-.03; .05]	.02	.02		.76
CPD Hours	-.03 [-.17; .10]	.07	-.03		.62
CPD Rating	.02 [-.03; .06]	.02	.05		.47
Knowledge of EBPs	.68 [.54; .81]	.07	.78		**<.001**
Openness to EBPs	.04 [.01; .06]	.01	.23		**.01**
Appeal of EBPs	-.01 [-.04; .02]	.01	-.04		.53
Step 2				.91	.70
Constant	.06 [-.82; .95]	.43			.89
Rating of ITE	.00 [-.06; .06]	.03	.00		.99
CPD Hours	-.10 [-.29; .10]	.10	-.08		.33
CPD Rating	.02 [-.05; .08]	.03	.06		.58

Knowledge of EBPs	.67 [.46; .88]	.10	.78	**<.001**
Openness to EBPs	.03 [-.01; .07]	.02	.17	.13
Appeal of EBPs	-.01 [-.06; .03]	.02	-.07	.55
Lack Principal Support	-.00 [-.10; .09]	.05	-.01	.95
Lack Time Devise Inter.	.19 [-.08; .46]	.13	.40	.17
Lack Time Research Int.	-.04 [-.23; .14]	.09	-.11	.64
Lack Training Interventions	-.06 [-.19; .07]	.06	-.14	.36
Ineffectiveness Previous Inter.	.06 [-.03; .15]	.04	.12	.19
Lack of Materials	-.03 [-.11; .04]	.04	-.10	.37
Lack Time Implement	-.05 [-.22; .12]	.08	-.13	.54
Demand Non-Teaching	-.01 [-.08; .06]	.04	-.03	.76
Lack Communication Parents	.00 [-.10; .10]	.05	.00	.98
Lack Training Autism	-.00 [-.09; .09]	.05	-.00	.99
Comfort Working Autism	.00 [-.08; .08]	.04	.00	.99
Lack Support Professionals	.05 [-.02; .12]	.04	.14	.18
Think Intervention Won't Work	.03 [-.06; .12]	.04	.08	.47
Lack Time Identify Students Needs	-.01 [-.10; .07]	.04	-.03	.73
Level Autism Symptoms	.01 [-.09; .11]	.05	.03	.84

Lack Training Research Procedures	-.09 [-.22; .05]	.07	-.24	.19
Lack Training Reading Research	.07 [-.05; .19]	.06	.20	.23
Inability Regular Instruction	-.03 [-.13; .08]	.05	-.08	.59
Class Size	-.01 [-.09; .07]	.04	-.03	.75
Support Staff Lack Training	.05 [-.03; .14]	.04	.13	.22

In step 1, CPD hours, ITE rating, CPD rating, knowledge of EBPs, openness to EBPs and EBP appeal were significantly predictive of EBP use, R^2= .86, Adjusted R^2= .84, F (6, 47) = 47.77, p <.001. At step 2, all barriers were entered into the model, however this equation was not significant, R^2= .91, Adjusted R^2= .83, F(20, 27)= 0.80, p= .695, indicating that barriers to EBPs were not predictive of EBP use.

Model one indicated that only knowledge of EBPs, B= 0.78, p<.001, 95% CI [.54; .81] and openness to EBPs, B= -.26, p= .005, 95% CI [.01; .06] were significantly predictive of use of EBPs.

Another HM regression was conducted to examine if openness to EBPs remained predictive when controlling for knowledge. The regression revealed that openness to EBPs was significantly predictive of use of EBPs independent of knowledge of EBPs, R^2= .81, Adjusted R^2 = .81, F (1,109) = 12.06, p = .001, with knowledge of EBPs accounting for 79% of the variance in this model, R^2 = .79, Adjusted R^2 = .79, F (1,110) = 406.53, p <.001.

Lastly, a HM regression was conducted to examine if knowledge of EBPs remained predictive of use of EBPs when controlling for openness to EBPs. Both models were significantly predictive of use of EBPs, with openness to EBPs accounting for 28% of the variance R^2 = .28, Adjusted R^2= .27, F (1, 110) = 42.30, p <.001. Knowledge of EBPs was independently predictive of an additional 53% of variance in use of EBPs in the sample, R^2= .81, Adjusted R^2= .81, F (1,109) = 301.56, p <.001. These results suggest that openness to EBPs and knowledge of EBPs are key predictors of EBP use and are predictive independent of each other.

Sensitivity Analysis

As knowledge and openness to EBPs were key predictors of the use of EBPs, these were explored further in post-hoc analyses to examine if training or barriers had an impact on these factors. Knowledge was significantly correlated with the number of CPD hours received, r =.32, p = .019, teachers ratings of ITE, r = .34, p =.014, and ratings of CPD, r =.58, p <.001. This indicated that higher number of hours of CPD, higher ratings of ITE training and CPD training were associated with higher knowledge of EBPs. Openness to EBPs was significantly associated with knowledge of EBPs, r = .45, p <.001, indicating that higher knowledge was associated with more open attitudes to EBPs.

The association between barriers and knowledge of EBPs was also examined. Three barriers were significantly correlated with knowledge of EBPs- lack of training in children with autism, r = -.20, p = .035; lack of training in research procedures, r = -.19, p =.041; and lack of training in reading research, r = -.28, p =.003. These results indicated that less knowledge of EBPs is associated with less autism training, less training in reading research and less training in research procedures. Only satisfaction ratings with CPD were significantly associated with openness to EBPs, r = .29, p =.034. One barrier was significantly negatively correlated with openness to EBPs- the ineffectiveness of previous interventions, r =-.20, p =.031.

Discussion

Given the importance of identifying factors which impact EBP adoption in school settings, this study significantly furthers our understanding of factors which can help or hinder MCT's implementation of EBPs. Teachers in this sample rated a number of barriers as extremely serious, including class size, lack of training in interventions and autism, lack of time to implement, research and devise interventions, and having support staff who lack training. Furthermore, this study also identified factors that were associated with EBP use, including training, knowledge and attitudes towards EBPs, with openness to using EBPs and knowledge of EBPs being identified as predictive of EBP use. Interestingly, despite the serious barriers experienced by teachers, no barriers were associated with use of EBPs, or predictive of the use of EBPs. These findings advance our understanding of factors that impact MCTs adoption of EBPs and provide novel insights into the research-to-practice gap in autism education.

This study provides important insights into factors which may be key in increasing uptake of autism EBPs in school settings, which are important considering the low levels of use found in this and previous studies examining MCTs. We found that teachers reported using only three EBPs “some of the time”, reflecting research conducted by Sulek et al. (2019) who found teachers used seven EBPs “some of the time”. This demonstrates that MCTs are not implementing the vast majority of the 28 EBPs identified by Steinbrenner and colleagues (2020) on a regular basis. Some preliminary reasons for this were identified in this study. Knowledge was identified as the key predictor of EBP use in this sample, supporting previous research examining MCTs use (Sulek et al., 2019), SETs use (McNeill, 2019) and EI practitioners’ use (Paynter et al., 2017). Knowledge was associated with training, and considering that high numbers of teachers reported receiving very little training, the low levels of knowledge are somewhat explained by this. Knowledge in this study was also associated with teachers’ self-reported satisfaction with their training, adding to our understanding of the importance of socially valid and stakeholder-endorsed training programmes which has recently been emphasised in the literature (Callahan et al., 2017.

Evidence was also found for the association between attitudes and EBP use, and this was the first study to demonstrate this in mainstream, inclusive education settings. This supports previous research which found a link between attitudes and EBP use in autism early intervention settings and community mental health settings (Paynter et al., 2017; Stahmer & Aarons, 2009), adding to our understanding of the impact of this factor. While the appeal of the EBP and openness to using EBPs were correlated with EBP use, openness to EBPs was the only attitudinal factor to remain predictive when added into the model. Developing teachers' openness to using EBPs may therefore be a key factor in overcoming the research-to-practice gap. Post-hoc analyses identified that openness was associated with training and knowledge, highlighting again the importance of effective training to build knowledge. Openness was also negatively associated with teachers' ratings of the ineffectiveness of previous interventions, indicating that if teachers perceive that previous interventions have failed, they may be less open to using EBPs. The association between the appeal of the EBP and use of EBPs is reflective of broader literature suggesting that the "fit" and social validity of EBPs for the classroom is an important facilitator of implementation (Barry et al., 2020a; McNeill, 2019; Sulek et al., 2019), and reflects the importance of adapting and making EBPs appropriate for larger group settings where teachers experience many competing demands (McNeill, 2019).

This research highlights many barriers faced by MCTs which may need to be overcome in order to upscale EBP use in inclusive education settings. While statistical analyses found that no EBPs were associated with EBP use, this could be because the low levels of knowledge in the sample obscured some of these associations. For example, previous research has also identified that class size, lack of time, and lack of training are barriers experienced by teachers and which can impact on their use of EBPs (Barry et al., 2020a; Barry et al., 2021; McNeill, 2019; Sulek et al., 2019). Thus, in samples where knowledge is higher, other barriers may then be more salient and impact the use of EBPs. As this was the first study to use this measure to examine quantitatively if use and ratings of barriers were associated, the association between knowledge, use of EBPs and barriers needs to be further explored in contexts where knowledge is higher, and teachers receive higher levels of training. These findings suggest that increasing teacher knowledge may be the first step in increasing implementation of these practices.

Limitations

While the present research has provided novel insights into factors that impact EBP use, and in particular MCTs' use of EBPs, some limitations should be considered. The sample is a convenience sample and it is possible that data may differ if a representative sample had been obtained so findings should be interpreted with caution. In addition the data were cross-sectional and as such causal inferences as to the impact of factors on EBP use cannot be ascertained. Furthermore, response rates could not be calculated due to the data collection method, and so it is not possible to rule out response bias.

Another limitation is that teachers' knowledge and use of EBPs was measured using self-report of a fixed number of choices, and there is the potential that the choices offered do not represent all practices that teachers may use. Furthermore, as individuals tend to self-report favourably, observational data may provide more objective measurements of the EBPs teachers use. The included EBPs were derived from the Early Intervention Practices Scale (Paynter & Keen, 2015), however, since the launch of this measure, some previously unsupported practices have been identified as EBPs using the most recently available evidence (Steinbrenner et al., 2020). While this didn't affect the reliability of the scale, it might impact on the comparability of the findings of this study with previous findings.

Conclusion

This study enhances our understanding of key factors impacting MCTs' use of autism EBPs, such as training, knowledge of EBPs and openness towards EBPs, and provides insights into MCTs' use of these practices. Knowledge of EBPs and openness to EBPs were identified as key factors impacting MCTs' use of EBPs, and despite previous research suggesting that barriers such as teacher and school characteristics impact EBP use, no barriers were associated with EBP use in this sample. It appears from these findings that MCTs did not have access to appropriate levels of training and knowledge of EBPs, and in turn, employ EBPs infrequently when educating students with autism. This has important implications for the education of students with autism, and suggests that training programs (including CPD) should be made immediately available to teachers if we are to improve the uptake and implementation of autism EBPs and provide the best opportunity for students with autism to thrive and succeed at school.

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Chapter 6 **Study 5**

Establishing the feasibility of the Evidence-Based Practices for Autism, Implementation in Mainstream schools (EBP-AIM) Toolkit: A Protocol

Abstract

Establishing the effective implementation of evidence-based practices (EBPs) in classroom settings with students with autism continues to be an important step in overcoming the research-to-practice gap in autism education. Previous research has demonstrated that Irish teachers lack knowledge of EBPs and as knowledge of EBPs is associated with use of EBPs, accessing effective and appropriate training to increase teachers' knowledge of EBPs is an important first-step in scaling up EBP use. However, research suggests that increasing knowledge is unlikely to significantly impact EBP use without other implementation strategies and supports. This protocol aims to outline the development and feasibility testing of the Evidence-Based Practices for Autism Implementation in Mainstream school (EBP-AIM) Toolkit for teachers, and the implementation strategies which will be used to assess its efficacy and feasibility.

Supporting the translation of evidence-based practices into applied settings has become a key focus of autism education research. Up to 28 evidence-based practices (EBPs) for students with autism have been identified, which have been found to improve outcomes across a range of social, communicative and adaptive skills (Steinbrenner et al., 2020). Yet research has found that these EBPs are poorly adopted outside of clinical or 1:1 settings, or they are adopted alongside unsupported practices (USPs) which can diminish the efficacy of the EBPs (Dingfelder & Mandell, 2011; Paynter et al., 2019). This research-to-practice gap persists in the face of policy guidance and legislation for EBP use (NICE, 2013; NCSE, 2016; US Dept of Education, 2008), meaning that teachers continue to use a mix of USPs and EBPs when teaching students with autism (Brock et al., 2019; McNeill, 2019; Sulek et al., 2019).

In trying to characterise this research-to-practice gap, researchers have used implementation science to explore multi-level barriers and facilitators to EBP implementation (Barry et al., 2020a; Domitrovich et al., 2008; Fixsen et al., 2013). Implementation science is defined as the scientific study of factors to promote the uptake of EBPs (Eccles & Mittman, 2006), and identifying determinants of implementation or implementation drivers is a key strategy in understanding the adoption of EBPs (NIRN, n.d.). Factors that help or hinder implementation have been identified across macro, school and individual levels, including factors such as policy support, access to multi-disciplinary teams, principal and administrative support, staff and resources, and teacher and intervention characteristics (Barry et al, 2020a), demonstrating the complexity of supporting the implementation of EBPs in school settings. Of concern for understanding the research-to-practice gap and building sustained implementation of EBPs is the lack of research conducted in mainstream or general education school settings where the majority of students with autism are now educated (NCSE, 2016). The most recent systematic review of EBPs conducted by Steinbrenner et al.

