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Effectiveness of Applied Behavioral Analysis for Toddlers with Autism: A Scoping Review

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The rise in the number of diagnosis of autism spectrum disorders (ASDs) has produced an increased number of studies and awareness among these groups of disorders. Although there are numerous treatment options available, the families and caregivers for individuals along the ASD spectrum have difficulty finding appropriate support and direction for these individuals with disabilities.

The purpose of this review is to assess literature on Applied Behavioral Analysis (ABA) treatment methods and whether it can meet the needs of young children with ASD. This paper used scoping review as a research method as this provides a broad overview of the research evidence available. Inclusion and exclusion criteria was set to address the review objectives. Studies underwent selection through PRISMA flow process and data collected was then quality was assessed through Joanna Briggs Institute (JBI) Critical Appraisal Tools in this review. The results of included studies were narratively summarized and the research questions were narratively responded.

The results showed that studies reviewed confirmed ABA was effective but had various degrees of success dependent on each individual. Certain studies concluded that ABA is appropriate for toddlers with ASD, but is still recommended for early detection in order to treat the problem at the onset. Furthermore, it is suggested that ABA be used in conjunction with other treatments in order to produce more impressive and definitive outcomes. Further studies are needed to determine the best treatment options for toddlers with ASD.

Keywords	autism, Applied Behavioral Analysis, ABA, toddler, young children, preschoolers, early childhood, Autism Spectrum Disorder, ASD

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1. Introduction

The rise in the number of diagnosis of autism spectrum disorders (ASDs) has produced an increased number of studies and awareness among these groups of disorders. Autism is one of the most recognizable and accurately recognized developmental disorders. (Jensen & Sinclair 2002; Volkmar et al. 1994.) The level of impairment among individuals with ASD is fluctuating, but the repercussion on affected individuals and their families is generally impactful (Newschaffer et al. 2007). Presently, the most effective treatments are behavioral, developmental or some integration therein (Butter, Wynn & Mulick, 2003; Kasari, Freeman & Paparella 2006). Although there are numerous treatment options available, the families and caregivers for individuals along the ASD spectrum have difficulty finding appropriate support and direction for these individuals with disabilities (Melrose, Dusome, Simpson, Crocker & Athens 2015). There is no single treatment across the full spectrum of this disorder and no single correct approach that improves overall functioning and lessens the problematic or intrusive manifestations of this affliction. There is neither a cure nor proven cause for autism to all children. (Fani-Panagiota 2015.)

Applied Behavioral Analysis (ABA) is frequently mentioned as a treatment option that produces significant improvement and aims to teach new skills and mitigate specific problem behaviors by reinforcing desirable behavior and there is a potential to provide high-quality early intervention. However, in the treatment of children, analysis of this approach is essential to determine the evident capacity of applied behavioral analysis in autism. (Jensen & Sinclair 2002.) Moreover, the use of ABA principles by therapists consistently with specialized training on children with autism are considered to be the most crucial component for the success of treatment (Klintwall, Gillberg, Bölte & Fernell 2012). One of the benefits of the ABA intervention plan is the participation of parents, which allows for a more intense approach in the relaxed home setting (Fernandes & Amato 2013). In addition, there are more optimistic outcomes for people with autism spectrum disorder (ASD), in conjunction with the advances in the fields of applied behavior analysis, along with developmental psychopathology, neurobiology, genetics, cognitive and affective developmental neuroscience (Dawson 2008). In some of the studies, such as Lovaas (1987), McEachin (1993), Harris (1991) and Fernell et al. (2011) presented, ABA displayed affirmative outcomes in cognitive, adaptive, educational and language results compared to other treatment programs and likewise produced compelling conclusions including methodology that are robust to the majority of its studies (Fani-Panagiota 2015).

According to Harris & Delmolino (2002), some research indicates that using ABA methods by means of prompt and intensive treatment provide for a significant number of children to achieve normal intellectual functions and participate into mainstream education thus, the techniques of applied behavioral analysis (ABA) are effective in altering the developmental trajectory of some very young children with autism. But these studies alone cannot determine the effectiveness of such treatment especially for early treatment of this disorder that is so vital at the onset. The purpose of this review is to assess literature on ABA treatment methods and determine what ABA can do to impact these young children with ASD and whether ABA is effective in treating their conditions compared to other treatments available.

2. Theoretical background

2.1. Autism Spectrum Disorders

Autism Spectrum Disorder (ASD) refers to a group of disorders marked by impaired social behavior, communication, and vocabulary, as well as a limited set of behaviors and habits that are both specific to the person, done repeatedly. Epilepsy, depression, anxiety, and Attention Deficit Hyperactivity Disorder (ADHD) are common co-occurring disorders in people with ASD. Individuals with ASDs have a wide range of intellectual abilities, ranging from severe disability to exceptional abilities. (WHO 2021.) ASD is a prevalent condition that affects one out of every 68 girls, and one out of every 42 boys, according to the Centers for Disease Control and Prevention (CDC). Scientists are not sure what causes autism, but it is well agreed that it is a multifactorial disease in which biology and climate play a synergistic function (Srinivas 2019). Since the meanings and diagnostic criteria for ASD differ greatly between trials, the conclusions are difficult to compare or aggregate, resulting in inconsistent evidence. The several differences that must be understood include improvements in the understanding and what can be found within the autism spectrum (Fernandes, De La Higuera-Amato, Cardoso, Navas & Molino-Avejonas 2015).

2.1.1. Etiology, epidemiology and diagnosis

Worldwide, it is approximated that one in 160 children has ASD (WHO 2021). ASD has no known cause so far. Autism is yet to be linked to a single cause, according to researches. While the precise cause of autism is yet to be determined, much progress has been made in linking some of the developmental and biologic pathways that are

thought to be involved, including environmental and genetic factors (Jensen & Sinclair 2002). The prevalence of ASD continues to be growing worldwide, according to epidemiological surveys undertaken over the last 50 years. This apparent increase may be due to a variety of factors, including increased recognition, expanded diagnosis criteria, enhanced diagnostic equipment, and improved reporting. (WHO 2021.) The US Surgeon General and the US Department of Health and Human Services, together with many professional organisations, recommends that all children be screened for autism, especially those who are considered to be at risk, should receive medical evaluations (Jensen & Sinclair 2002). Tools used for screening autism are: (a) Autism Diagnostic Interview-Revised (ADI-R) - a gold standard diagnostic tool. (b) Autism Diagnostic Observation Schedule (ADOS) - also one of the gold standards in screening towards autism. (c) Childhood Autism Rating Scale (CARS) - symptom-based scopes that are also valid when used by experienced users, to classify co-morbid disorders, devise clinical diagnosis, prioritize areas of disability, and offer data-supported care guidelines, a mixture of physical, developmental, and behavioral information is required. (Jensen & Sinclair 2002.) The scale was made for children above the age of two, and it takes between 20 to 30 minutes to complete. It involves preparation to administer this procedure. It's the strongest, well-documented, and commonly used professional rating scale for autism. (Johnson & Myers 2008.) Intervention in early childhood is critical for people with ASD to achieve optimum development and well-being. Child growth should be monitored as part of normal maternal and child health care. When diagnosed, it's critical that children with ASD and their families receive appropriate information, resources, referrals, and meaningful assistance tailored to their specific needs. While there is no proven solution for ASD, evidence-based psychosocial approaches, such as therapeutic treatments and skills training services for parents and other providers, can help people with ASD communicate more effectively and improve their quality of life. (WHO 2021.) With its multidisciplinary richness, the Early Intervention setting is the perfect setting for containing and educating a family, as well as establishing a healthy relationship with the goal of developing a child's skill. The following objectives should be pursued by early detection programs: Interdisciplinary early evaluation, creation and execution of specific prevention plans, use of effective tools and strategies, and communication and interrelationships with all health, educational, and social services affecting the child and his or her family are all important (Cervera, Romero, Mas & Delgado 2011). The goal of collaborating with the family and coordinating the efforts of the people who work with ASD is to increase the quality of life for each family member and the family system as a whole. The purpose of parental participation in therapies is based on the idea that neuropsychological progress is influenced by the environment (Rojas-Torres, Alonso-Esteban & Alcantud-Marin 2020).