(2020) found that in the included studies for EBPs, 80% of the studies were conducted in individual settings (i.e. one-to-one), with only 5.5% being conducted in groups of 7 or above, and 20% of the implementers in the studies were educators (with 0.9% being general education teachers). Taken together, these data demonstrate that by majority, EBP research has been conducted in 1:1 sessions, with researchers or therapists as intervention implementers, and as such, issues with adoption in educational settings where general education teachers are teaching in classrooms with upwards of 25 students are unlikely to be identified by intervention developers.

These findings have been further explored by Watkins and colleagues (2019) who conducted a meta-analysis which aimed to identify EBPs in inclusive education settings. This research further highlighted the lack of EBP research in classroom settings, with only 43% of the studies conducted with those in the students' natural environment as implementers. So while these studies were conducted in inclusive education settings, researchers were the implementers for over half of these studies meaning that teacher implementation factors are potentially under-explored. Interestingly, this meta-analysis also identified that in studies where teachers or school staff implemented interventions, student outcomes were significantly better than other implementers, suggesting that teachers in inclusive classrooms can implement EBPs sufficiently and increase positive outcomes for students with autism. The authors also reflected the need for teacher involvement in developing interventions, and the need for developing teacher-informed training programmes (Watkins et al., 2019). This supports previous calls in the literature for stakeholder involvement in the development of autism interventions and training (Gulberg, 2017).

This meta-analysis also drew attention to the need for research to address social validity in a more thorough manner (Watkins et al., 2019), echoed by others suggesting poor social validity considerations in autism education research (Callahan et al., 2017; McNeill, 2019). One way of addressing the above concerns is to use implementation science frameworks as a basis for analysing implementation and developing feasible, context appropriate interventions (Watkins et al., 2019). One approach, the Active Implementation Frameworks (AIF) (NIRN, n.d.) has previously applied to examining implementation of autism interventions (Odom et al., 2014; Odom et al., 2020). These frameworks posit that implementation occurs across four distinct Implementation Stages: exploration, installation, initial implementation and sustained implementation (NIRN, n.d.). In the exploration stage, it is important to identify extant levels of knowledge and preparation for the installation of interventions, and to identify potential barriers and facilitators that may occur in the installation of interventions. Below we will describe the data identified in the exploration of EBPs in Ireland, and outline a feasibility protocol to fit within the broader Implementation Stages model to begin to scale up EBP use.

The context

In Ireland, as in much of Europe, teachers adopt an eclectic teaching style when educating students with autism (Keenan et al., 2015; McMahon & Cullinan, 2016), meaning that teachers employ a mix of practices drawn from a variety of philosophical underpinnings. Teachers receive varying levels of special education training in their initial teacher education (ITE) programmes, (Barry et al., 2021a; Barry et al., 2021b; McCoy et al., 2014), and therefore emerge from their ITE experiences with a varied and limited understanding of special educational needs (SEN) (Hick et al., 2018), and in particular autism EBPs (Barry et al, 2020b; Barry et al., 2021a; Barry et al., 2021b). Teachers can also avail of a variety of continuous professional development (CPD) programmes, from a number of different sources, including school in-service days, department-led CPD programmes through the Special Education Support Service (SESS) or National Council for Special Education

(NCSE), while also being able to avail of training offered from private providers (Fennell & Dillenburger, 2018). This results in some teachers receiving a mixed variety and quality of training, meaning that mainstream teachers can feel ill-prepared to support these students, and encounter significant stress in trying to teach students with autism effectively (Anglim et al., 2018; Barry et al. 2020b; Mahony, 2016).

To address the gaps in our understanding of EBP use in mainstream schools in Ireland, Barry and colleagues (2020b; 2021a; 2021b) conducted a series of studies to examine Irish teachers' use of EBPs, and barriers and facilitators that impact teachers' adoption of EBPs. A qualitative study on the perspectives of Irish teachers' use of EBPs found that Irish teachers lacked knowledge and training in EBPs (Barry et al., 2020b). Of their training, only one out of the 14 teachers had received autism-specific training before beginning to teach a child with autism. Teachers felt that the current model of CPD available to them was not appropriate for their needs, with teachers describing having to wait long periods of time for training, or accessing training during the summer which meant that the retention of information from the workshops was compromised. Teachers reported that they turned to colleagues for support, and also used the internet to research strategies to use with their students with autism. Teachers also reported completing much work outside of school hours, and the time constraints that they experienced in school impeded on their ability to effectively plan and implement interventions with their students with autism. Also of note from this study was that teachers did not perceive a culture of EBP use in Ireland, with the majority of teachers unfamiliar with the term, unaware of what EBPs were, and that EBP use was not something emphasised in the educational culture.

Following this, teachers were surveyed to assess their extant levels of knowledge and use of EBPs, and to examine if there were differences in knowledge and use across teacher characteristics (Barry et al., 2021a). This study found that overall, Irish teachers had poor knowledge of EBPs and used them infrequently, with the majority of EBPs being used less than once per week. There were significant differences in EBP knowledge and use across teacher position, teacher experience, teacher training and support from multi-disciplinary professionals. Least knowledge and use of EBPs was rated by: mainstream class teachers (MCTs); teachers with less than 3 years of experience or more than 21 years of experience; teachers who had not received any training in autism; and teachers who had no access to support professionals. The very low levels of knowledge and use of EBPs reported by MCTs in particular highlights the need for developing training for MCTs.

Lastly, another study examined predictors of EBP use in mainstream class teachers in more detail (Barry et al., 2021b). In this study, training, knowledge of EBPs, attitudes to EBPs and barriers to EBP use were examined as potential predictors. Teachers rated many barriers as serious or extremely serious including class size, lack of time to research interventions, and lack of training on interventions, however, none of these barriers were significantly associated with, or predictive of EBP use. Knowledge of EBPs and openness to EBP use were the only significant predictors in this study, highlighting the importance of teacher knowledge in the use of EBPs, and also teacher attitudes towards EBPs.

Teacher Training

As teachers in the above studies reported low levels of training, knowledge and use of EBPs, developing effective EBP resources and training that increases teacher knowledge and use of EBPs is a pressing contextual need. Embedding implementation science within the testing of the effectiveness of interventions is one recommended method to overcome this poor sustainment and builds on ensuring interventions are feasible and socially valid as outlined above (NIRN, n.d.). This protocol aims to outline a multi-phase study which will use the implementation strategies identified in the Active Implementation Frameworks (AIF; NIRN, n.d) as a basis for scaling up EBP use in mainstream schools in Ireland.

Method

The development and feasibility testing of the EBP-AIM Toolkit for Teachers will be conducted across two phases, as outlined in Figure 6.1. These phases are embedded within the Active Implementation Frameworks (AIF) (NIRN, n.d), and in particular within the Implementation Stages framework. The study will include implementation strategies to assess Implementation Drivers and Usable Innovations, will develop Implementation Teams, and conduct Improvement Cycles as outlined in the AIF. An iterative, mixed-methods, hybrid implementation design will be employed to explore these constructs, as has been used before in research in this area (Beamish et al., 2021; Curran et al., 2012; Pellechia et al., 2020).

Figure 6.1.

Phases included in the EBP-AIM Toolkit for Teachers' development.

Phase 1 **Exploration**	**Phase 2** **Installation**
Key Objectives: Form community and expert advisory groups Identify & develop resources for inclusion in the Toolkit	Key Objectives: Test efficacy of toolkit Test feasibility of toolkit
Implementation Strategies: Identify usable innovations Develop implementation teams Assess feasibility and fit	Implementation Strategies: Improvement cycles Installation phase

Phase 1: Creating an implementation team to inform the development of the EBP-AIM Toolkit for Teachers.

The purpose of this first phase is to develop a Review Team which will inform the development of the EBP-AIM Toolkit for Teachers. In the AIF Implementation Teams are crucial to identify feasible and appropriate "Usable Innovations", to identify potential barriers and facilitators to implementation, and to determine the need for new practices, and the Review Team in this first phase will mirror this purpose, (Cook et al., 2019; NIRN, n.d).

While we have identified in previous studies that teachers lack knowledge of EBPs and need training and supports, it is important to gain community insights into teachers' specific needs and "what works" (Barry et al., 2021a; 2021b; Guldberg, 2017). This is especially important given the lack of school-based autism-specific EBP research present in the literature as outlined above. The aims of the first phase is to conduct the following Exploration activities (NIRN, n.d.): (1) develop Implementation Teams, (2) identify needs and (3) identify resources for inclusion in the EBP-AIM Toolkit.

Participants

We will recruit stakeholders from multiple levels in the autism and education field to form a community-partnered Review/Implementation Team. The following stakeholders will be invited for participation: (1) school principals, (2) special education teachers, (3) mainstream class teachers, (4) parents of students with autism and (5) adults with a diagnosis of autism. Recruitment will occur through social media and through contacting mainstream primary schools directly via email. We aim to recruit up to 10 participants in Phase 1.

Components of the Toolkit and Procedure

It is envisaged that the toolkit will be an online resource, and be hosted on a website (Beamish et al., 2021) or online platform such as Microsoft Teams (Alcorn et al., 2021). As this project will be co-designed with community partners, it is not possible to determine what resources will definitively make up the toolkit, however, based on the findings of our research we propose developing a number of core modules or topics, specifically targeting the following areas: (1) autism and school, (2) theories of EBPs, (3) evaluating EBPs, (4) EBPs for autism, and (5) how to assess what EBPs to use and if they are working. These core areas have been proposed due to the findings of the programme of research as outlined in the introduction, and address issues such as the educational culture of EBPs, knowledge of EBPs and autism, and developing teacher capacity around research literacy and EBP identification.

The materials for inclusion in the modules will be identified through systematic searches and reviewed for suitability by the research team prior to Phase 1, and novel materials or workshops may also be developed. We propose that the toolkit can also draw together a number of resources. For example, the AFIRM modules (Sam et al., 2019) have demonstrated efficacy in increasing teachers' knowledge of EBPs, and so these may be included within the content area examining "EBPs for autism". Best practice classroom guidelines for autism developed by researchers such as those developed by Charman et al. (2011) may also be included under "autism and school". Furthermore, policy guidelines around the continuum of support may be included to make the toolkit socially valid and allow it to mirror and fit within existing structures in the Irish education system (DES, 2017).

The EBPs to be included in the toolkit will be drawn from a recent meta-analysis of the efficacy of EBPs in inclusive settings (Watkins et al., 2019). These EBPs had the largest reported effect sizes for positive outcomes, and so have the greatest established evidence for use in inclusive education settings. These EBPs are as follows: function-based interventions, visual supports, self-monitoring, peer-mediated interventions, prompting, modelling and reinforcement.

Procedure

Firstly, a manual will be developed to guide participants' understanding of the requirements of participating, outlining the design cycles, and the core areas which will be covered. This will ensure that all participants are aware of the requirements of the research and it will also outline elements such as how they will interact with the online platform, the feedback and feasibility forms, and contact details of all of the researchers as well.

Design cycles (Alcorn et al., 2021) will be used to develop each module. The design cycle will be based upon Action Learning, and will consist of four key steps which broadly map onto the “Plan, Act, Reflect, Review” process of action learning (Revans, 2011). These steps are outlined below, and similar design cycles have been used in the creation of novel modules for education settings previously (Alcorn et al., 2021).

Step 1: The researchers prepare materials and content for all of the participants to review. The researchers will upload these files to Microsoft Teams to be reviewed by the participants two weeks in advance of a planned focus group meeting.

Step 2: The participants will spend two weeks prior to the focus group engaging with the materials and content. They will actively review the materials by reflecting on their experience with the content (this can be written reflections/spoken reflections or otherwise depending on the participants preferred method of communication). Two days prior to the focus group, the participants will be asked to complete feasibility measures on the content included within the module and process of using them, using the Acceptability of Intervention (AIM), Intervention Appropriateness Measure (IAM) and Feasibility of Intervention Measure (FIM) (Weiner et al., 2017). The participants will be asked to upload these feasibility scores and their reflections on the content to the Microsoft Teams site two days prior to the focus group meeting.

Step 3: The researchers will review and collate data on participants’ thoughts about the content of the module and the process of completing it. This will draw together the overarching themes and commonalities between participants’ views on the module. The purpose of this is to identify topics for discussion at the focus group and has previously been identified as a useful strategy in developing these types of modules (Alcorn et al., 2021).

Step 4: Focus groups will be conducted with all participants to discuss the key themes emerging from participants' completed reflections and feasibility measures. The focus groups will vary in length depending on the depth of discussion needed. Key objectives for the focus groups is to discuss with participants relevant changes to be made to the content of each module, and to gain agreement on materials and additional resources for inclusion.

Following the focus groups, the researchers will make the agreed upon recommended changes to the module. The finalised module will then be re-uploaded to the Microsoft Teams site for final review by the participants. If any disagreements in content arise at this point, the design cycle can be re-started, or individual perspectives may be taken in to account through a one-to-one review. The design cycles will be completed for all five modules.