2.1.2. Symptoms and effects to young children and families

Interpersonal abilities, mental or affective behavior, and intellectual functioning are all affected in different degrees by this psychiatric condition. However, one of the most common symptoms of the condition is a difficulty or weakness in the capacity to develop and respond to words. (Secan, Egel, & Tilley 1989.) Many children with autism may not learn vocabulary, while some show irregular speech patterns such as echolalia, or the imitation of what they have heard. The tone of their voice is often bland and unexpressive. Mental impairments exacerbate language problems. Autism causes them to be unresponsive to others, refuse to make eye contact and lack social signals including facial, auditory, postural, and gestural responses. (Gena, Krantz, McClannahan & Poulson 1996.) Delays and impairments in the growth of social cognition and social skills can influence a child's early development in a variety of ways. (Jensen & Sinclair 2002) Stereotypic habits, self-stimulatory behaviors, self-injurious behaviors, repetitive behavior, preoccupation with certain items or subjects, agitation, inflexibility in patterns, and over-sensitivity of sensory stimulation are also typical symptoms of these conditions (Schoen 2003). ASDs will severely restrict a person's ability to carry out everyday tasks and engage socially. ASDs frequently have a negative impact on a person's professional and social achievements, as well as job prospects (WHO 2021).

Although some people with ASD may live comfortably, others have serious disabilities and may need lifelong treatment and support. People with ASDs and their families also face severe social and financial hardships as a result of these conditions. Caring for children with a serious type of the disorder can be difficult, particularly where care and resources are lacking. As a result, caregiver empowerment is becoming more widely understood as a vital aspect of caring for children with ASD (WHO 2021). Complications of autism include co-morbid medical diagnoses seen in 15% to 37% of people with autism, and developmental anomalies seen in 5% to 14% of people with autism, that further complicates the condition (Jensen & Sinclair 2002; Gillberg & Coleman 1992; Rutter, Bailey, Bolton & LeCouteur 1994). ASD typically costs a family in the US about an average of $60,000 a year. Early detection and prevention will help save money on long-term care. Raising adolescents with ASD is expected to cost 4.1 to 6.2 times more than, raising adolescents without the condition. (Autism Speaks 2017.)

2.2. Treatment options for ASD

One of the greatest challenges for the public health response to autism is providing access to evidence-based care. By recognizing the need to create or strengthen these responses, according to WHO. Health-care programs that include all people with dis-

abilities, mental illnesses, and developmental delays as such in, Resolution WHA65.4 is in line with the Convention on the Rights of Persons with Disabilities' campaigns (WHO 2021).

Here are some of the commonly used regimens used to treat individuals with autism: (a) Occupational Therapy (OT) - used to treat the sensory processing problems involved with ASD; (b) Speech Therapy - aims to develop a person's coping abilities, helping him to properly articulate his desires or wishes. (Paul 2008.) Assist in the teaching of fine-motor skills like dressing, using utensils, cutting with scissors, and printing; (c) Physical therapy (PT) aims to enhance gross motor skills and address sensory integration problems, particularly those affecting a person's ability to feel and be mindful of his body in space; (d) Medications - tend to alleviate some of the behavioral manifestations of ASD, such as irritability, agitation, and self-injurious behavior and (e) Behavioral Interventions - based on Applied Behavioral Analysis (ABA), they are designed according to age and symptoms to lessen the effect of the key characteristics and related deficits of ASD and to optimize functional freedom and quality of life. (Autism Science Foundation 2021.)

2.2.1. Applied Behavior Analysis

The science of integrating what has been learnt from behavior analysis to explain the causal interaction between behavior and environments is known as Applied Behavioral Analysis (ABA). This approach works regardless of etiology or "cause" and develops approaches to change established behaviors. As a result, data from behavior analysis is used to alter behavior in a structured and purposeful manner. It uses learning concepts originating from behavioral psychology to help people improve their behavior in a systematic way. ABA promotes positive behaviors while discouraging negative ones. ABA also introduces new skills and allows them to be applied to new scenarios (Jensen & Sinclair 2002).

2.2.1.1. Types of Applied Behavioral Analysis

There are several different types of ABA that can help children with autism and reinforce positive behaviors and teach new skills. These types depend on the individual conditions and needs that provide lasting gains to the patient. (1) Early Intensive Behavioral Intervention (EIBI), a form of ABA for children with ASD who are under the age of five, and sometimes under the age of three. (2) Pivotal Response Training (PRT) is another form of ABA that aims to improve a child's desire to learn, as well as his ability to control his own behavior and facilitate contact with others. (3) Discrete Trial Teaching, which is ABA’s common form. Tasks are broken down into smaller chunks, and

each one is taught with prompts and incentives. Prompts and incentives are then gradually phased out. (4) The Lovaas Model, which incorporates ABA strategies into an early intervention curriculum, consists of 20-40 hours of highly planned, discrete trial instruction. The intervention usually starts when the child is between the ages of 2 and 8, and ends when the child is 12 years old. To inspire and reward performance, the technique employs child-specific encouragement. In addition, the teaching paradigm requires the use of vocabulary and imitation. (5) Early Start Denver Model (ESDM), is an autism-specific early intervention program for babies, toddlers, and preschoolers aged 12 to 48 months. It is the first experimentally validated early-intervention program for children with autism as young as 18 months old, established by Geraldine Dawson, Ph.D., and Sally Rogers, Ph.D. ESDM. It is an early intervention program that uses ABA standards. Interventions are delivered within play-based, relationship-focused routines, similar to Pivotal Response Training. The plan "resulted in substantial changes in IQ, vocabulary, adaptive behavior, and autism diagnosis", according to studies examining its effectiveness. (Autism Science Foundation 2021.)

2.2.1.2. Goals and efficiency of ABA

Heflin and Simpson (1998) offer a comprehensive review of autism treatments for children and adolescents, including psychoanalytic, medical, developmental, and behavioral methods. To parents and caretakers, this is both confusing and overwhelming. According to research, ABA improves standardized test scores for this group of pupils (Rosenwasser & Axelrod 2001). And the most successful strategy for autistic children, according to experts, is to use an aggressive intervention delivered in high doses (Schreibman 2000). According to Jensen & Sinclair ’s (2002) research, ABA has repeatedly shown important benefits, such as a general improvement in functional abilities and cognitive capacity, as well as a reduction in autism symptoms. Lovaas (1987) discovered that about half of the treated participants achieved substantial results after 2 to 3 years of intervention and had sustained these benefits at a 7-year follow-up in the most well-controlled and followed study. The evidence showed that even though these people were not “cured,” upon closer inspection, all of them were indistinguishable from their peers. The introduction of ABA is especially important for people with autism because it is the only mode of teaching that has consistently demonstrated changes in the disorder's core symptoms. (Dempsey & Foreman 2001.) And finally, language learning, self-help skills, vocational skills and everyday life skills all improved because of ABA (Grindle & Remington 2002; Snell 1978). The goal of ABA method is to alter behavior in order to improve and increase socialization, communication, and overall adaptive functions (Jensen & Sinclair 2002). In each phase of actions with close evaluation and positive reinforcement, or prompting (Simpson 2001), ABA is able to

make big improvements in standardized IQ, expression, and adaptive behavior measures (Hayward, Gale & Eikeseth 2009).

Here are the five (5) steps in the ABA process: The behavior needs to be measured first. The desired behavior change should be detectable and quantifiable. The measurement of behavior, should be followed by planning and monitoring and based on daily target responses. The next step is to ensure that systematic procedures are followed, those protocols can then be repeated to change the behavior. The fourth would be recording of data on the individual level, graphing the progress. And then lastly, interventionists should demonstrate that the findings were collected in a scientifically supervised way in order to exhibit that the method was responsible for the improvement in behavior. (Snell 1978.)