Phase 2: Initial Installation- Testing of the Toolkit

The purpose of this phase is to examine if the EBP-AIM Toolkit is effective at increasing teacher's knowledge and use of EBPs, and if it is feasible and acceptable for teachers who use it. We will use a mixed methods-design to examine this in line with previous research (Beamish et al., 2021), and efficacy and feasibility will be evaluated in tandem as outlined in hybrid models of implementation (Curran et al., 2012)

Participants & Setting

As previous research has suggested (Beamish et al., 2021), it may be ethically inappropriate to implement an untested intervention with a large group of teachers, and so similar to their study, we will use a small sample size to identify initial efficacy, and allow for rich perspectives to inform improvement cycles that may be needed (NIRN, n.d). As used by Barry et al., (2021c; 2021d), all mainstream primary schools will be canvassed by email offering participation in the study. Principals will be provided with information about the study, such as the purposes of the research, the structure of the online EBP-AIM Toolkit, and the study requirements such as in-class observations and in-class support for some teachers. If principals are interested in participating, they can then identify teachers who may be suitable for inclusion, and contact the research team to lodge their interest.

The study aims to recruit a minimum of 40 teachers (Beamish et al., 2021). Interested teachers will be provided with an information booklet to outline the procedure and minimum eligibility requirements for participation. Teachers who agree to participate will be required to complete informed consent forms. As in-class observations and support may be necessary, principal informed consent will also be required/

Procedure

The intervention will run for 8 weeks based on previous studies evaluating the implementation of models of practice (Beamish et al., 2021). Teachers will be given access to the EBP-AIM Toolkit (modules and/or online platform depending on the outcomes of Phase 1), and asked to independently engage with the five modules. To determine the level and type of support needed to affect teachers' use of EBPs, we will test this across three groups employing differing levels of support as in previous research: (a) 2x2hr online support, (b) 2x2hr in person support, and (c) no support (Beamish et al., 2021). This is being done to test if the EBP-AIM Toolkit is effective in isolation, or if implementation support has an impact on frequency of use.

Pre-Intervention.

Teacher Characteristics. Demographic information will be collected on the participants prior to beginning using a short demographic questionnaire. Teachers will be asked to provide data on their gender, age range, education level, teaching position, years' experience working with students with autism, and previous training they have received.

Use of EBPs. The Evidence-Based Practice Classroom Observation Measure (EBP-COM; Paff et al., 2019) will be used to measure teachers' use of EBPs. Teachers' use of EBPs will be measured by a direct observation of the teacher in the classroom. This will be conducted by the research team, and inter-rater reliability will be conducted on 40% of all observations, as in the original study (Paff et al., 2019). This is a partial-interval recording time sampling measure, whereby observers collect data on teacher use of 12 EBPs within a 4 minute interval. If the teacher is observed to use an EBP within the 4 minute time period, they circle a "+" sign on the page to indicate the teacher has used it. The teachers are observed over 40 minutes, with ten 4-minute intervals being examined within this 40 minute period. This measure was developed and tested for feasibility in classrooms prior to finalisation of the measure. The final version of the tool demonstrated high inter-rater reliability and sensitivity to change, and was assessed in classroom environments which are highly similar to the ones being measured in this study.

Knowledge of EBPs. Teachers' knowledge of EBPs will be measured using the knowledge subscale of the Early Intervention Practices Scale (Paynter & Keen, 2015). This is a measure designed to measure teachers' ratings of their knowledge of EBPs on a scale of 1 (very little knowledge) to 5 (a great extent of knowledge). Teachers self-report their knowledge on 37 practices, 10 of which are non-EBPs and 27 of which are EBPs. These have previously been used by the research team (Barry et al., 2021a; 2021b) and have high reliability (Cronbach's Alpha= .94)

Pre-intervention Interview. An interview guide will be developed containing questions related to the teachers' initial perceptions of the EBP-AIM toolkit, and assess their confidence and self-efficacy in working with students with autism and employing EBPs.

Intervention

During the intervention phase the teachers will be instructed to engage with the EBP-AIM Toolkit online platform for 8 weeks, and complete all modules contained within. The teachers will be provided with support on three levels (a) 2x2 hour face-to-face support, (b) 2x2 hour online support, and (c) no support, as used previously by Beamish et al (2021). This support will be provided to teachers in week 2 and week 5 of the intervention.

Post Intervention.

Use of EBPs. After the intervention has finished teachers will again be observed using the EBP-COM to determine their frequency of use of EBPs after using the toolkit.

Knowledge of EBPs. Knowledge of EBPs will be assessed again using the Early Intervention Practices scale (Paynter & Keen, 2015).

Feasibility. Feasibility and acceptability of the EBP-AIM toolkit, and also the EBPs which teachers have used will be assessed using the Acceptability of Intervention (AIM), Intervention Appropriateness Measure (IAM) and Feasibility of Intervention Measure (FIM) (Weiner et al., 2017). These are reliable scales which measure the validity of an intervention. Each scale consists of four items, scored on a likert scale from 1- "completely disagree" to 5- "completely agree". The AIM measure includes items such as "(intervention) meets my approval" and "I like (intervention)". The IAM measure includes items such as "(intervention) seems suitable" and "(intervention) seems like a good match". The FIM measure includes items such as "(intervention) seems implementable" and "(intervention) seems easy to use.

Post-intervention Interview. A post-intervention interview guide will be developed to examine teachers' perceptions of the utility of the toolkit, and the contextual fit of the toolkit. Teachers will also be asked if the toolkit was socially valid, would fit within the educational culture in Ireland, and would be suitable for roll out on a larger scale. Lastly, teachers will be asked to share their perspectives on the barriers and facilitators they experienced when using the toolkit, and any amendments that could be made to improve usability and efficacy.

Data screening and analysis

All quantitative data will be analysed using SPSS software. Data will first be screened for outliers and normality in SPSS. Changes in teacher knowledge of EBPs following use of the toolkit will be assessed using paired t-tests to test for differences in EBP knowledge pre and post-test.

The feasibility of the Toolkit, and also the feasibility of each EBP used will be measured using descriptive analyses of the subscales of the AIM, IAM and FIM. The differences in use of EBPs between pre and post classroom observations will be assessed using visual analysis. One-way Analysis of Variance (ANOVAs) will be used to explore differences in EBP use across teacher demographics such as teacher position and years of experience.

Lastly, qualitative data collected during pre and post-intervention interviews will be analysed using Thematic Analysis (Braun & Clark, 2006). Data will be transcribed, entered into an NVivo file and analysed by two separate coders following the six step process outlined by Braun and Clark (2006).

Discussion

Overcoming the research-to-practice gap in autism education is a pressing issue, and one of the key components in increasing teacher's use of EBPs appears to be increasing knowledge of EBPs through quality training. Recent research in Ireland has highlighted a troublesome disparity in access to teacher training, and raised questions about the quality of training available to teachers. This paper aimed to outline the protocol for a toolkit for increasing teachers' knowledge and use of EBPs for autism, and aimed to overcome gaps in the literature by including stakeholder perspectives in the use of innovations to ensure contextual fit and feasibility (Watkins et al., 2019). This study therefore aimed to embed feasibility testing alongside efficacy testing (also called a hybrid model of implementation) to ensure the fit of this toolkit with the needs of Irish teachers. This builds on previous findings by the authors which found that teachers struggle to access timely and appropriate CPD (Barry et al., 2020b; 2021a; 2021b), and findings which suggested that increasing teacher knowledge appears to be a crucial first step in scaling up use of EBPs in Irish contexts. The use of a toolkit or blueprint for practice has previously been identified as efficacious in developing teacher capacity for EBPs in other countries (Beamish et al., 2021), and embedding the feasibility aspect within the study will ensure the contextual fit of the toolkit. However, as previous research has demonstrated (Barry et al., 2020a) the uptake and sustained implementation of EBPs in school contexts is a complex and multi-faceted process, and increasing teacher knowledge is unlikely to lead to sustained implementation as a stand-alone intervention. We therefore proposed other implementation strategies that align with the AIF to enhance the feasibility of implementation for the toolkit in a systematic manner. Employing these strategies which are rooted in implementation science will enhance our understanding of key determinants of implementation (Cook et al., 2019) and will enable us to modify and adapt strategies based on contextual needs. Further research will be needed to scale-up testing on the EBP-AIM Toolkit on a wider scale, however, this protocol outlines important first steps in addressing the key gaps in teacher training in autism EBPs identified in previous studies.

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Chapter 7 **Discussion**

Overview

A summary of the findings of this thesis will be presented in this chapter, along with a discussion of the findings in relation to the theoretical framework and relevant literature. Following this, a discussion of the applied implications, and implications for future research will be discussed.

Integrated Summary of Studies

Taking together all of the evidence collected through the studies conducted in this thesis, the research achieved it's aims as set out in Chapter 1 of identifying (a) extant levels of knowledge and use of EBPs, (b) extant levels of training, (c) identifying barriers and facilitators to implementation, and (d) identifying factors which impact EBP use. The findings of this programme of research make a significant contribution to understanding barriers and facilitators at play in the research-to-practice gap in schools in Ireland and the broader literature.

With regard to teachers' levels of knowledge and use of EBPs in Ireland, it is evident from the findings of Chapters 3 through 5 that teachers have low levels of knowledge and use of EBPs. This was evident in Chapter 3 through teachers' qualitative responses that they "weren't sure" of what EBPs were, and supported further in Chapter 4 with teachers only "moderately" knowledgeable of 7 EBPs, and used only 4 EBPs "some of the time". In Chapter 5, mainstream class teachers (MCTs) reported moderate knowledge of 6 EBPs and only used 3 EBPs some of the time. Given that 28 EBPs for autism exist (Steinbrenner et al., 2020), these findings demonstrate a significant gap in Irish teachers' knowledge and use of EBPs to support students with autism in inclusive education settings.

These low levels of knowledge and use are perhaps reflective of another key finding of the thesis, which demonstrated a gap in developing teacher capacity for educating students with autism. In relation to training, 13 out of 14 teachers in Chapter 3 reported receiving no autism training before beginning to teach a student with autism, and teachers perceived many issues with their access to appropriate CPD. This was further demonstrated in Chapter 4, with one third of teachers receiving no autism specific CPD training, and in Chapter 5, where 40% of mainstream class teachers received no autism CPD. Results from both studies also suggested very little training in ITE. This highlights a concerning lack of availability of teacher training in autism and EBPs.

A key objective of this programme of research was to identify barriers and facilitators which were specific to the implementation of autism EBPs in school settings, and factors which impacted implementation. Barriers and facilitators were identified through conducting a scoping review of the extant literature, and through qualitative and quantitative analyses completed in Chapters 3 through 5. Key barriers and facilitators identified are presented below in Table 7.1. With regards to factors which impact implementation, in Chapter 4, teacher position, access to support professionals, knowledge, training and years of experience impacted the use of EBPs. Further analysis in Chapter 5 found that mainstream class teachers' use of EBPs was associated with knowledge, attitudes to EBPs (appeal and openness), and training, with knowledge identified as the key predictor of use in this study. These findings largely fit within the broader literature as identified in Chapter 2, and add to our understanding of the mechanisms at play. In particular, Chapter 5 made an important addition to understanding of the adoption of EBPs, as low knowledge levels may have impacted the salience of other factors impacting implementation.

Table 7.1.

Integrated summary of implementation factors identified through studies.

Level	Chapter 2	Chapter 3	Chapter 4	Chapter 5
Macro	Cultural differences	Culture of EBPs	Multi-disciplinary support	
	Lack of access to Multi-Disciplinary teams	Multi-disciplinary supports		
	School budgets			
	Lack of consistency of use across settings and providers			
School	Lack of resources	Leadership	Class Type	Class size
	Lack of time	Collaboration		Time
	Lack of awareness of the intervention	Parent support		
	Staffing	Lack of time		
	Lack of school personnel support	Lack of resources		
	Leadership prioritisation of competing demands	Class sizes		
	School Policies			

	Large classes			
	Supervisor lacking training			
	Cost of implementation			
Individual	Lack of training/ experience	Training	Training	Training
	Competing demands	Knowledge	Years' experience	Knowledge
	Difficult to implement	Buy-in		
	Restrictions placed by intervention	Fear of change		
	Difficult to implement in group settings	Positive student outcomes		
	Staff buy-in and resistance to change			
	Hesitation to be observed			
	Student characteristics			
	Lack of alignment with curriculum			

Overall, the findings from this thesis strengthen and extend our understanding of the factors which can help or hinder implementation of autism EBPs in school settings, and support some previous findings. These findings have important theoretical and practical implications which will be discussed below.

Theoretical Implications

This thesis provides a number of important theoretical insights under implementation science. The findings support the broader implementation science literature, which posits that "letting it happen" (i.e., implementation will occur simply because EBPs have been identified) is an ineffective implementation tactic (Cook & Odom, 2013). Policy guidance exists in Ireland for teachers to use EBPs (DES, 2017; NCSE, 2016), yet teachers reported low levels of knowledge and use, suggesting that that policy guidance alone (i.e. letting it happen) is ineffective at fostering teachers' use of EBPs. By applying the AIF theoretical framework to the studies (NIRN, n.d.), and applying an implementation strategy such as assessing readiness (Cook et al., 2019), a contemporary overview of autism EBP use in Ireland was provided. This supports the use of these strategies and frameworks as a basis for analysing implementation in contexts where EBP use is undetermined.

In terms of assessing readiness for implementation, it would appear that the teachers in our studies remain ill-prepared to implement EBPs, and experience some significant barriers to implementing EBPs, as outlined in Table 7.1 above. Working within the "exploration stage" of the AIF and employing an implementation strategy of "assessing readiness" to identify barriers and facilitators allowed identification of key drivers of implementation (Cook et al., 2019; NIRN, n.d.). This adds to the overall understanding of implementation drivers, with key competency-based and organisational-based barriers and facilitators identified (NIRN, n.d.). As identified in Chapter 5, knowledge appears to be a key "implementation driver" in this context, indicating that to upscale EBP use in Ireland, emphasis needs to be placed on developing teacher knowledge of EBPs (NIRN, n.d.). Teachers also identified other barriers throughout the studies, and previous research has found that knowledge alone is not enough to ensure sustained implementation of autism EBPs in school settings (McNeill, 2019). Therefore, it is proposed that increasing teacher knowledge of EBPs may be the first step necessary to building implementation, and inbuilt implementation assessments can then identify other barriers which become salient as knowledge increases. A blueprint for advancing the implementation of EBPs in mainstream classes in Ireland is provided in Chapter 6, which is embedded within the findings from this thesis and from the broader implementation science field. This protocol has the potential to develop teacher capacity in implementing autism EBPs.

The findings also significantly add to our understanding of how educational culture and contexts impact implementation. When comparing with similar studies in the USA and Australia, it is clear that Irish teachers have comparatively low levels of use of EBPs (Knight et al., 2018; Hamrick et al., 2021; Sulek et al., 2019; McNeill et al., 2019). A comparison with these other school-based studies examining teachers' use of autism EBPs is provided below in Table 7.2.

Table 7.2.

Comparison of EBP knowledge and use across studies in the literature.

Reference	Country	Teacher Type	EBP rated as moderate knowledge	EBP rated as "sometimes" used	Number of EBPs rated as used daily by over 50% of teachers
Sulek et al. (2018)	Australia	Mainstream Class Teachers (MCTs)	6 EBPs (visual supports, modelling, reinforcement, prompting, RIRD, exercise)	7 EBPs (visual supports, modelling, reinforcement, prompting, RIRD, exercise, differential reinforcement)	
McNeill (2019)	USA (North Carolina)	Special Education Teachers (SETs)			7 EBPs (reinforcement, prompting, modelling, visual supports, social skills

					training, RIRD, self-management)
Knight et al., (2018)	USA (Tennessee)	SETs & MCTs			2 EBPs (modelling, environmental arrangements)
Hamrick et al., (2021)	USA (Texas)	SETs & MCTs			13 EBPs (differential reinforcement, DTT, exercise, FCT, modelling, PECs, prompting, reinforcement, RIRD, self-management, technology, time delay, visual supports).
Chapter 4	Ireland	SETs & MCTs	7 EBPs (visual supports, social skills training, social stories,	4 EBPs (exercise, modelling, reinforcement, social stories)	2 EBPs (reinforcement, Social stories/narratives)

			reinforcement, prompting, modelling, exercise)		
Chapter 5	Ireland	MCTs	6 EBPs (exercise, reinforcement, social stories, social skills training, structured play groups, visual supports)	3 EBPs (exercise, reinforcement, social stories/ narratives)	2 EBPs (social stories/narratives, reinforcement)

The above table demonstrates Irish teachers used lower numbers of EBPs than all other studies bar Knight and colleagues (2018). Their sample consisted of teachers educating students with autism and/or intellectual disabilities unlike all other studies which examined autism alone, and this may account for this finding. Interestingly, there were also some differences in EBP use across US states (Knight et al., 2018; Hamrick, et al., 2021; McNeill, 2019), highlighting the variability of EBP use within countries also. Educational culture was also identified as a barrier to implementation in the scoping review (Chapter 2) and these findings provide early evidence for the importance of considering different educational contexts and cultures when examining autism EBP implementation.

The finding that Irish teachers have lower levels of use in comparison with Australia and the USA is somewhat unsurprising, given the findings of Chapter 3 in which teachers reported that “EBPs weren’t a big thing in Ireland”, and the eclectic approach which is evident in Ireland differs from mandated use of EBPs in the USA (Keenan et al., 2015). The lack of alignment in philosophy may be because the Department of Education and Skills (DES) in Ireland has repeatedly iterated its stance that no one approach or intervention for autism is favoured (DES, 2017; NCSE, 2016). However, decades of research have demonstrated the effectiveness of Applied Behaviour Analysis (ABA)-based interventions (Hall, 2017), and the evidence that has been gathered by the NCSE on behalf of the DES also acknowledges the efficacy of many ABA-based interventions (peer-mediated interventions, social skills interventions, behavioural interventions to reduce challenging behaviour; NCSE, 2016). The lack of recognition therefore for ABA-based interventions is reflective of a long-standing mis-interpretation of ABA as a rigid intervention rather than a basic science (Dillenburger, 2011), and this misinterpretation is common across European educational contexts (Keenan et al., 2015). Thus, the lack of alignment between the philosophy adopted by the DES and that underlying most EBPs (ABA) may contribute to the lack of adoption of these EBPs. This provides some preliminary evidence that underpinning philosophical approaches of the school setting and context may be an important implementation driver, and that aligning the broader educational philosophies with the practice may be a necessary organisational driver which needs to be addressed in Ireland (Domitrovich et al., 2008; NIRN, n.d.).

Of further theoretical concern is the suitability or "fit" of EBPs within inclusive education settings, which may also impact EBP implementation. The literature has demonstrated that the efficacy of many autism EBPs has been established in tightly controlled, 1:1 settings and researchers have previously proposed that this in itself would cause issues in the transferability of EBPs (Guldberg, 2017; Kasari & Smith, 2013). The findings of this programme of research support this theoretical viewpoint in a number of ways. The findings from the scoping review suggest that lack of alignment with the curriculum and the fit of the intervention with the context were barriers to implementation. Further to this, in Chapter 5, 23.9% of teachers reported "demand to perform non-teaching duties" as a serious barrier, highlighting that interventions may be seen as an "add-on" rather than as core components of effective teaching. This supports previous research which found that social validity was linked with increased use of EBPs (McNeill, 2019; Sulek et al., 2019), and highlights the importance of establishing efficacy of EBPs in the settings where they will ultimately be employed.

Further evidence for the lack of fit of EBPs within inclusive large group classroom settings was identified in Chapter 4, where highest use of EBPs was reported by autism special class teachers (ASCTs), who teach in small group settings. This has also been found in a previous study (McNeill, 2019), who found that teachers in small group, self-contained classrooms reported higher use of EBPs than teachers in inclusive education settings. As teachers of students with larger groups typically experience barriers related to class size (Chapter 5) and more competing demands (Chapter 2; Chapter 5; McNeill, 2019), they may find it more difficult to adopt interventions which are not feasible for large group implementation. As only 5.5% of studies included in the most recent systematic review of EBPs (Steinbrenner et al., 2020) were conducted in groups of 7 or more, the lack of fit with the classroom setting is perhaps not surprising.

On that note, important movements have been made recently to understand the research-base for EBPs in school settings. Watkins et al. (2019) conducted a meta-analysis specifically on school-based intervention studies, and found large effect sizes for function-based interventions, visual supports, self-monitoring and peer-mediated interventions, indicating that interventions falling under these areas are highly effective. A secondary descriptive analysis of the studies included in the Steinbrenner et al. (2020) systematic review was conducted to determine the numbers of studies ran in classroom settings by Martin et al. (2021). They found that a number of EBPs had very little to no studies conducted in classroom settings, for example, modelling, which had 0 studies examining its efficacy in classroom settings in the National Clearinghouse on Autism Evidence and Practice (NCAEP) review (Martin et al., 2021; Steinbrenner et al., 2020). Given that low levels of use of EBPs were demonstrated in this thesis and the broader school literature (McNeill, 2019; Sulek et al., 2019), and as one of the key aspects of the AIF is "Usable Innovations", this thesis raises some questions about whether the EBPs identified in the literature are actually usable for teachers in inclusive classrooms (NIRN, n.d.).

Overall, this suggests that while the body of literature surrounding the utility of EBPs for use in classrooms has expanded since this research project began, there is still a lot that needs to be done to clarify which EBPs are acceptable, feasible and effective for use in inclusive classroom settings. Furthermore, this research highlights a number of significant barriers which need to be overcome in order to facilitate the adoption of autism EBPs in classroom settings, including developing teacher capacity through effective training. Theoretically, the results of this thesis support the use of implementation science frameworks such as the AIF for analysing implementation in novel contexts, and provides us with important insights into the implementation of EBPs in school contexts. This may be useful to other researchers aiming to gain implementation insights in other contexts. Lastly, the findings of this thesis raise a number of important questions regarding autism education and policy in Ireland.

Practical and Applied Implications

Policy implications

This thesis has a number of important policy implications for the education of students with autism in Ireland, as the findings highlight that there is a lack of policy alignment and policy implementation in a number of areas. The NCSE and DES have recommended that teachers should be knowledgeable of, and use EBPs in their practice (NCSE, 2016; DES, 2017), yet this programme of research has identified that teachers seem largely unaware of EBPs and use them infrequently which may be due to a gap in policy implementation. When examining autism education policy and policy recommendations, there is a consistent history of bodies such as the NCSE (2016) recommending that teachers have access to sufficient training to enable them to meet the needs of students with autism. It was recommended in 2016 (NCSE, 2016) that the Teaching Council of Ireland and Inclusion Support Service develop standards and frameworks for teacher training in autism which would be progressive. However, structured and systematic training and professional development for teachers in relation to autism and evidence-based practices remains a serious contextual need based on the results of Chapters 3, 4 and 5.

When examining the state of the art in Ireland, it is clear that significant movements have been made towards developing teacher capacity in recent years, with the NCSE, Middletown Centre for Autism, PDST and Teaching Council responsible for providing teacher training and developing teacher capacity. Given that many teachers report issues with accessing training and the quality of the training, this thesis suggests a missing link in the provision of this training, and the translation from training into practice. High numbers of teachers reported very little training in autism (Chapters 4 and 5), and teachers described courses as being oversubscribed and "stand-alone", meaning that teachers attend and there is no follow-up support to aid implementation, or further training to develop skills (Chapter 3). When examining this through an implementation science lens, there appears to be a gap in service provision, namely around a progressive systematic programme of training for teachers of students with autism and appropriate follow-up support to assist with implementation issues. So while it seems that significant investment in training to develop teacher capacity has been made, it is the lack of cohesive and systematic training, and the lack of implementation support that may be the missing link in developing teacher capacity.

Leading from this, another important gap between policy advice and implementation is in the lack of availability of multi-disciplinary professionals to support teachers in educating students with autism, which has been a key policy recommendation on numerous occasions (DES, 2017; NCSE, 2016; Task Force, 2001). The impact of the lack of multi-disciplinary support was demonstrated in Chapter 4, with lower levels of support associated with less use of EBPs, and is also likely compounded by further factors such as low levels of teacher training and large class sizes. Teachers also felt that they were being expected to perform duties which fell outside of their scope of practice and described feeling daunted and anxious about meeting the needs of their students with autism (Chapter 3). Teachers also had positive perceptions of receiving support from professionals in Chapter 3, which is in support of previous literature which found that teachers place significant trust in therapists to help them educate students with autism in inclusive education settings (Sulek et al., 2019). However, little guidance exists as to the frequency or type of support needed within the literature, which remains a pressing research need. Previous research has found little difference between online and in-vivo support for teachers, with results demonstrating that as little as two hours of support or mentoring per month increased teachers' use of EBPs significantly in comparison with no support at all (Beamish et al., 2021). This is in line with implementation science which posits that "implementation teams", individuals with designated responsibility for developing teacher capacity and supporting adaptations necessary to implementation in class settings, are crucial to increasing implementation. Thus, these preliminary findings suggests that low-intensity offsite support can be beneficial, which has important implications for the Irish setting where professional support remains a scarcity. This suggests that the research-to-practice gap evident in Ireland could be somewhat bridged through the provision of low-intensity dedicated implementation support by professionals with expertise in autism EBPs.

Lastly, the findings of this research add understanding to a lack of alignment between DES policy and what is happening in classrooms. The DES posits that the ultimate responsibility for the education of students with SEN in MCs falls to the MCT (DES, 2017). However, Study 2 of this thesis found that teachers rely on the SETs in their schools to support them in choosing and implementing strategies for use with their students with autism.

This is in support of the evaluation of autism provision (NCSE, 2016), which found that MCTs often rely on SETs for educational planning and support, and appears to be reflective of the issues MCTs encounter, such as being less knowledgeable of EBPs and receiving little to no training. Therefore, the question arises, would time and resources be better spent on giving responsibility of designing educational interventions to the SET, who could then oversee the ongoing implementation of EBPs? This may already be happening in Irish primary schools as this research suggests, but if this is the case then further clarity and policy guidance regarding roles and responsibilities of staff key in the implementation of EBPs is badly needed. Formalising the structures of support and the roles and responsibilities of school personnel would provide clarity to teachers and ensure a uniform provision of EBPs to all students with autism.

Overall, implementation efforts appear dependent on a multi-level approach to bring about meaningful change in schools. This needs to be both a top-down and bottom-up process, and policy change is needed to clear up the ambiguity surrounding the following: (a) responsibility for autism education planning, (b) whether or not teachers must use EBPs in autism education in Ireland, (c) to streamline the process for CPD focusing on EBPs to enable teachers to develop capacity for using these in the classroom, (d) to fund expert professionals who can provide guidance to schools on identifying EBPs, and support teachers in their implementation efforts, and (e) identify effective CPD training for teachers specific to autism and EBPs. Without restructuring training systems and providing implementation supports, implementation efforts are likely to fail. Chapter 6 of this thesis provides an important proposal to enhance implementation efforts which could be utilised to test and evaluate implementation and could be a valuable resource for policy change.