3. Research aim, purpose and research questions

The study process started in August 2020 by choosing the topic, research questions and the study method. This author had some actual experience dealing with ASD in his personal and professional life. The author worked on different levels and sectors of the healthcare industry. He had almost a decade of experience in the pharmaceutical industry. In the author's job as a medical sales consultant, the author would constantly encounter such peculiar behaviors. In his free time, the author volunteered in the Red Cross of the Philippines. During which, the author would sometimes work with adolescent teens and adults with autism in a place called "The Chosen Children Village" in the Philippines. There the experience has shown him some gaps in treatments related to ASD that were prominent. It led to a question in the author's mind to determine a solution. Finland has a national guideline concerning the treatment and support of individuals with Autism. But there are also shortcomings in clarity on treatment to be used and recommendations for health care professionals on which treatments are the most ideal. Since time and resources are of utmost importance. It is essential to determine the best course of action on the onset of screening and validation of autism disorders.

The aim of the review is to find evidence about the use of Applied Behavioral Analysis (ABA) as an effective treatment for young children with Autism spectrum disorders (ASD).

This Master's thesis' purpose is to review literature that shows efficiency of ABA for young children and evaluate these studies, whether these studies showed enough strong evidence to support the improvement of ASD in young children.

(P):population; (I): intervention; (C): control and (O): outcomes

The research questions for the scoping review are:

1. What can ABA early treatment do to impact young children with ASD?

   P= young children, 12 months to 5 years old

   I = Applied Behavior Analysis (ABA)

   C= (-) none

   O= impact on ASD symptoms to decrease symptoms and negative behavior?

2. How effective ABA is in the treatment of ASD of young children compared to other treatment options available?

   (P)= young children, 12 months to 5 years old

   (I) = Applied Behavior Analysis (ABA)

   (C) = Other behavioral ASD treatments

   (O) = produce effective results

4. Research methods

It is crucial to determine the research question. A research question serves as a road map for the rest of the process. Relevant aspects of the query must be described precisely since they affect strategies for searching. The results on a scoping research are generally address a wide range of topics. Next, it is needed to identify relevant studies. Identifying applicable studies as well as creating a plan for where to look, what keywords are going to be used, which references to search for, what period of time, and of course, which languages to include are all part of this decision. In a query, comprehensiveness and breadth are essential. Electronic directories, reference lists, hand searching of main publications, associations and conferences are all good places to start. The search's breadth is essential, but so is the search's practicalities. Time, schedule, and costs are all possible restricting variables, and choices on how they will affect the search must be taken ahead of time. Study selection should also take part in the present study. (Sucharew and Macaluso 2019.)

4.1. Scoping review as a research method

The research will be made as a scoping review. (Figure 1). This graph was adopted from the University Libraries graph, representing scoping review's standing in evidence based research (University Libraries 2021). It is a more recent approach to proof synthesis that differs from systematic analysis in terms of meaning and objectives with a medium level of confidence. The aim of this is to provide a broad overview of the research evidence available without providing a concise response to a specific research issue. Scoping reviews may be helpful for addressing general questions like "What evidence has been provided on this subject in the literature?" as well as collecting and evaluating data before doing a systematic summary of the studies. (Munn, Peters, Stern & Tufanara 2018.) Scoping reviews summarize current literature and other sources of evidence, and they often contain results from various research designs and procedures. The vast reach of the data makes formal meta-analytic approaches difficult, if not impossible, to apply. The scope of content found is often the subject of a scoping review, and quantitative evaluation is often limited to a count on how many publications cover a particular topic or recommendation. Systematic description, on the other hand, often pick knowledge sources by requiring particular study forms, such as randomized controlled trials, and applying consistency criteria, such as satisfactory allocation concealment, and focusing on data synthesis to answer a specific study query. The synthesis part of a systematic review also takes the form of a meta-analysis, in which the findings of various experimental reviews are compiled to develop a summarized hypothesis, such as a general impact estimation, as well as an assessment of its variability through studies. (Davis, Drey & Gould 2009.)

Figure 1. Scoping review level of confidence graph.

4.2. Data search and databases

Search protocols were made in order to proceed with the study's review. Database search was used to identify journals, studies that are fitting to be scoped in the review. The databases used for literature search were: ProQuest Central, Science Direct, PubMed, Cinahl and Taylor & Francis, a publishers website online. They were chosen because they are important to the research question and provide information derived from medical, ethical, and technical studies in relation to the topic. In order to do successful authentic research, one must first conduct a literature search. It aids in the formulation of a research question and the study's planning. (Toronto & Remington 2020.) Because the amount of published data is vast, selecting appropriate articles that are relevant to the study is an important skill. Search terms were identified through synonyms and keywords to look for different databases. Search terms (Figure 2) used were "Title: autism AND Title/Abstract: Applied Behavioral Analysis, Title: autism or asd or autism spectrum disorder AND Abstract: applied behavior analysis or aba or applied behavior analysis AND All text: toddlers or preschoolers or early childhood, Document Title(TI): Autism AND Abstract(AB): Applied Behavioral Analysis AND Abstract(AB): children AND Document text(FT): toddlers, Title: autism AND Abstract: applied behavioral analysis AND Abstract: children, and Title: Autism AND Title, abstract, keywords: Applied Behavioral Analysis AND Children."

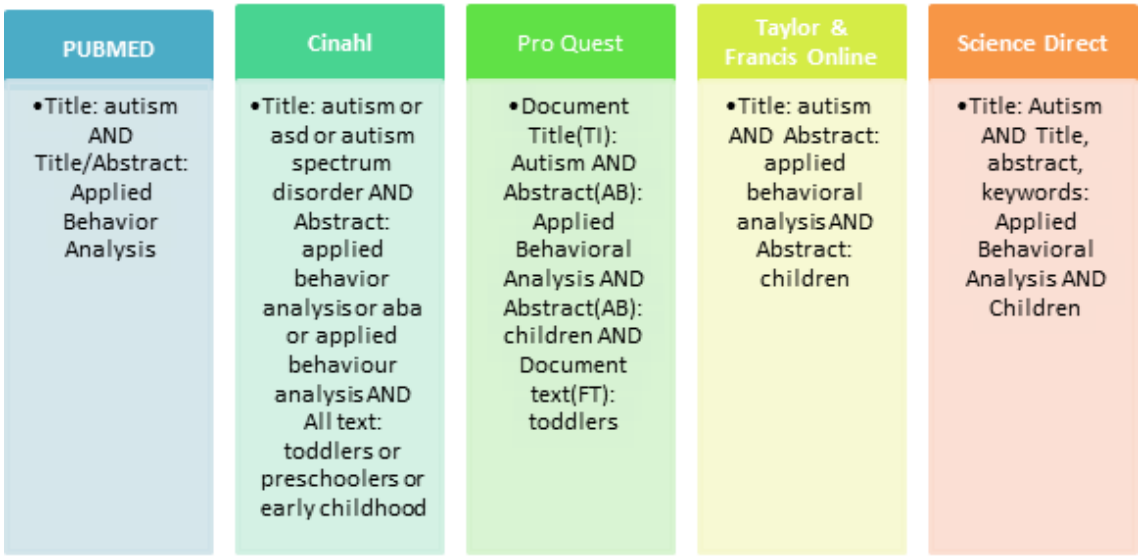

Figure 2. Data search from databases.

The six electronic databases yielded a total of 313 documents (Pubmed: 70, Proquest: 32, Taylor and Francis publishers database online: 74, CINAHL: 50, and ScienceDirect: 87), resulting in 311 titles and abstracts that were scanned after duplicates were removed. Following full-text reviews, additional publications were omitted for the purposes outlined in the flowchart (Figure 3). Moreover, to thoroughly review the said studies, several tools were used for screening, assessment and evaluation, such as the Joanna Briggs Institute (JBI) Critical Appraisal Tools. They were categorized based on the anchored research designs, tools were used for assessment and evaluation.