School, Teacher & Student Implications

The findings from this thesis provide important insights into school systems and factors which can help or hinder the individual teacher's adoption of EBPs. A large body of research supports the use of EBPs to help students with autism achieve better outcomes (Eldevik et al., 2009; Howard et al., 2014; Steinbrenner et al., 2020; Wong et al., 2015), and further research has identified that when teachers implement EBPs, they perceive less stress and lower levels of burnout (Ouellette et al., 2019; Jennet et al., 2003). Furthermore, research conducted where teachers were implementers of EBPs reported significantly better outcomes than studies where researchers were interventionists (Watkins et al., 2019), highlighting the potential benefits associated with teachers' use of EBPs.

As identified through data collected throughout this thesis, a number of school-based factors can bear on teacher's use of EBPs, namely access to resources, systems of collaboration, and principal support. This research found that teachers reported frequently seeking information about autism and EBPs using web-based resources (Chapter 3), in support of previous research (Sulek et al., 2019). Data now exists for the efficacy of web-based resources in increasing teacher knowledge of EBPs (Beamish et al., 2021; Sam et al., 2019), and developing the content of contextually appropriate resources in collaboration with teachers as provided in Chapter 6 will prove an important step in developing teacher capacity in Ireland. As 47.3% of teachers reported lack of time to research interventions and 23.2% reported lack of training in reading research as serious barriers in Chapter 5, teacher literacy in reading research and evaluating evidence may be lacking. One evidence-based resource proven effective at increasing teacher knowledge of EBPs for autism is Autism Focused Intervention Resources and Modules (Sam et al., 2019), and may prove useful to schools and teachers looking to develop capacity. The feasibility of these is yet to be explored in an Irish context but as proposed in Chapter 6, may be appropriate for increasing knowledge.

Support within school systems was also identified as an important facilitator of EBP implementation in Chapter 2. Leadership from school principals may be particularly important, as identified in Chapter 3 where teachers reported positive outcomes from principal involvement in the development of teacher capacity. This is further supported by evidence from Chapter 5, with lack of principal support receiving the lowest percentage of "serious" ratings on the barriers scale. Systems of collaboration between teachers were also identified as very helpful by teachers in Chapter 3, reflective of previous research (Sulek et al., 2019). In terms of developing teacher capacity for implementing autism EBPs, communities of practice and mentoring may significantly help to bridge the research-to-practice gap, and reduce the need for training and support from professionals which are scarce.

For our students, research on outcomes paints a concerning picture. The inability of the teacher to implement appropriate interventions has been identified as a key factor in preventing students with autism and SEN to learn in these environments. Students with autism are more likely to be excluded from school, and up to one fifth of students with autism are placed on reduced timetables, whereby their access to education is compromised (AsIAm, 2019). Over half of the parents surveyed in this study felt that their children were being excluded from school and being placed on reduced timetables due to a lack of knowledge and understanding of autism and autism-specific strategies in schools. Furthermore, previous research has identified that up to 40% of students with SEN including autism, transfer from a mainstream primary school into a special needs school for secondary-level education (Kelly et al., 2014). The principals surveyed in this study perceived that students were transferring out of inclusive education settings at the post-primary level due to difficulties in accessing the mainstream curriculum and the inability to provide appropriate interventions to meet the needs of the child, as well as the lack of access to multi-disciplinary support. In both of these studies, as EBPs have such robust scientific evidence, the adoption of these practices in these settings could positively transform student experiences and student outcomes.

Future Directions

It would appear from the findings of this thesis and the literature developing the field of implementation science, that significant efforts remain to be made in upscaling teachers' use of EBPs in inclusive classrooms in Ireland. Many of the future directions recommended for the Irish context are outlined in the implementation protocol in Chapter 6, which provides a comprehensive overview of the future directions which can be taken in improving EBP implementation.

In the broader literature, further research is needed to delineate barriers and facilitators impacting implementation of autism EBPs in school settings. It is promising to see a proliferation of research in this area since the commencement of this thesis, however, given the differences demonstrated in EBP use across contexts, further exploration of this in different settings (inclusive education, special education) and different countries/cultures is needed to truly begin to understand how these factors bear on EBP adoption. Given the increasing importance placed on the social validity of EBPs, it is also important to include the teachers' voice in informing the research-to-practice gap, to move away from the dichotomous model of research-to-practice, and enable a more integrated development and evaluation of EBPs in schools.

Of issue in the broader literature, is the continuing question of the appropriateness of EBPs for implementation in school settings. Since the commencement of this thesis, significant efforts have been made to address this gap, with Watkins et al., (2019) and Martin et al., (2021) providing extremely useful overviews and analyses of the evidence for implementation in school settings. Evidence now strongly exists for the efficacy of a number of EBPs in classroom settings, including visual supports, reinforcement, prompting, social skills interventions and peer-mediated interventions. This is a positive and welcomed advancement in our understanding. However, serious questions remain about the suitability of a number of EBPs for the classroom setting, including those least frequently used in our studies, such as discrete trial training, extinction and self-management interventions, and further research on evaluating the social validity and effectiveness of these EBPs in classroom settings is needed.

Future research should also explore developing teacher capacity in contexts where EBP culture is not evident. One novel approach which may be considered in bridging the gap in contexts where eclectic approaches are common, is the use of "technical eclecticism" (Odom et al., 2012). As Odom suggests, this would facilitate a break from the ABA vs eclectic argument, and promote that within the eclectic model, the focus shifts to offering teachers autonomy to choose from interventions which meet EBP criteria, rather than from a mix of interventions with no explicit focus on EBP use (McMahon & Cullinan, 2016). As the thesis demonstrates, implementation can be impacted by constructs such as culture and context. Therefore, streamlining the narrative on using EBPs with students with autism appears necessary, regardless of philosophical approach. In Chapter 6, the development of the EBP-AIM Toolkit was proposed to provide teachers with a go-to resource to gain information on EBPs to apply with students with autism in their classrooms. This may bridge some of the gap between policy and practice, however, this needs to be embedded within a broader implementation framework as outlined in Chapter 6, to be truly effective.

Limitations

This thesis has a number of limitations which are important to consider when analysing the results. The sample size of the studies included in the thesis was relatively small. In Chapter 3, fourteen teachers were interviewed with data collection continuing until data saturation had been met. These participants were also from a relatively small geographical area and so limitations exist around the parallels which can be drawn with the wider teacher population in Ireland. For the quantitative study, 369 teachers were included, and while this is a relatively small sample (there are 22,970 mainstream primary school teachers currently registered in Ireland), there was good geographical spread across all 26 counties in the Republic of Ireland. Furthermore, one of the inclusion criteria for the studies were that teachers had to have taught a student with autism, and there is no national register for the number of primary school teachers with experience teaching students with autism. There was a high percentage of missing data for the knowledge and use scales in this study, however, as data were missing at random in the sample, listwise deletion was used, ensuring unbiased estimates of means and variances. In Chapter 5, large dropouts before completion of the scaled measures significantly decreased the sample size (from 207 to 112). The dropout of participants at the scale measures hints at a limitation with the design of the questionnaire, however, given data collection occurred during the Covid-19 crisis, online data collection was the most feasible and appropriate measure of collecting data. Future research with longer surveys and using scales with multiple answers may benefit from using paper and pen data collection.

Another issue with online data collection centres on response rates and selection bias. As a result of the data collection method, response rates are impossible to calculate as there is no way of knowing the population to which they were distributed and how this impacted on selection biases. For example, those with an interest in autism may have been more likely to respond to the survey and therefore this may impact on the generalisability of the findings. However, many of the findings are largely in line with similar research in the area with regards to factors impacting EBP use (McNeill, 2019; Sulek et al., 2019), and Irish teachers' issues with training (Anglim et al., 2018; Finlay et al., 2019; McCormack, 2019), but yet caution is advised on the generalisability of the results.

One key limitation is that it was not possible to directly observe teachers and analyse which practices were being used in classrooms. As previous research has identified that teachers perceived knowledge and actual knowledge of practices may differ (Fennell & Dillenburger, 2018), this is an important limitation to note. To overcome this, a validated scale measuring EBP use was utilized to try to ensure methodological rigour (Paynter & Keen, 2015). A number of contextually driven adaptations to this scale were made following consultation with two teachers with the aim of enhancing the social validity of the measure, and Cronbach's Alphas remained very high after these changes, indicating that the scale was reliable at measuring teachers' use of practices. However, further research is needed to examine the association between teachers' perceived and actual knowledge of EBPs, and teachers' perceived and actual use of EBPs, to further explore these limitations. One such tool which has recently been developed is the Evidence-Based Practice Classroom Observation Measure (EBP-COM; Paff et al., 2019), and this observational tool has been included in the protocol in Chapter 6 to overcome this issue in future research.

Another potential limitation is that the newest iteration of the NCAEP EBP document was published after the development of the survey instrument used for data collection in Chapters 4 and 5, and after data collection had taken place. Therefore, as some new categories had been added to the 2020 review (e.g., Music Therapy and Sensory Integration Therapy), this may potentially have impacted the findings. However, teachers' reported knowledge and use of the practices, which were new, was low and this re-categorisation did not have an impact on our identification of the most frequently used EBPs. Some of the other practices such as PECs and scripting were also re-categorised under broader headings, but again, this did not have a major impact on the findings as these were not frequently used and teachers were not very knowledgeable of them. Therefore, our findings from Chapter 4 which suggest that teachers were most knowledgeable and used visual supports, social stories, reinforcement, exercise, social skills training and modelling; and the findings from Chapter 5 which suggest that mainstream teachers were most knowledgeable and used visual supports, social stories, reinforcement, social skills interventions and exercise, hold true despite the re-categorization of some EBPs as per the Steinbrenner et al., (2020) review.

As with any study, there were limitations with the number of variables we decided to explore in more detail. There are a number of broader variables which may also be important to explore including organisational climate, organisational culture and social validity that were not examined thoroughly in our study. The qualitative study suggested some broader cultural issues which may be important, but these were not statistically analysed. We attempted to overcome some of these limitations by using a broad-range barriers to EBPs measure (Barriers to Behavioural Interventions; McGoey et al., 2014) as a way to assess multiple barriers from multiple levels at once. This scale had reported high reliability (McGoey et al., 2014), and after we had made a number of contextual changes which were necessary to make the scale valid in the educational context for Ireland reliability remained high. However, given that we found no association between any of the barriers from the scale and EBP use, even though teachers scored many of these barriers as extremely serious, the scale may not have been sensitive enough to measure these associations. An alternative explanation may be provided by the low levels of knowledge which may have obscured the associations between barriers and use of EBPs, but further studies using this scale are necessary to identify if the scale is useful in determining factors which impact EBP use in education settings.

Lastly, since the commencement of this programme of research, significant movements have been made within the autistic community for the inclusion of the autistic voice in research, and therefore I must acknowledge the shortcomings of this research in including autistic students perspectives of school and their education. As students with autism are the recipients of these interventions, for social validity and acceptability purposes it is important to include perspectives of these individuals also. To address and acknowledge this, in Chapter 6, in the development of community advisory groups we aim to include autistic students and adults to inform the development of the EBP-AIM toolkit.

Conclusion

Bridging the research-to-practice remains one of the most important issues in autism education. EBPs have proven efficacy in improving outcomes across some of the core difficulties experienced by individuals on the autism spectrum, therefore, the potential for EBPs to improve outcomes for these students is vast. Yet this potential remains unfulfilled, as the translation of EBPs into classroom settings has been marred by implementation issues which are complex and inter-related.

This thesis has made a significant contribution to our understanding of the research-to-practice gap in Ireland, by identifying multi-level factors which impact the adoption of EBPs in this setting. Within implementation science, identifying barriers and facilitators is an important first step in assessing readiness for adopting EBPs, and this thesis has found that the most important factor influencing implementation in this context was knowledge. Therefore, increasing knowledge may be the first step in implementation in contexts, such as Ireland, where there is a lack of philosophical and policy alignment with EBP use, and this finding provides an important contribution to the literature.

To scale-up use of EBPs in Ireland, significant implementation efforts must be made and evaluated. The EBP-AIM protocol developed from the findings of this research, provides a contextual and theoretically driven proposal of discrete and evaluable steps to implementation, which if successful, could positively impact teacher and student experiences in the autism education context in Ireland. Movements must also be made in the research community towards evaluating EBPs in classroom contexts, to ensure this research-to-practice gap can be bridged. To conclude, while implementation is complex, there are definitive steps which have been identified that can be taken to cross the bridge from research to practice. The findings of this programme of research provide important knowledge and insights that will assist those interested stakeholders in designing and implementing teacher training in this area. As every moment in school is a critical aspect of preparing students with autism to achieve their full potential no time can be lost in ensuring teachers are fully prepared to educate students employing current and proven methods and strategies.

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Appendices

Appendix A.

Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) Checklist- Study 1; Chapter 2.

SECTION	ITEM	PRISMA-ScR CHECKLIST ITEM	REPORTED ON PAGE #
TITLE			
Title	1	Identify the report as a scoping review.	1
ABSTRACT			
Structured summary	2	Provide a structured summary that includes (as applicable): background, objectives, eligibility criteria, sources of evidence, charting methods, results, and conclusions that relate to the review questions and objectives.	3
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known. Explain why the review questions/objectives lend themselves to a scoping review approach.	6
Objectives	4	Provide an explicit statement of the questions and objectives being addressed with reference to their key elements (e.g., population or participants, concepts, and context) or other relevant key elements used to conceptualize the review questions and/or objectives.	6
METHODS			
Protocol and registration	5	Indicate whether a review protocol exists; state if and where it can be accessed (e.g., a Web address); and if available, provide registration information, including the registration number.	7
Eligibility criteria	6	Specify characteristics of the sources of evidence used as eligibility criteria (e.g.,	8-9

SECTION	ITEM	PRISMA-ScR CHECKLIST ITEM	REPORTED ON PAGE #
		years considered, language, and publication status), and provide a rationale.	
Information sources*	7	Describe all information sources in the search (e.g., databases with dates of coverage and contact with authors to identify additional sources), as well as the date the most recent search was executed.	7-8
Search	8	Present the full electronic search strategy for at least 1 database, including any limits used, such that it could be repeated.	7-8
Selection of sources of evidence†	9	State the process for selecting sources of evidence (i.e., screening and eligibility) included in the scoping review.	9
Data charting process‡	10	Describe the methods of charting data from the included sources of evidence (e.g., calibrated forms or forms that have been tested by the team before their use, and whether data charting was done independently or in duplicate) and any processes for obtaining and confirming data from investigators.	9-10
Data items	11	List and define all variables for which data were sought and any assumptions and simplifications made.	9-10
Critical appraisal of individual sources of evidence§	12	If done, provide a rationale for conducting a critical appraisal of included sources of evidence; describe the methods used and how this information was used in any data synthesis (if appropriate).	NA
Synthesis of results	13	Describe the methods of handling and summarizing the data that were charted.	10
RESULTS			
Selection of sources of evidence	14	Give numbers of sources of evidence screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally using a flow diagram.	10-11

SECTION	ITEM	PRISMA-ScR CHECKLIST ITEM	REPORTED ON PAGE #
Characteristics of sources of evidence	15	For each source of evidence, present characteristics for which data were charted and provide the citations.	12-14
Critical appraisal within sources of evidence	16	If done, present data on critical appraisal of included sources of evidence (see item 12).	NA
Results of individual sources of evidence	17	For each included source of evidence, present the relevant data that were charted that relate to the review questions and objectives.	12-14
Synthesis of results	18	Summarize and/or present the charting results as they relate to the review questions and objectives.	15-21
DISCUSSION			
Summary of evidence	19	Summarize the main results (including an overview of concepts, themes, and types of evidence available), link to the review questions and objectives, and consider the relevance to key groups.	22-24
Limitations	20	Discuss the limitations of the scoping review process.	25
Conclusions	21	Provide a general interpretation of the results with respect to the review questions and objectives, as well as potential implications and/or next steps.	26-27
FUNDING			
Funding	22	Describe sources of funding for the included sources of evidence, as well as sources of funding for the scoping review. Describe the role of the funders of the scoping review.	28

JBI = Joanna Briggs Institute; PRISMA-ScR = Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews.

Appendix B.

Participant Information Sheet & Consent Form- Paper 2; Chapter 3.

EHSREC APPROVAL NO: 2016_01_11_EHS

Participant Information Sheet

Title of Project

Teachers use of evidence-based practices with children with Autism Spectrum Disorder.

The Study

This study is being conducted as part of a PhD being completed by Lorna Barry, in collaboration with the *Teaching for Inclusion (i-Teach) laboratory* and *School of Education,* within the University of Limerick. The overall aim of the PhD is to explore teacher's use evidence-based practices when working with children with an Autism Spectrum Disorder (ASD).

One of the current challenges in the teaching climate is the increased diversity and needs of students in mainstream classrooms. Using evidence-based practices with children with ASD has proven beneficial to students and teachers alike. Whilst these practices have been well researched, there is little indication of their use in everyday classroom. This gap between theory and practice needs to be explored to give a more rounded view of teachers views of evidence-based practices when teaching children with ASD. More insight can provide researchers with a clearer view of the practices that are beneficial to teachers and therefore possibly inform teacher training programmes.

This study aims to explore a possible variable involved in the literature-to-practice gap, which is teachers use of EBP and the facilitators to their use in the classroom.

What will I have to do as a participant?

As a participant, your opinion and use of evidence based practices in educating children with ASD will be explored during a short interview. The total time commitment for the interview will be at least 30 minutes but no more than 1 hour in length.

What are the risks?

There are no known risks involved in this study. It is important to note that you are under no obligation to participate in this study, and you are free to withdraw from this study at any time.

Confidentiality

All information provided by you will be kept confidential. Access to the recordings taken of the interview will only be made available to the researcher and supervisor involved in this study. No identifying information will be included on the recording (e.g. name), and no information about you or the school you teach in will be identified in the final report.

You may decide to withdraw from this study at any time. If you choose to withdraw from the study you should notify the researcher. There are no consequences if you withdraw from the study.

Thank you for taking the time to read this and I would greatly appreciate if you would consider participating in this study.

Contact Details:

Dr. Jennifer McMahon

School of Education

University of Limerick

Email: Jennifer.mcmahon@ul.ie

Phone: 061202663

Lorna Barry

FG167, Foundation Building,

University of Limerick,

Email: lorna.barry@ul.ie

EHSREC APPROVAL NO: 2016_01_11_EHS

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OLLSCOIL LUIMNIGH

Participant Consent Form

Title of Project

Teachers use of evidence-based practices with children with Autism Spectrum Disorder.

Please read the following questions and tick the appropriate yes or no box. Please sign the bottom of the page if you consent to participate in this study.

	Participant	
	Yes	**No**
I have read and understand the participant information sheet.		
I understand what the project is about and what the results will be used for.		
I am fully aware of all procedures and of any risks and benefits associated with the study.		
I know that my participation is voluntary and that I can withdraw from the project at any stage without giving reason.		
I am aware that the results will be kept confidential.		

Participant (Block Letters): ___________________________________

Signature: ____

Date: ____/____/________

Appendix C.

Interview Schedule- Paper 2; Chapter 3.

EHSREC APPROVAL NO: 2016_01_11_EHS

Background questions:

Gender: male/female

1. What is your current teaching position?
2. How many years have you been teaching?

EBP specific questions:

3. Are you familiar with the term "evidence-based practice?"
4. What is your understanding of evidence based practices?
5. What do you believe is the teacher's role in implementing EBP?
6. How do you use research to inform your practice in the classroom/school?
7. What are the challenges facing teachers/schools in the area of EBP?
8. What skills/abilities do teachers need to implement EBP?
9. What resources are needed to support teachers/schools in implementing EBP?
10. What role do you think teacher preparation courses play in developing teacher capacity in the area of EBP?

ASD specific questions:

1. How many years' experience do you have working with children with ASD?
2. What training, if any, did you receive prior to beginning working with children with ASD
3. How was it decided what type of ASD training you would undertake?
    a. Probe: did the principal decide? Did you research training courses?
4. Do you use any EBPs when teaching children with ASD?
5. What types of EBPs do you use in your teaching of children with ASD?
6. How can teacher preparation courses better support teachers to develop their research skills and enhance EBP use with children with ASD?
7. How do you find information on EBP and ASD?

8. What kind of resources are available to teachers looking to inform themselves about EBP and Autism?

Appendix D.

Codebook for Qualitative Analysis- Paper 2; Chapter 3.

Code	Definition of Code	Examples
Knowledge	References to teachers perceived knowledge of evidence-based practices and autism interventions. Also references to awareness/ knowledge of the strengths/difficulties associated with an autism diagnosis.	C- "I'm not sure is it to do with .. researching different teaching methods and then seeing the results and then implementing them in classrooms with advantages and disadvantages" H- "don't know what's evidence based and what isn't evidence based, I presume that it is but I don't question it so I don't know. I always presumed that every programme that was handed to me was evidence based."
Training and preparation.	Reports of training received in professional development and/or initial teacher education. Also reports of issues with accessing appropriate training, and/or issues with adequately preparing teachers to teach students with autism.	A- "very little college training" D- "it's hard to prepare you for something until you're in the classroom. In 6 weeks I had one lecture in SEN, I didn't have a clue and then it's learning on the job." E- "I do remember being very anxious about it because I felt at the time my teacher training didn't equip me for it" L- "I didn't get any training"; I think a huge problem for teachers really is the whole system of having to do our summer courses in the summer because people are exhausted they try to pick something easy they're in holiday mode" M- "I don't think we're equipped with the skills when we come out to deal with kids with those kind of diagnoses"

Sources of Information	Where teachers report gaining access on autism/ interventions for use. Also any issues with accessing information and issues with the source.	F- "Researching on the web, talking to professionals and people working in the area" J- "well the SESS is very good for special education in Ireland where you can click in to different aspects am whatever special need that you're learning about you can read up on it it's very helpful that way, also YouTube and things like this" M- "with the Teaching Council that we're registered with you can log into these databases where they have like EBSCO you can actually search educational journals"
Educational Culture	References to school culture or the broader educational culture.	F- "the use of evidence based, it wasn't something that was highlighted for us" G- "a lot of the time we are told these are evidence based but we don't really research it" L- "they have far more access in other countries to like trained psychologists"
Systems of Collaboration	Teachers reports of working together with other teachers or with professionals.	C- "it's always good to have professional conversations as well just to get information off other teachers" C- "you need a full circle of all different professions" G- "the principal might often send down an email saying give a look at this"

		J- "very often in teaching, two or three people from a school go, learn how to implement stuff and then they're teaching the other teachers about it"
Classroom specific factors	Factors affecting implementation that are specific to the classroom. This can include issues with adapting the curriculum, time, and class size.	B- "time is key, curriculum overload is a huge issue" D- "it's hard to factor in all of the needs when there is only one of you". K- "how do you implement that in a class in a mainstream classroom with like even with big number like I've 35 at the minute" N- "I think it's difficult because there's a variety of students in my class in particular there's 3 students with special needs and I find it very time consuming to am do research on each of the needs"
Resources	Mention of resources necessary to support implementation of interventions. Also lack of resources as an issue in implementing.	K- "I think resources is a big thing like for mainstreams that are not special schools to have the funding basically to be able to like set up these resources and to have them readily available"
Teacher Characteristics	References to characteristics which may be beneficial to teachers adoption of EBPs.	B- "For EBPs to be adopted, people need to change their mentality and open their doors for collaboration and be comfortable with observation and build trust in teams" D- "teachers have to have a willingness to change their practice and to adapt"
Teacher's Role	Mention of the teachers role- i.e. being asked to perform duties that are outside of their role, or the importance of the teacher	B- "teachers have more contact time with the child than any other professional, so have a very important role and has a

	as an educator and the importance of their experience.	stronger influence over the child's education than external factors". D- "teachers aren't psychologists they aren't OTs or anything like that so we really don't know" L- "I think sometimes we're expected to do something that we're just not trained to do"
Role of "experts"	References to working with multi-disciplinary professionals, receiving support from them, issues with accessing support from health services, how valuable this support may be.	I- "people working with autistic children are at the coalface.. they know what they're saying" N- "it would be nice to have maybe a professional then that could give proper guidance on what students need from the get go"

Appendix E.

Survey- Papers 3 & 4; Chapters 4 & 5.

EHSREC APPROVAL NO: **2019_10_15_EHS**

EHS RESEARCH ETHICS COMMITTEE

Participant Information Sheet

An Exploration of the Use of Autism Interventions in Ireland.

The Background

Internationally, teachers have indicated that the inclusion of children with autism in classrooms has led to more training needs. Without knowing the benefits and challenges teachers are experiencing in implementing interventions with students with Autism, it is very difficult to understand professional development needs. This study aims to address an important gap in our understanding of teachers needs in relation to autism training and interventions. This research could potentially be used to inform policy change and continuous professional development needs.

This Study

This study aims to identify the following:

1. What training do teachers have in autism?
2. What practices are teachers using when educating students with autism?
3. What barriers are teacher facing in using interventions designed for students with autism?

What will I have to do as a participant?

As a participant, you will have to fill out a short questionnaire (max. 10 mins to complete). You will answer questions related to your experience educating children with autism.

What are the risks?

There are no known risks involved in this study. It is important to note that you are under no obligation to participate in this study, and you are free to withdraw from this study at any time.

Confidentiality

All information provided by you will be kept confidential. No identifying information will be included in the study, and no information about you or the school you teach in will be identified in the final report.

You may decide to withdraw from this study at any time. If you choose to withdraw from the study you should notify any of the researchers involved in this project. There are no consequences if you withdraw from the study.

Research team information

This study is part of a PhD study being conducted by Lorna Barry, MSc., BCBA & Dr. Jennifer McMahon, PhD, of the *Teaching for Inclusion (i-TEACH)* Research Lab at the University of Limerick.

Contact Details:

Dr. Jennifer McMahon,	Lorna Barry, MSc., BCBA
Lecturer- Special Educational Needs	PhD Candidate & Irish Research Council Scholar,
School of Education,	School of Education,
University of Limerick	FG167, Foundation Building,
Email: Jennifer.mcmahon@ul.ie	University of Limerick,
Phone: 061202663	Email: lorna.barry@ul.ie

EHS Research Ethics Committee: ehsresearchethics@ul.ie

EHSREC APPROVAL NO: **2019_10_15_EHS**

EHS RESEARCH ETHICS COMMITTEE

Participant Consent Form

Title of Project

An Exploration of the Use of Autism Interventions in Ireland

Should you agree to participate in this study please read the statements below and if you agree to them, please sign the consent form.