4.3. Inclusion and exclusion criteria

When creating high-quality testing protocols, establishing inclusion, same with exclusion requirements for sample subjects, is a routine and effective procedure. The target's most important characteristics of the demographic that the researchers would use to answer their study question are acknowledged as inclusion criteria. Inclusion criteria include demographic, clinical, and geographic factors. Exclusion criteria, on the other hand, are characteristics of potential research subjects that match the inclusion criteria but have additional characteristics that could jeopardize the study's effectiveness or increase the likelihood of a negative outcome. Exclusion criteria include characteristics that make people more likely to be lost to follow-up, skip scheduled data collection appointments, have misleading data, have comorbidities that may distort the study's findings, or increase their risk of adverse effects. (Patino & Ferreira 2018.)

When conducting a study or review, it is important that the author not only decide on the appropriate inclusion and exclusion criteria, but also consider how their decisions could impact the findings' external validity. These are the following examples of common inclusion and exclusion criteria mistakes: using the same variable to identify both inclusion and exclusion criteria; choosing variables as inclusion criteria that are unrelated to addressing the test question; and failing to describe main variables in the inclusion criteria that are used to make a point about the study results' external validity. The table (Table 1) below shows the Inclusion and Exclusion Criteria of the present scoping review.

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The following are examples of common inclusion and exclusion criteria mistakes: using the same variable to identify both inclusion and exclusion criteria; choosing variables as inclusion criteria that are unrelated to addressing the test question; and failing to describe main variables in the inclusion criteria that are used to make a point about the study results' external validity.

INCLUSION CRITERIA	EXCLUSION CRITERIA
• Age specific to toddlers (5 years old and below) • Applied Behavioral Analysis therapy • Language: English • Research articles specific to Applied Behavioral Analysis as treatment for Autism Spectrum Disorder • Articles with abstract • Articles dated from year 2000 up to the present	• Age: 7 years old and above • Other therapies not related to Applied Behavioral Analysis • Non - academic Journals.

The table above shows the Inclusion and Exclusion Criteria of the present scoping review.

Table 1. Inclusion and exclusion criteria

It is critical to pay attention and to be precise with the data quest and the accuracy of the selected studies in order to ensure the reliability of this literature review. It's also

crucial to pay attention to the publication dates of the publications you've selected so that the literature review is current and contains the most recent findings.

Scoping reviews seek to provide an outline of the available data, while systematic reviews report on the implementation of reliable clinical guidelines and recommendations. As a result, most scoping analyses do not have a consistency evaluation of the literature. (Peters et al. 2020.) This is also a requirement by Metropolia University of Applied Sciences that added an evaluation of source content to its master's degree criteria.

4.4. Quality assessment

Joanna Briggs Institute (JBI) Critical Appraisal Tools are assessment tools that were used to evaluate the quality of studies to be reviewed. It has checklists for systematic reviews and research synthesis, qualitative research and quasi-experimental studies. As a result, the final data acquisition, content assessment and appraisal ensued a total of 19 studies. The aim of this assessment is to create deliberate actions that enable researchers to participate actively in the development of healthcare quality and delivery methods. The findings of this evaluation will then be used to help settle conflicts among researcher and uphold the high standards of quality in the creation of studies, subsequently decreasing the “risk of bias”. (Joanna Briggs Institute 2017.) Scoring is commonly used in quality assessment checklists. Scoring was applied, In order to make results of the JBI quality assessment straightforward, percentages were added for the comparison of the quality between different studies, which would be apparent. (The quality of the included systematic reviews were mainly moderate to high (82%-100%; mean 92%), although the quality of the evidence in some studies were assessed to be low due to uncertain nature of the study designs or combination of lack of strength in criteria set by JBI, therefore excluded from the final sources for review. And regarding qualitative research (mean 100%) and JBI Quasi-experimental studies (mean 100%), with one study scoring 59% and subsequently being excluded from the pool of sources. Nonetheless, the strength of study designs increased, as well as the in-depth understanding of the topic.

4.5. Summary of research method

After the selection of research topic and title for the review. The type of research and methods to be used were decided, following the aims and purpose of the intended research. Next, the research questions and its parameters were determined. Subse-

quently, inclusion together with exclusion standards are selected in choosing studies to be admitted to the review. These standards are dependent on the specificity of the study issue as well as new knowledge gained by reading the reports. Furthermore, it is needed to chart the data well, in order to increase the quality of the research. To collect data from each database, the PRISMA method for data charting is created and utilized. To derive qualitative or process-oriented knowledge from each sample, a narrative summary approach was used. After results gathering, summarizing of results wasdone in order to narratively respont to the research questions. And finally, a broad summary was ensued to derive conclusion to the reviews made. Tables and maps are used to provide a numerical description of the scope and purpose of studies. Assessment of quality of studies were included, using the Joanna Briggs Institute (JBI) Critical Appraisal Tools. When it comes to disclosing data, clarity, accuracy and ethical considerations are to be prioritized (Levac, Colquhuon & O'Brien 2010).

5. Results

The results of the data check yielded a total of 313 references. After excluding duplicates, 311 possible sources remained for further review. The titles and abstracts were first screened for relevance, resulting in a reduction to 31 references. Moreover, the full texts were screened, producing 24 references that were examined, resulting in a final selection of 19 references. These sources were reviewed and narratively described after JBI evaluation methods was done. This thesis contained a total of 19 sources during the integration of results period. The most common explanations for denying papers were that they were duplicates of articles contained in other databases, that the topic was not the subject of this study, that the topic lacked detail rather than being precise, and/or that it was not directly related to the issue.

5.1. Description of the included studies

PRISMA is an evidence-based method of summarizing data collected in reviews produced and other forms of studies described narratively. It helped the author to improve the reporting of literature reviews and meta-analyses. On the other hand, it is not an actual quality assessment tool for validating the quality of a systematic review. (PRISMA 2015.) Thirteen of the 19 studies used in the study were systematic reviews, three qualitative studies, and three quantitative studies. Many of the studies were performed in the 2000s, with the majority of them beginning in 2003 and above, bringing the evidence up to date. The studies were mainly conducted and written in the United States, with the following numbers: USA (n=11), Korea (n=1), Europe (n=1), Ireland (n=1), the Netherlands (n=1), Australia (n=1), Spain (n=1), and the United Kingdom (n=2). De-

spite the fact that the research was conducted in various countries, the bulk of the researchers were primarily interested in applied behavioral analysis in relation to Autism spectrum disorder (Figure 3).

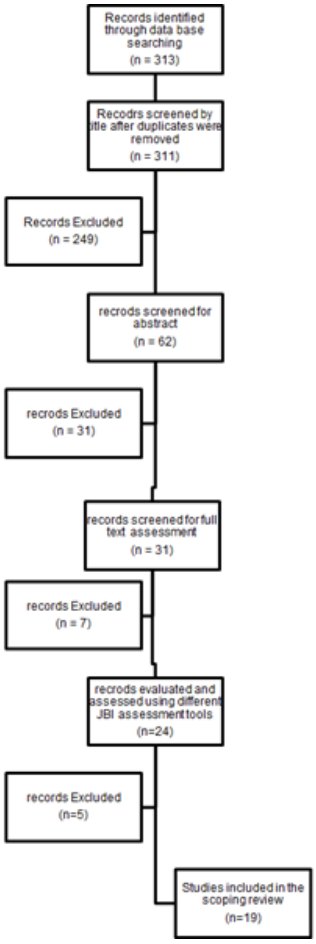

Figure 3. PRISMA data flow diagram.

5.2. Impact of Applied Behavioral Analysis to toddlers with Autism Spectrum Disorder

Most early comprehensive clinical modification interventions use applied behavior therapy as the foundation of their design. It aims to teach new skills by reinforcing positive habits, facilitating their generalization, and reducing negative behaviors. In a seminal report published in Lovaas (1987) based on the principles of applied behavior therapy, half of the patients referred to treatment were able to be placed in a neuro-typical classroom and complete first grade. Furthermore, a review of current and new clinical experiments with randomization and cohort studies was revised by the Agency for Healthcare Research and Quality in 2014. Bodies of research suggests that an inte-

grated behavior analysis-based early comprehensive behavioral intervention delivered over the course of time contributes to improvements in cognitive capacity, vocabulary, and adaptive skills (Sanchack & Thomas 2016: 976; Foxx 2005: 821; Goin-Kochel, Myers, Hendricks, Carr & Wiley 2007: 151). The ABA sector has seen even more dramatic progress with regards to the field of behavioral therapies with autistic children, just like evidenced in the growing industry of care providers, likewise trained experts in the area. There is proof that ABA works and has aided in the retention of knowledge over time, vocabulary and social responsibilities of autistic children since the mid-1980s (Yu, Li, Li & Liang 2020). Also, in both IQ and adaptive behavior tests, children with ASD who took part in Early Integrated Behavioral Intervention (EIBI), a branch of ABA, did better than those who underwent other treatments or therapy (Peters-Scheffer, Didden, Korzilius & Sturmey 2011: 65; Papatola & Lustig 2016: 139).

5.2.1. Impacts of the different types of Applied Behavioral Analysis to toddlers

ESDM stands for Early Start Denver Model, PECS stands for Picture Exchange Communication Systems, DTT stands for Discrete Trial Training, and PRT stands for Pivotal Response Treatment: are examples of ABA-based approaches that share a similar collection of core characteristics of PRT. All interventions have their own styles and delivery methods, but they all adhere to ABA standards. They have all been seen to be involved in various roles in ASD children. (Yu et al. 2020: 433; Denne, Hastings & Hughes 2017.) Most of the interventions being routinely studied as an intervention for Autism Spectrum Disorder in children is Early Integrated Behavioral Intervention (EIBI), which is focused on the concepts of cognitive behavioral analysis with regards to ASD. Several trials have shown that this therapy improves the emotional, linguistic, and overall functional coping of ASD children in some, though not all, cases (Goin-Kochel et al. 2007). Positive Behavioral Support (PBS) programs have been designed for particular age ranges and communities, while some have been developed to resolve specific concerns, such as connectivity. Furthermore, the teaching practices as seen in the Lovaas (1987) study (i.e., DTT) are specifically viewed as a single method of imparting information and new interventions focused on learning science use a range of strategies to assist in the teaching of crucial life skills. Natural Environment Teaching (NET), DTT, and Pivotal Response Training (PRT) are one of the examples of basic approaches in teaching that are usually used in EIBI. Alternatives to ABA are often classified, defined, and often sold as comprehensive instructional approaches and teaching strategies based on behavioral values. (Denne et al. 2017: 5; Newcomb & Hagopian 2018.) On the other hand, ABI, also known as Applied Behavioral Analysis Intervention (ABAI) or Intensive behavioral treatment (IBT), relies on the principle of applied behavioral analysis (ABA). Discrete trial training is a technique introduced by Lovaas (1987)

for teaching effective habits by mission decomposition into small discrete steps and training them in a structured and accurate manner. This method depends on the idea that ASD children have substantial impairment in communicating, and are unable to learn just by repetition, thus are unable to listen as much as their peers. (Spreckley & Boyd 2009: 339; Dillenburger, Keenan, Doherty, Byrne & Gallagher 2012.)

5.2.2. ABA in decreasing symptoms and negative behavior

More than half of children with autism were institutionalized, according to early estimates. Recent research has revealed marginally better outcomes. According to one small survey, adults with ASD and an IQ of at least 70, can likely live independently. A small number of children with an ASD diagnosis, who no longer follow medical requirements but still achieve normal cognitive function. These children receive the best possible results. Centered on the person-environment fit, these results show a higher proportion of good outcomes for patients with ASD. The person-environment fit was increased by increasing daytime leisure opportunities and group participation, resulting in higher levels of satisfaction. (Sanchack & Thomas 2016: 977; Blenner, Reddy & Augustyn 2011.) In regard to ABA, the therapy has a beneficial impact by reducing the targeted negative habits over time (Nunez-Rodriguez, Hernandez, Guzmán & Jiménez-Martinez 2017; Brunner & Seung 2009).

5.3. Effectivity of ABA towards young children among other treatment options for ASD

In the study by Yu, Li, Li and Liang (2020: 440-441), general ASD signs such as: reactive vocabulary, adaptive behavior, IQ, verbal IQ, nonverbal IQ, daily life skills, limited number patterns of actions, motor skills and cognition had few to no substantial improvents through ABA. However, socialization, connectivity, and descriptive expression had major results. Parental synchrony and empathy were also shown to be important in assisting mediators in improving the contact and ASD children's peer interactions, as well as the efficacy in improving children's social contact reciprocity with anyone. In some young children with autism trials of ABA methods, variants of early comprehensive behavioral intervention, as well as the early start Denver model, have increased academic development, verbal abilities and adaptive behavior skills (Blenner et al. 2011: 897; Hastings 2003). ABA is mostly adult-led, in contrast to developmental practical approaches, with therapists playing a key role in program management. It is usually provided in advanced nursery and school settings. Parents exhibit a key role in execution of interventions in a home-based environment, with the assistance of ABA practitioners. One advantage of having parents in therapies is that they will be invested by their role in their child's success. (Pasco 2018: 366; Nunez-Rodriquez et al. 2017.) It

has been shown that ABA teaching strategies have a positive effect on the learning of young children with autism. Hundreds of meticulous reviews of basic processes of improvement have been conducted on the implementation of ABA concepts to meet the needs of people who have autism over the last 30 years. Furthermore, it has been investigated through a number of global outcome trials, which indicate that certain children benefit significantly from this therapy during their childhood years. (Harris & Delmolino 2002: 16; Dawson & Bernier 2013.)

5.4. Other behavioral ASD treatments

Children with ASD who are older and have an average or above-average IQ, showed that cognitive behavior therapy significantly decreases depressive symptoms. Several other behavioral approaches were investigated in Sanchack and Thomas's (2016) research, however there was insufficient evidence of value. Early social networking skills have improved as a result of targeted games. Social skills instruction has been shown to enhance social skills and cognitive recognition in school-aged children without learning disabilities in the short term. Parent curriculum and instruction improves children's language skills and reduces aggressive behavior. More specifically, effects relevant to the three fields of dysfunctional functioning that characterize ASD, such as: coping skills; infant internalizing and externalizing attitudes; parent-child relationship and family well-being, should be evaluated. (Spreckley & Boyd 2009: 343; Shire & Kasari 2014.) Parents with autistic children are often involved in complementary and holistic therapies. Many of these therapies appear to alleviate symptoms, but only a handful have been thoroughly tested, and far fewer have been shown successful in a clinical trial. Melatonin is effective in the treatment of sleep disorders caused by autism, especially in improving sleep onset. Some therapies, such as chelation therapy, may, on the other hand, be directly dangerous, with case records of children with autism dying after undergoing chelation. Clinicians should be willing to explore these therapies with parents so that they can have adequate counseling and allow them to obtain more research if needed. (Blenner et al. 2011: 343.) Another intervention would be Developmental Pragmatic Approaches, it represents a wide variety of common and specialized programs focusing on how language and communication are supported in traditionally developing children. There is also a comprehensive environmental system that focuses on influencing different facets of the world to provide clearer insight about what is required of a person in any particular situation. Based on the study of Pasco (2018), about 50 common and specialized treatments for people with ASD are listed on the Research Autism website. Chemical, hormonal, mineral and nutritional therapies, as well as behavioral programs and other types of prevention, are among them. Others have been shown to be dangerous or highly detrimental, although some have no ap-

parent or common sense cause to be useful in the treatment of autism. Few prescription therapies, such as the use of methylphenidate to reduce hyperactivity and impulsivity, may be helpful for some of the symptoms involved with autism, However, there is no proof that the benefits exist of any pharmacological therapy in relation to the overall presentation of ASD. In addition, the study of Harris & Delmolino (2002: 15) stated other interventions or treatment, in Mand fluency training, where it entails delivering constant support for communicative actions and introducing the infant to an atmosphere rich in desired stimuli. There is also the Natural Environment Training (NET) which is the framework and environment in which verbal action language learning occurs. Lastly, Fluency, which is the philosophy that is a product of conditioning and learning concepts by constant repetition. (Harris & Delmolino 2002: 15.)