- I have read and understood the participant information sheet.
- I understand what the project is about, and what the results will be used for.
- I understand that what the researchers find out in this study may be shared with others but that my name will not be given to anyone in any written material developed.
- I am fully aware of what I will have to do, and of any risks and benefits of the study.
- I know that I am choosing to take part in the study and that I can stop taking part in the study at any stage without giving any reason to the researchers.

I agree to the statements above and I consent to taking part in this research study.

Name: (please print): ___________________________

Signature: ____________________________________ Date: _______________

Investigator's signature : _________________________ Date: _______________

EHS Research Ethics Committee

ehsresearchethics@ul.ie

EHSREC APPROVAL NO: **2019_10_15_EHS**

UNIVERSITY OF LIMERICK
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EHS RESEARCH ETHICS COMMITTEE

Data Protection Consent Section

I, the undersigned, declare that I am freely giving specific, informed and an unambiguous consent to the University to process my Personal Data for the purposes of undertaking the research project entitled *"An exploration of the use of Autism interventions in Ireland"*.

	Yes	No
• I declare that I have read and fully understand the contents of the Research Privacy Notice, which is appended at this Consent form and I explicitly consent to my personal data being processed in line with this Research Privacy Notice.	☐	☐
• I explicitly consent to the University contacting me as part of current or similar future research and holding my contact details on its database for the purpose of contacting me.	☐	☐

Signatures

1.

___________________________________ ___________________________ ____________________

Name of participant [IN CAPITALS] Signature Date

RESEARCH PRIVACY NOTICE

(UL template Version 3: 05-07-19)

This Privacy Notice governs the use and storage of your personal data by the University of Limerick (the University). The processing of this data is carried out in accordance with the General Data Protection Regulation (GDPR) / Data Protection Acts 1988-2018 ("Data Protection Law") and in accordance with this Data Protection Privacy Notice. The University is the Data Controller for personal data we process about you.

The purpose of this Data Protection Privacy Notice is to explain how the University uses and processes personal data we collect and hold about you as a research participant ("you", "your"). This notice extends to all your personal data as defined under Article 2(1) of the General Data Protection Regulation (EU) 2016/679.

1. Title and Purpose of the research project

1.1 "An exploration of the use of autism interventions in Ireland". This project aims to identify teachers' training needs through gaining insights into teacher's perceptions of autism training and interventions.

1.2 **Potential benefits that may arise from the research project**

This research aims to address an important gap in our understanding of teachers needs in relation to autism training and could be used to inform policy change and continuous professional development training.

2. Research Ethics Committee

2.1 Ethical approval was granted by the EHS Research Ethics Committee on 14th November 2019.

3. Identity of the Data Controller(s)

3.1 The Data Controller/Joint Controllers are:

- University of Limerick, Plassey, Limerick.
- Lorna Barry, FG167, Foundation Building, University of Limerick.

4. Identity and Contact Details of the Data Protection Officer of the Data Controller(s)

4.1 You can contact the University of Limerick's Data Protection Officer at dataprotection@ul.ie or by writing to Data Protection Officer, Room A1-073, University of Limerick, Limerick.

5. The Identity of the Principal Investigator

5.1 The Principal Investigator for this Research Project is Dr. Jennifer McMahon.

6. Why the University Holds Your Personal Data

6.1 The University must process your personal data in order to undertake research relating to teachers use of autism interventions.

7. Research Participant Personal Data held by the University

7.1 You provide us with your personal data to enable us to undertake the research project. Participation in this research project is voluntary and participants may withdraw without giving any reason. Should you wish to withdraw you may do so by contacting the Principal Investigator at lorna.barry@ul.ie or writing to her at FG167, Foundation Building, University of Limerick.

7.2 The categories of personal data collected/recorded may include:

- Your Name.

8. Lawful Basis for University Processing Personal Data

8.1 Data Protection Law requires that the University must have a valid lawful basis in order to process personal data.

8.2 The University will rely on your explicit consent in order to process your personal data for research purposes. Consent must be freely given, specific, informed and an unambiguous indication of your wishes by which you (by a statement or by a clear affirmative action) signify agreement to the processing of personal data relating to you. Your decision not to consent will have no adverse consequences for you.

8.3 You are free to withdraw this consent and you can do so by contacting the Principal Investigator at the following email address lorna.barry@ul.ie.

9. Protecting Your Personal Data

9.1 Reasonable appropriate administrative, technical, personnel procedural and physical measures are employed to safeguard Personal Data against loss, theft and unauthorised uses access, uses or modifications.

9.2 All researchers of the University must adhere to the University's Data Protection Policy when processing Personal Data on behalf of UL (available at www.ul.ie/dataprotection). Non adherence to the University's Data Protection Policy may lead to disciplinary action. Researchers of the University shall undertake Data Protection Training before they engage in the research project.

9.3 Personal data collected for this research project will be pseudonymised within 1 day after collection and will fully anonymised within/after 12 months. Truly anonymised data is not Personal Data. Once data is anonymised for the purposes of this research project, the terms of this Privacy Notice will no longer apply.

10. Sharing Your Personal Data with Third Parties

10.1 The University will not disclose your personal data to third parties.

12. Retention of your Personal Data

12.1 All Personal Data collected for this research project will be retained in accordance with the University's Records Management and Retention Policy. *The Retention Policy currently states a retention period of 7 years (July 2019). Where the personal data collected for this research will be held for a longer/shorter period, this should be stated here. Note that truly anonymised data is not personal data.*

13. Your Rights

13.1 Depending on the legal basis which we rely on to process your Personal Data, you may have the right to request that we:

- provide you with information as to whether we process your data and details relating to our processing, and with a copy of your personal data;
- rectify any inaccurate data we might have about you without undue delay;
- complete any incomplete information about you;
- under certain circumstances, erase your Personal Data without undue delay;
- under certain circumstances, be restricted from processing your data;
- under certain circumstances, furnish you with the Personal Data which you provided us within a structured, commonly used and machine readable format;

13.2 Requests for any of the above should be addressed by email to the Principal Investigator at lorna.barry@ul.ie AND the Data Protection Officer at dataprotection@ul.ie. Your request will be processed within 30 days of receipt. Please note, however, it may not be possible to facilitate all requests, for example, where the University is required by law to collect and process certain personal data including that personal information that is required of any research participant.

13.3 It is your responsibility to let the Principal Investigator know if your contact details change.

14. Queries, Contacts, Right of Complaint

14.1 Further information on Data Protection at the University of Limerick may be viewed at www.ul.ie/dataprotection. You can contact the Data Protection Officer at dataprotection@ul.ie or by writing to Data Protection Officer, Room A1-073, University of Limerick, Limerick.

14.2 You have a right to lodge a complaint with the Office of the Data Protection Commissioner (Supervisory Authority). While we recommend that you raise any concerns or queries with us first at the following email address [insert PI's email address], you may contact that Office at info@dataprotection.ie or by writing to the Data Protection Commissioner, Canal House, Station Road, Portarlington, Co. Laois.

15. Review

15.1 This Privacy Notice will be reviewed and updated from time to time to take into account changes in the law and the experience gained from the Notice in practice.

An Exploration of the Use of Autism Interventions in Ireland

Thank you for participating in this survey, please answer the questions below to the best of your ability. You are free to withdraw at any time.

Section 1

Please tick the relevant information below.

Sex

- Male ☐
- Female ☐
- Prefer not to say ☐

Age Range

20-25	☐	41-45	☐
26-30	☐	46-50	☐
31-35	☐	51-55	☐
36-40	☐	55+	☐

Teaching position

- Mainstream Class Teacher ☐
- Special Education Teacher ☐
- Learning Support/ Resource ☐
- Principal ☐
- Autism class teacher ☐
- Other (please describe) ______________________

Teaching experience (in years)

- 1-3 ☐
- 4-7 ☐
- 8-11 ☐
- 12-15 ☐
- 16-20 ☐
- 20+ ☐

Level of Education	Bachelor of Education (BEd.)	☐
	Professional Masters in Education (PME)	☐
	Masters in Education/Science (MSc./MEd.)	☐
	Postgraduate Diploma	☐
	Postgraduate Certificate	☐
	PhD.	☐
	Other (please describe)	____________________

In which higher education institution did you complete your initial teacher education?

St Patrick's College ☐	Mary Immaculate College ☐	NUI Maynooth ☐	Hibernia College ☐
Colaiste Mhuire, Marino ☐	Church of Ireland College of Education, Dublin ☐	Other (please describe) ____________________ ____________________	

What county do you live in? ____________

School Information	DEIS	☐
(please tick all that apply)	Non-DEIS	☐
	Rural	☐
	Urban	☐

School size (estimate number of pupils) ___________________________

Section 2

For the purposes of this questionnaire, "autism" may also refer to autism spectrum disorder, PDD-NOS and Asperger's Syndrome. Please answer the questions with any of these diagnoses in mind.

Please tick the relevant box below.

Have you taught children with autism during your teaching career? **Yes** ☐ **No** ☐

How many years' experience do you have teaching students with autism? (circle appropriate answer)

Less than 1 ☐ **1-3** ☐ **4-7** ☐ **8-11** ☐ **12-15** ☐ **16-20** ☐ **20+** ☐

Approximately how many students with autism have you taught?

2 or less ☐ **3-5** ☐ **6-10** ☐ **11-15** ☐ **15+** ☐

Approximately how many hours were dedicated to teaching about autism during your **initial teacher education.**

0 hours ☐ **1-3 hours** ☐ **4-8 hours** ☐ **9+ hours** ☐ **Other** ______________

Please rate the extent of your autism-specific training during your initial teacher education.

Not at all trained									Very well trained
1	2	3	4	5	6	7	8	9	10

Before beginning to teach a child with autism, did you receive any autism-**specific Continuous Professional Development** (CPD) training?

Yes ☐ **No** ☐

What type of training did you receive?

Department approved CPD course (Online or in-person) ☐

Local Education Centre Workshop ☐

Whole School Workshop ☐

Professional Development (Croke Park Hours) ☐

Other ______

Have you received any additional training since beginning to teach children with autism?

Yes ☐ **No** ☐

What type of training did you receive?

Department approved CPD course (Online or in-person) ☐

Local Education Centre Workshop ☐

Whole School Workshop ☐

Professional Development (Croke Park Hours) ☐

Other ______

Approximately how many hours were dedicated to teaching about autism during your **CPD?**

0-5 hours ☐ **6-10 hours** ☐ **11-20 hrs** ☐ **21-30 hrs** ☐ **30+ hrs** ☐ **Other** ____________

Please rate the extent of your autism-specific CPD training

Not at all trained									Very well trained
1	2	3	4	5	6	7	8	9	10

Do all your students with autism have Individual Education Plans (IEP's)?

If a student does have an IEP are the strategies you use outlined in the IEP?

Related to children with autism that you have taught, have you received in-person support or consultation (i.e. a visit or training) for these children from any of these professionals? Please tick all that apply.

HSE Psychologist	☐	Occupational Therapist	☐	Speech and Language Therapist	☐
Behaviour Support Specialist	☐	NEPS Psychologist	☐	CAMHS	☐
SESS	☐	NBSS	☐	Private consultants (describe) ________________________ ________________________ ___________________	

Other (please describe): ____________________________

Thinking about the last child with autism you taught, approximately how many times per year did you have access to any of the supports listed above?

None	☐	1-2	☐	3-4	☐	5-6	☐	6+	☐

Did you find these supports beneficial?

Yes ☐ **No** ☐

Would you like access to more professional supports?

Yes ☐ **No** ☐

Please shortly outline why:

____
____
____

The Early Intervention Practices Scale

Please read the description of each of the following practices and rate your level of knowledge and use of each practice (including elements of the practice) using the following scale. Please rate *both* knowledge and use of each practice. **Should you need explanations of the interventions, please look at the appendix to this survey (page 15).**

Knowledge

0	1	2	3	4
Very Little: Know nothing about this practice.	*To a Slight Extent:* Heard of this practice.	*To a Moderate Extent:* Know a little about this practice.	*To a Great Extent:* Have a good amount of knowledge of this practice.	*To a Very Great Extent:* Know a great deal and could instruct others on this.