5.5. Effective results

According to Sanchack and Thomas (2016), a 2012 research looked at diagnostic stability as a prognosis indicator. In an over 8 to 10-year period, with repeat Autism tests, more than 80% of patients held improved symptom standards. Checks on the Diagnostic Observation Schedule indicate that only about 15% were seen to deteriorating ASD cases. The best predictors of potential function were the magnitude of the diagnosis and IQ rate. The mildest type of ASD was excluded from this study, resulting in a bias toward more extreme manifestations. Furthermore, it was discovered that in the long-term, systematic ABA-based approaches were helpful to children with ASD's lifelong growth. The findings of Virués-Ortega's (2010) research revealed that at long-term, in children with ASD, a systemic ABA-based intervention resulted in a positive-medium outcome to significant effects in terms of cognitive processing, language acquisition, daily life skill growth, and social functioning. Despite positive results across the board, language-related outcomes, nonverbal IQ and social functioning were outperformed by everyday life skills with impact sizes reaching 1.5 times for sensitive and articulate skills in language and conversation. For language and adaptation composite ratings, levels of overall patient hours revealed dose-dependent effect sizes. (Yu et al. 2020: 441.) In the study of Goin-Kochel et al. (2017), their research looked at archival records pertaining to a private ABA-based nursery that offered EIBI to autistic children. The findings of three separate tests stated that all children in a group should perform at least one ability area over time in order to master a skill. For certain children, these gains were important, but for others, they may be insignificant.

6. Discussion

As such, studies presented showed the efficacy of ABA for toddlers with autism. While older children with ASD will benefit from ABA preparation, it is more successful if treatment starts while the child is under the age of 5. It is essential to screen children during early age, especially those manifesting symptoms of this range of disorders, in order to immediately start appropriate treatments with the objective of improving symptoms and attenuate behaviors of Autism. The difficulty in selecting therapy for these young children rises from issues related to social, intellectual, language and coping deficiencies. ABA aids in the teaching of emotional, motor, and verbal habits, as well as reasoning abilities, especially in the management of difficult behaviors. ABA also provides a development and learning environment that can be extended to all aspects of teaching. The behavior is changed, affirmation strengthens and then maintains the behavior due to the effects of the treatment. Different types of ABA strategies mainly differ in methods used and mode in delivering treatment, but the goals and principles remain the same: to modify behavior through purposeful, structured and systematic approach. This should be done at home as well as in the classroom. For example: if a child is given a chore at home; the child will then be given a reward and if the child lifts his hand in class; the teacher will then pay attention to the child. Since there are so many adults vested into a child's everyday life, it's important to use therapeutic teaching to help each child achieve his or her full potential. Behavioral education follows a program that is tailored to the interests of the student. Each competence is broken down into its smallest component and implemented one at a time in active environments. Then the next sub-skill will eventually be added gradually.

ABA is not the same as a collection of prepared drills. Rather, each program is adapted to the learner's individual needs. The goal of every ABA program is to reach out to each individual to learn skills that will lead them to become more self-sufficient and to succeed in the short and long term objectives. Early systematic behavioral modification is a 25-hour-per-week, immersive outpatient care for children with ASD in nursery and early elementary education. Some early structured behavioral therapy techniques include applied behavior counseling. Its aim is to teach new skills by reinforcing positive habits, making them more generalizable and negative behavior reduced. Early comprehensive clinical modification based on applied behavior therapy delivered over a long period of time results in improvements in academic ability, vocabulary, and adaptive skills (Sanchack & Thomas 2016: 976). ABA-based therapies produced promising results such as socialization, speech and expressive language in children with ASD (Yu et al. 2020: 441).

Identification of the role of behavior aids in the prevention of problem behavior and the maintenance of continuity across all contexts, provides better opportunities for children to get their needs met. Observing a child in his or her surroundings, describing what happens before and after the problem behavior appears, identifying the mechanism, teaching a replacement behavior that satisfies the same need as the problem behavior, reinforcing the replacement behavior and understanding how a behavior works will help reduce problem behaviors and increase desirable or desired conduct.

Alternatives to ABA does often categorize, classify and advertise themselves as systematic educational methods and training practices focused on behavioral principles. This may be erroneous. Some researchers see ABA as a term that describes a behavioral practice that was evolved from basic human learning capacity and is aimed at providing stable and healthy spaces in which individuals can reach their full potential. This definition of ABA is not entirely accepted, even inside academic settings, some experts describe ABA as a developmental method instead of behavioral (Denne et al. 2017: 5).

Despite the fact that autism is a medical condition, the majority of treatments take place in a school setting. This makes it necessary for the pediatric clinician to understand cultural and educational facilities, as well as laws concerning the curriculum for disabled children. Clinicians must be able to educate parents about the right therapies for their children by consulting with all other experts involved in their care. Aside from ABA, there are a variety of other interventions available and furthermore, their underlying principles vary, but they all serve the same function. Despite the fact that activities vary, there is growing a consensus on the basic components of an autism educational program. Intensive care should begin as soon as the disorder is recognized as severe (Blenner et al. 2011: 897).

More so, when it comes to handling children with ASD, there are a few things to keep in mind, it's understandable to believe that the quicker route is ideal but there is no scientific proof to back up this argument. Autism is a neurological condition, but it's important to remember as well to recognize that both direct and indirect influences can affect some aspects of behavior, speech, and social contact. It is possible that constructive approaches will have a greater impact on these and other fields of learning if implemented sooner rather than later. One of the difficulties of intervening with very young children with ASD, as previously discussed, is the age at which they are detected and diagnosed. Many children who will eventually be diagnosed with ASD will have had some form of overt or indirect treatment in the interim, though not all treatments require a formal diagnosis (Pasco 2018: 366).

6.1. Strengths and limitations

The current study's strength is that it provides a detailed overview of the relevant literature on the usefulness of Applied Behavioral Analysis for autistic toddlers. The ABA intervention was widely used and also extensively investigated in the studies. Both of the experiments reported and included were unique to the care of ASD and included ABA as part of the intervention in any case. Furthermore, the studies included were current as of the year 2000. As for 'Risk of bias' assessment,

> "As scoping reviews do not aim to produce a critically appraised and synthesized result/answer to a particular question, and rather aim to provide an overview or map of the evidence. Due to this, an assessment of methodological limitations or risk of bias of the evidence included within a scoping review is generally not performed." (Munn et al. 2018: 18.)

Therefore no assessment of bias was done. The research's strength is that it had strong acceptance criteria and approved all study designs, allowing it to find a large number of current experiments. The inclusion requirements are strictly based on age, and are exclusive to toddlers aged 5 and under. More importantly, research involving ABA should be very descriptive, and if not, at the very least, the report should have listed and expanded on ABA as an appropriate therapy for ASD. The use of English is restricted, and studies can include abstracts as well as dates ranging from years ago to the present. The study excluded studies that included children aged 7 and over, as well as studies that relied on treatments other than ABA.

We are limited to what is written. This review's strength is that the feasibility of the included studies was thoroughly assessed using appropriate measuring instruments. The standard of the studies used ranged from poor to excellent. Data retrieval was problematic in some reports due to insufficient reporting and interpretation of the evidence.

The bulk of the studies were systematic analyses, which makes sense considering the topic of the study. Any of the study results was deemed to be of medium quality; evidence should be interpreted with caution, and generalizability is minimal. Nonetheless, one of the strengths of this scoping review is that it includes data from a number of study designs. The study designs' strength, rather than the systematic reviews' generalizability, is their ability to provide in-depth comprehension. Individuals should be observed and interviewed in their natural settings, providing comprehensive data on the efficacy of ABA in toddlers with ASD, which is the focus of this research. Moreover,

considering some gaps in the results, the available information could answer the study questions in a number of ways.

6.2. Ethical considerations

Scoping reviewers, unlike primary researchers, do not gather highly intimate, private, or confidential information from participants. Scoping reviews rely on publicly accessible data for reporting, and they are rarely required to receive administrative ethics clearance before starting the work. Scoping reviews are not usually included in the recommendations for legal studies conducted by institutional review boards. Nonetheless, for the past four decades, scoping studies have evolved to become more methodologically inclusive, and they now play a significant role in influencing strategy, practice, future studies and public opinion. As a result, ethical issues about how various stakeholders' interests are reflected in a research study have become crucial. To situate their ethical decision-making, scholars of educational sciences also draw from the philosophical principles of consequentialism, deontology, and virtue ethics. Through doing a cost-benefit study of research's positive and negative effects on all stakeholders, consequentialism or utilitarianism focuses on maximizing benefit and minimizing damage. Deontology, also known as universalism, is based on the logic of Immanuel Kant that certain acts are necessarily right or wrong, and thus ends cannot justify means. Rights-based philosophies that emphasize fundamental commitment to the values of beneficence (do good), non-maleficence (prevent harm), justice, fairness, and gratitude underpin a deontological perspective. Although both consequentialism and deontology are concerned with acts and behavior, virtue ethics is concerned with being virtuous, especially in interactions with different stakeholders. Within and through these intellectual traditions, there are many overlaps as well as conflicts. (Suri 2020: 42.)

The author has no conflicting interests in this report. There is conscious subjectivity and reflexivity, as well as audience-appropriate openness and purposefully informed limited inclusivity.

6.3. Author’s contribution and acknowledgement

The author has put in a lot of effort to complete the scoping review. The author was in charge of planning the theoretical history for the manuscript's completion. The author is in charge of data collection, assessment, and summary. The reviewer, which is also the author, has contributed to the report's writing and discussion. It's worth noting that the reporting and dialog were all founded on accepted logic. The research was carried out

as part of the writers' Master's thesis in Metropolia University of Applied Science in Finland.

6.4. Implications for practice and future research

In the case of ASD, evaluations are crucial because they can be an effective way to prove and strengthen therapies and interventions. The intent of this research was to determine whether the efficacy of Applied Behavioral Analysis (ABA) for toddlers with Autism Spectrum Disorder together with the influence of ABA and its various forms, its methods for reducing symptoms and negative behavior, its efficacy of ABA to young children among other ASD care choices, other behavioral ASD therapies, and overall effective outcomes. These results will help increase the effectiveness of the intervention by highlighting certain concerns that should be considered during the procedure. The established literature supports the use of "gold standard" experiments, or randomized controlled trials testing treatments, as seen in some of the research. Such trials are the most attractive sample designs since they are thought to reduce bias collection. Randomized controlled experiments, on the other hand, may be ethically problematic and difficult to carry out due to the age and condition of its subjects. Furthermore, other ASD treatments should be studied in the context of Applied Behavioral Analysis for contrast. It's also worth noting that our research found no studies on the subject conducted in Finland. As a result, correlating and disseminating this research across the country could be extremely beneficial.

7. Conclusions

The aim of this scoping study was to see whether Applied Behavioral Analysis was successful with toddlers with Autism Spectrum Disorder. The influence and form of ABA, as well as its methods for reducing symptoms and disruptive attitudes, other ASD therapies, and overall efficacy were examined. There were 19 studies in all, consisting of systematic analyses, qualitative and quantitative designs. All of the studies that were reviewed confirmed that ABA is successful, but they also reported a spectrum of ineffectiveness from no impact to limited amounts only. Furthermore, various results are dependent on each subject. It may include perceptual, vocabulary, and motor skills, among other things. As a result, it is concluded that Applied Behavioral Analysis is appropriate for toddlers with Autism Spectrum Disorder. But given the results, it is still recommended for early detection in order to treat the problem at the onset. Furthermore, it is suggested that ABA be used in conjunction with other treatments in order to produce more impressive and definitive outcomes, because compared to other treatment programs ABA produced affirmative outcomes in cognitive, adaptive, educational

and language results. Based on these conclusions, practitioners should consider incorporating ABA-based treatment methods into their resources to produce definitive improvements of symptoms. Further research is needed to determine the relationship between ABA treatment methods' successes in certain individuals and other treatment options' accomplishments in ASD conditions. To better understand the implications of these results, future studies could address the effectiveness of other therapies in combination with ABA and in optimizing outcomes for this individuals towards adulthood in order to establish baseline of effectiveness of treatment and to promote this design for legislation.

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Figures and Tables

Figures

Tables

Appendices

Appendix 1. Timetable

Stages	Timetable
Planning stage • Choosing the subject and method and presenting the topic to my tutor teacher • Thesis plan	 • October 2020 • November 2020
Implementation stage • Literature search and collecting data • Data evaluation • Data analysis and writing synthesis	 • December 2020 • January 2021 • February - April 2021
Final stage • Presenting the results • Publication	 • May 2021 • May 2021