Use

0	1	2	3	4
Never: I do not use this practice	*On rare occasions:* Less than once per week	*Sometimes:* One or more times a week but not everyday	*Often:* About once per day	*Frequently:* More than once per day

Practice	**Knowledge**					**Use**				
	Very Little ↔				A Very Great Exte nt	Never ↔ Frequently				
1. ***Antecedent-based Intervention***	0	1	2	3	4	0	1	2	3	4
2. ***Applied Behaviour Analysis (ABA)***	0	1	2	3	4	0	1	2	3	4
3. ***Cognitive behavioural interventions (CBI)***	0	1	2	3	4	0	1	2	3	4
4. ***Developmentally-Based (e.g., Floor time DIR/Greenspan)***	0	1	2	3	4	0	1	2	3	4
5. ***Differential reinforcement (DRA/I/O/L):***	0	1	2	3	4	0	1	2	3	4
6. ***Discrete trial teaching***	0	1	2	3	4	0	1	2	3	4
7. ***Exercise***	0	1	2	3	4	0	1	2	3	4

8. ***Extinction***	0	1	2	3	4	0	1	2	3	4
9. ***Facilitated Communication***	0	1	2	3	4	0	1	2	3	4
10. ***Functional Behaviour Assessment***	0	1	2	3	4	0	1	2	3	4
11. ***Functional communication training***:	0	1	2	3	4	0	1	2	3	4
12. ***Intensive interaction***	0	1	2	3	4	0	1	2	3	4
13. ***Modelling***	0	1	2	3	4	0	1	2	3	4
14. ***Music therapy***	0	1	2	3	4	0	1	2	3	4
15. ***Naturalistic interventions***	0	1	2	3	4	0	1	2	3	4
16. ***Peer-mediated instruction/intervention***	0	1	2	3	4	0	1	2	3	4
17. ***Picture Exchange Communication System (PECS)™***	0	1	2	3	4	0	1	2	3	4
18. ***Play Therapy***	0	1	2	3	4	0	1	2	3	4
19. ***Prompting***	0	1	2	3	4	0	1	2	3	4
20. ***Reinforcement***	0	1	2	3	4	0	1	2	3	4

21. ***Response interruption/Redirection***	0	1	2	3	4	0	1	2	3	4
22. ***Scripting***	0	1	2	3	4	0	1	2	3	4
23. ***Self-management***	0	1	2	3	4	0	1	2	3	4
24. ***Sensory diet/ Sensory Integration***	0	1	2	3	4	0	1	2	3	4
25. ***Sensory rooms/ Snoezelen and sensory equipment***:	0	1	2	3	4	0	1	2	3	4
26. ***Sign Language Instruction (e.g., Lámh)***	0	1	2	3	4	0	1	2	3	4
27. ***Social narratives/Social stories***	0	1	2	3	4	0	1	2	3	4
28. ***Social skills training groups***	0	1	2	3	4	0	1	2	3	4
29. ***Structured play groups***	0	1	2	3	4	0	1	2	3	4
29 ***Speech and Language Therapy Programmes***:	0	1	2	3	4	0	1	2	3	4
30. ***Speech Generating Devices and other Alternative and Augmentative Communication (AAC)***	0	1	2	3	4	0	1	2	3	4

31. ***Task analysis***	0 1 2 3 4	0 1 2 3 4
32. ***Technology-aided instruction***	0 1 2 3 4	0 1 2 3 4
33. ***TEACCH***	0 1 2 3 4	0 1 2 3 4
34. ***Time delay***:	0 1 2 3 4	0 1 2 3 4
35**. *Traditional teaching methods***	0 1 2 3 4	0 1 2 3 4
36. ***Video modelling***	0 1 2 3 4	0 1 2 3 4
37. ***Visual supports***	0 1 2 3 4	0 1 2 3 4

Evidence Based Practice Attitudes Scale

The following questions ask about your feelings about using new types of interventions. **Manualized intervention refers to any intervention that has specific guidelines and/or components that are outlined in a manual and/or that are to be followed in a structured/predetermined way**. Please circle indicating the extent to which you agree with each item using the following scale:

0	1	2	3	4
Not at All	To a Slight Extent	To a Moderate Extent	To a Great Extent	To a Very Great Extent

1. I like to use new types of interventions to help my students with Autism.	0	1	2	3	4
2. I am willing to try new types of interventions even if I have to follow an intervention protocol.	0	1	2	3	4
3. I know better than academic researchers how to teach my students with Autism.	0	1	2	3	4
4. I am willing to use new and different types of interventions developed by researchers.	0	1	2	3	4
5. Research based interventions are not useful in the classroom.	0	1	2	3	4
6. Teaching experience is more important than using manualized interventions.	0	1	2	3	4
7. I would not use manualized interventions.	0	1	2	3	4
8. I would try a new intervention even if it were very different from what I am used to doing.	0	1	2	3	4

For questions 9-15: If you received training in an intervention that was new to you, how likely would you be to adopt it if:

9. it was intuitively appealing?	0	1	2	3	4
10. it “made sense” to you?	0	1	2	3	4
11. it was required by your principal?	0	1	2	3	4

12. it was required by a professional, e.g. NEPS/ HSE team.	0	1	2	3	4
13. it was a new policy required by the Department of Education?	0	1	2	3	4
14. it was being used by fellow teachers who were happy with it?	0	1	2	3	4
15. you felt you had enough training to use it correctly?	0	1	2	3	4

Barriers to Behavioural Interventions

Please rate from 0 (not a problem) to 6 (extremely serious barrier) the following statements with relation to factors impacting on your ability to implement interventions with children with autism

	Not a problem ⟵					⟶ Extremely serious barrier
Lack of principal support	0	1	2	3	4	5	6
Lack of time to devise interventions	0	1	2	3	4	5	6
Lack of time to investigate/research interventions	0	1	2	3	4	5	6
Lack of training on interventions	0	1	2	3	4	5	6
Ineffectiveness of previous interventions	0	1	2	3	4	5	6
Lack of materials	0	1	2	3	4	5	6

Lack of time to implement interventions	0	1	2	3	4	5	6
Demand to perform nonteaching duties	0	1	2	3	4	5	6
Lack of communication with parents	0	1	2	3	4	5	6
Lack of training on children with autism	0	1	2	3	4	5	6
Comfort in working with children with autism	0	1	2	3	4	5	6
Lack of support from support professionals (e.g. occupational therapists, speech therapists, psychologists)	0	1	2	3	4	5	6
Think intervention will not work	0	1	2	3	4	5	6
Lack of time to identify student's needs	0	1	2	3	4	5	6
Level of autism symptoms (e.g. mild/ moderate etc)	0	1	2	3	4	5	6
Lack of training in research procedures	0	1	2	3	4	5	6
Lack of training in reading research	0	1	2	3	4	5	6
Inability of students to benefit from regular instruction	0	1	2	3	4	5	6
Class Size	0	1	2	3	4	5	6
Support staff lacking training	0	1	2	3	4	5	6

If you have any other thoughts on training and support for students with autism please write a short response here:

____
____
____
____
____

Thank you for your participation in this survey. Should you have any further questions, please contact:

Lorna Barry- lorna.barry@ul.ie

Dr. Jennifer McMahon- Jennifer.mcmahon@ul.ie

EHSREC (ethics)- ehsresearchethics@ul.ie

Appendix: Explanation of evidence based practices.

1. Antecedent-based Intervention*:* This intervention involves arranging events or circumstances that come before a challenging behaviour with the aim of reducing the behaviour.

2. Applied Behaviour Analysis (ABA): interventions derived from the principles of behavioural psychology.

3. Cognitive behavioural interventions (CBI): Instruction on management or control of cognitive processes that lead to changes in overt behaviour.

4. Developmentally-Based (e.g., Floor time DIR/Greenspan): Interventions that involve a combination of procedures that are based on developmental theory and emphasise the importance of building social relationships.

5. Differential reinforcement (DRA/I/O/L): Behaviourally based strategies that focus reinforcement on alternative, incompatible, other, or lower rates of the interfering behaviour in order to replace it with more appropriate behaviour.

6. Discrete trial teaching: One-to-one instructional strategy that teaches skills in a planned, controlled, and systematic manner.

7. Exercise: These interventions involve an increase in physical exertion as a means of reducing problems behaviours or increasing appropriate behaviour.

8. Extinction: Behaviourally based strategy that withdraws or terminates the reinforcer of an interfering behaviour to reduce or eliminate the behaviour.

9. Facilitated Communication: This intervention involves having a facilitator support the hand or arm of an individual with limited communication skills, and guiding their hand to help the individual express words, sentences, or complete thoughts by using a keyboard of words or pictures or typing device for the individual.

10. Functional Behaviour Assessment: A systematic approach for determining the underlying function or purpose of behaviour.

11. Functional communication training: A systematic practice of replacing inappropriate or ineffective behaviour with more appropriate or effective behaviours that serve the same function.

12. Intensive interaction: Interventions designed to work on interaction abilities, e.g. eye contact, facial expression, etc.

13. Modelling: This intervention involves demonstration of a desired behaviour with the aim of teaching it through imitation by the learner. This strategy is often combined with reinforcement and prompting.

14. Music therapy: These interventions seek to teach individual skills or goals through music.

15. Naturalistic interventions: Strategies that closely resemble typical interactions and occur in natural settings, routines and activities.

16. Peer-mediated instruction/intervention: Strategies designed to increase social engagement by teaching peers to initiate/maintain interactions.

17. Picture Exchange Communication System (PECS)™: A system for communicating that uses the physical handing over of pictures or symbols to initiate communicative functions.

18. Play Therapy: a Psychotherapeutic approach to helping a child cope in their world through natural expression.

19. Prompting: Behaviourally-based antecedent teaching strategy.

20. Reinforcement: Behaviourally-based consequence teaching strategy.

21. Response interruption/Redirection: Physical prevention or blocking of interfering behaviour with redirection to more appropriate behaviour.

22. Scripting: This involves a script (verbal/written description about a specific skill or situation) being practiced repeatedly as a model for the learner to later use in the actual situation.

23. Self-management: A method in which learners are taught to monitor, record data, report on, and reinforce their own behaviour.

24. Sensory diet/ Sensory Integration: This intervention uses a personalised activity plan that provides the sensory input throughout the day.

25. Sensory rooms/ Snoezelen and sensory equipment: This involves the use of a range of sensory experiences to meet an individual's sensory needs. Equipment may include manipulatives/ weighted vests/ brushes.

26. Sign Language Instruction (e.g., Lámh): the direct teaching of sign language as a means of communicating.

27. Social narratives/Social stories: Written narratives that describe specific social situations in some detail, aimed at helping the individual to adjust to the situation or adapt their behaviour.

28. Social skills training groups: Small group instruction with a shared goal or outcome of learned social skills in which participants can learn, practice, and receive feedback.

29. Structured play groups: small group activities characterised by their occurrences in a defined area and with defined activities.

30. Speech and Language Therapy Programmes: Including programmes such as : Hanen (more than words), Black Sheep Press, No Glamour Language.

31. Speech Generating Devices and other Alternative and Augmentative Communication (AAC): The use of high tech (e.g., electronic portable devices) and/or low tech (e.g., picture boards or books) aids that are used to teach the learner to communicate.

32. Task analysis: Behaviourally-based antecedent teaching strategy that breaks down steps and links them for prompting.

33. Technology-aided instruction: Instruction or interventions where technology is the main feature supporting goal acquisition.

34. TEACCH: individual classroom instruction designed to accommodate learning styles characteristic of autism spectrum disorders.

35. Time delay: Behaviourally based antecedent teaching strategy that promotes errorless learning.

36. Traditional teaching methods: teaching as normal in a classroom setting. Commonly used teaching methods may include class participation, demonstration, recitation, memorisation or combinations of these.

37. Video modelling: Utilises assistive technology as the core component of instruction and allows for pre-rehearsal of the target behaviour or skill via observation.

38. Visual supports: Tools that enable a learner to independently track events and activities.

Appendix F.

STROBE cross sectional guidelines- Paper 4; Chapter 5.

		Reporting Item	Page Number
Title and abstract			
Title	#1a	Indicate the study's design with a commonly used term in the title or the abstract	1
Abstract	#1b	Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background / rationale	#2	Explain the scientific background and rationale for the investigation being reported	3-7
Objectives	#3	State specific objectives, including any prespecified hypotheses	7
Methods			
Study design	#4	Present key elements of study design early in the paper	7
Setting	#5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	8
Eligibility criteria	#6a	Give the eligibility criteria, and the sources and methods of selection of participants.	8
	#7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	11
Data sources / measurement	#8	For each variable of interest give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group. Give information separately for exposed and unexposed groups if applicable.	8-12
Bias	#9	Describe any efforts to address potential sources of bias	NA

Study size	#10	Explain how the study size was arrived at	7
Quantitative variables	#11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen, and why	11
Statistical methods	#12a	Describe all statistical methods, including those used to control for confounding	11
Statistical methods	#12b	Describe any methods used to examine subgroups and interactions	11
Statistical methods	#12c	Explain how missing data were addressed	11
Statistical methods	#12d	If applicable, describe analytical methods taking account of sampling strategy	NA
Statistical methods	#12e	Describe any sensitivity analyses	11
Results			
Participants	#13a	Report numbers of individuals at each stage of study—e.g. numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed. Give information separately for exposed and unexposed groups if applicable.	7
Participants	#13b	Give reasons for non-participation at each stage	NA
Participants	#13c	Consider use of a flow diagram	NA
Descriptive data	#14a	Give characteristics of study participants (e.g. demographic, clinical, social) and information on exposures and potential confounders. Give information separately for exposed and unexposed groups if applicable.	7
Descriptive data	#14b	Indicate number of participants with missing data for each variable of interest	NA
Outcome data	#15	Report numbers of outcome events or summary measures. Give information separately for exposed and unexposed groups if applicable.	12-16
Main results	#16a	Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (e.g., 95% confidence interval). Make clear which	18-19

		confounders were adjusted for and why they were included	
Main results	#16b	Report category boundaries when continuous variables were categorized	NA
Main results	#16c	If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	NA
Other analyses	#17	Report other analyses done—e.g., analyses of subgroups and interactions, and sensitivity analyses	19
Discussion			
Key results	#18	Summarise key results with reference to study objectives	20
Limitations	#19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias.	22
Interpretation	#20	Give a cautious overall interpretation considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence.	23
Generalisability	#21	Discuss the generalisability (external validity) of the study results	23
Other Information			
Funding	#22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	Title page