Appendix 2. Characteristics of included studies

	Reference	Country	Aim an purpose	Design	Data and methods	Main results	QUALITY ASSESSMENT
1	**Blenner, S., Reddy, A. and Augustyn, M. (2011). Diagnosis and Management of Autism in Childhood. British Medical Journal, 343.**	USA	In the basis of previous findings, systematic analyses, and consensus comments, study the current nosology, diagnosis, and treatment of autism spectrum disorders, as well as current investigations into their origins and medical management.	Systematic review on diagnosis and management of autism in childhood	Searched databases of systematic reviews, and cited recommendations from The National Research Council, the American Academy of Pediatrics, and the National Institute for Health and Clinical Excellence.	Autism spectrum disorders share core impairments but have a range of presentations The prevalence of autism has increased because,includes milder forms of the disorder Autism not to be associated with any cause so far Surveillance and screening by the general clinician allow affected children to be identified early and to gain access to crucial early interventions Management strategies aim to improve communication, cognitive abilities, and social and daily living skills, while decreasing maladaptive behaviour Involvement of general clinicians and paediatricians in ongoing care helps families access services and prioritise and plan for future needs	(10/11) 91%
2	**Brunner, D. and Seung, H. (2009). Evaluation of the Efficacy of Communication-Based Treatments for Autism Spectrum Disorders: A Literature Review. Communication Disorders Quarterly, 31 (1),15-41.**	USA	The current standard of research in favor of communication-based therapies for children with autism spectrum disorders is examined in this literature review.	Literature review Total of 36 studies satisfied the criteria for inclusion. research published through 2002-2007	To select studies for the current study, several inclusion criteria were created. Between January 2002 and June 2007, papers were first written. Second, the majority of the sample participants were adolescents with ASDs. Third, the therapy approach looked for results related to prelinguistic abilities, grammar, or social pragmatics.	The study of autism therapy trials concluded that the field had not yet progressed to the point of statistically proven effectiveness. Additional research has since been published, providing physicians and educators with scientific evidence for treatments. Given the prevalence of children with ASD who are nonverbal or have limited verbal skills, findings pertaining to the use of AAC methods are clinically relevant, but research is needed. There are significant improvements in communicative behaviors may be observed in as little as 15 hr compared with dozens to hundreds of hours of behavioral discrimination training. PECS and sign language training foster speech acquisi- tion in nonverbal children with ASD, probably owing to the visual nature and functional approach of these methods. Individual characteristics should be consid- ered when selecting appropriate methods for nonverbal children with ASD.	(10/11) 91%
3	**Dawson, G. and Bernier, R. (2013). A Quarter Century of Progress on the Early Detection and Treatment of Autism Spectrum Disorder. Development and Psychopathology, 25 (4.2), 1455-1472.**	USA	This paper provides a perspective on the considerable progress that has been made over the past quarter of a century in the ability to identify children at risk for autism and the development of evidence-based early interventions that can lead to improved outcomes.	Systematic reviews of evidence of 21 studies of efficacy of early intensive behavioral intervention and 7 studies on long-term outcomes following early intensive behavioral intervention	References were all regards to the reviews of evidence of efficacy of early intensive behavioral intervention	Recent approaches integrate the methods of applied behavioral analysis within a developmental, relationship-focused intervention model that are implemented by both parents and clinicians. These interventions have been found to have positive effects on children's developmental trajectory, as measured by both behavioral and neurophysiological assessments.	(11/11) 100%
4	**Denne, L., Hastings R. and Hughes, J. (2017). UK Parents' Beliefs About Applied Behaviour Analysis as an Approach to Autism Education. European Journal of Special Needs Education, 32 (4), 543-555.**	Europe	Using a survey of parents in the UK to explain views about ABA in the education and support of children with autism The researchers also looked at whether there were any variations in the views of parents who had used behaviorally dependent treatments or those who hadn't. Additional demographic information was collected, and the relationships between these factors and parental beliefs were investigated.	Peer review; systematic review 151 participants were drawn from all four nations of the UK (England, Wales, Scotland and Northern Ireland), from 101 different local authority/local government areas. Participants were mothers of children with autism (n = 134, 89%), 12 (8%) were fathers, 3 people described themselves simply as 'parents' and there were 2 adoptive parents	A total with 176 parents of children with autism chose to participate in an online study. For the following factors, 25 respondents were omitted from the study: Three questionnaires were not completed within the demographics section, nine were not completed beyond the attitudes section, and 11 were not completed within the criteria defined by the parameters. The remaining 151 members came from the UK's four countries (England, Wales, Scotland and Northern Ireland) 75 (49%) of the participants were employed full-time or part-time, and 53% of the participants had an average salary of £45,000 or more. The majority of the children listed (n=125, or 83 percent) were male, with a mean age of 10.34 (range: 2-19; mode = 11 years). 52 percent said they had an intellectual disability, and 25% said they were nonverbal	The P-BAA was tested for internal accuracy and re-examined for adjusted item-total associations using a summed total of all 12 items. For all of the P.BAA products, the overall beliefs of the sample of parents were first analyzed descriptively. All participants in the current analysis had a mean score of 42.81, with scores ranging from 23 to 60. 'ABA should be used effectively for older children and adults,' was the thing that caused the most confusion. Multiple regression analysis was used in the first stage of the analysis to look at the cumulative P-BAA scores in the survey. All demographic variables with important invariable relationships with complete BAA scores were used. They used regression analysis in the second stage to see how the overall score compared to the total PBAA score. experience with behavioural educa- tional approaches, the child's diagnosis, Total household annual income and parental edu- cation were significant predictors of score. Belief and participation of parents is essential to the sucess of treatment.	(10/10) 100%
5	**Dillenburger, K., Keenan, M., Doherty, A., Byrne, T. and Gallagher, S. (2012). ABA-Based Programs for Children Diagnosed with Autism Spectrum Disorder: Parental and Professional Experiences at School and at Home. Child and Family Behavior Therapy, 34 (2), 111-129.**	Ireland	Aims to contribute to improved parental confidence by reporting parental views regarding ABA-based schools and home programs when compared with eclectic education provision regardless of care distribution (home or education, eclectic or ABA-based) or connection to the child (parental or professional), beliefs would be similar	Qualitative Research Participants: parental (n = 95) and professional (n = 67) experiences was carried out. Two settings: (a) schools that provided intensive interventions based on the science of Applied Behavior Analysis (ABA), and (b) non-intensive ABA-based home programs	The research included 95 parents (primary caregivers with parental responsibility) and 67 experts. Parents registered on a total of 100 students, with a boy-to-girl ratio of 4:1 and an average age of 8 years. The majority of the children (96 percent) lived with their birth parents, two children with immediate families, and two children in foster care. The Family Autism Needs Questionnaire (FAN-Q; Keenan, Dillenburger, Doherty, Byrne, & Gallagher, 2007) contained 69 questions about family history and demographics, diagnosis and forward planning, school provision, home and respite assistance, parental opinions and experiences, effects on family life, and prediction of potential needs. To provide qualitative illustrations of the results, focus group discussions were held.	Parents of children on the autism spectrum tried to get their children access to proper schooling. The existing credentials of their child's teachers is unknown to half of the parents. Home tuition was used by just over half of the children (53%) who took part in the study. Children ave age of 4.5 years old. The bulk of parents found out about the services by doing their own study. Parents belives that ABA services were always tailored to their child's specific needs. Any of the people who work in home tutoring services have never had any formal training (23 percent) Any parents believed that the ABA-based curriculum was sometimes suitable for their child's needs. Parents have expressed a need for assistance from stakeholders. Almost every parent who wants future home programs for their child indicated that they have future preparation requirements. Parents shared a general need for potential service provision. agreement between professionals and parents about the need for future. Number of parents working alone with their child will be reduced from 26 to 2 (ratio 6:1).	(10/10) 100%
6	**Foxx, R. (2008). Applied Behavior Analysis Treatment of Autism: The State of the Art. Child and Adolescent Psychiatric Clinics of North America, 17 (4), 821-834.**	USA	The aim of this report is to present the current state of the art of Applied Behavior Analysis Treatment for Autism.	Systematic review Provided summaries of evidence on 18 types of interventions.	A pannel of professionals and service providers screedned literature and conducted in-dept review on the most relevant articles. High-quality and adequate information is required, intervention methods, controlled designs and evalution on funtional outcomes were looked into.	The State of New York Department of Health does not endorse any such educational or therapeutic solution to autism. The panel provided overall recommendations and provided summaries evidence on 18 types of interventiones for autism. Only ABA was the only intervention recommented	(10/11) 91%

	Reference	Country	Aim an purpose	Design	Data and methods	Main results	QUALITY ASSESSMENT
7	**Goin-Kochel, R., Myers, B., Hendricks, D., Carr, S. and Wiley, S. (2007). Early Responsiveness to Intensive Behavioural Intervention Predicts Outcomes Among Preschool Children with Autism. International Journal of Disability, Development and Education, 54 (2), 151-175.**	USA	The aim of this study was to look at the developmental paths of children with autism when they were enrolled in an ABA-based kindergarten. Children's results will be predicted by their age, amount of time in the program, extent of functioning at program entrance, and degree of responsiveness to care. We wanted to track the children's school placements after they graduated from TFS to see what educational services they still need.	Quantitative Research Study sample included 27 boys and two girls; 25 were European American, three were African American, and one was Asian American. Children's average age upon programme entry was 45.7 months (SD = 9.6, range = 29.6–61.4 months). Children served by the school live in Virginia, a state in the southeast of the United States	All of the children at TFS have been diagnosed with autism or PDD-NOS (Pervasive Developmental Disorder—Not Otherwise Specified). The average age of the children when they started the program was 45.7 months (SD - 9.6, scale = 29.6—6 1.4 months). The school's students are from Virginia, a state in the southeast of the United States. Virginians had a median household income of USD$46,677 (AUD$61,264) in 2000, which was 11% higher than the national average. Assessment of J Basic Language and Learning Skills, Autism Treatment Evaluation Checklist, and Vineland Adaptive Behavior Scales—Classroom Edition were the instruments used.	The ABLLS decided that the children's quality of coping increased with each evaluation. Over time, each of the domains saw considerable change. Some, but not all, subscales on the ATEC and VABS-CE changed from Time 1 to Time 2. The sociability and composite measures showed significant improvements, but not the speech/language/communication, sensory/cognitive perception, or health/physical/behavior metrics.	(9/9) 100%
8	**Harris, S. and Delmolino, L. (2002). Applied Behavior Analysis: Its Application in the Treatment of Autism and Related Disorders in Young Children, Infants and Young Children. An Interdisciplinary Journal of Early Childhood Intervention, 14 (3), 11-17.**	USA	This research suggests that early, intensive treatment using the methods of ABA enables a significant number of children to enter the educational mainstream and achieve normal intellectual functioning	Systematic review A research on the benefits of ABA for the education of children with autism up to 5 or 6 years of age.	Review the basic features of DTI and then look at mand training, natural environment training, and fluency as important recent contributions to the ABA literature. Both inhome-based and center- or school-based models.	The techniques of applied behavior analysis (ABA) are effective in altering the developmental trajectory of some very young children with autism. This research suggests that early, intensive treatment using the methods of ABA enables a significant number of children to enter the educational mainstream and achieve normal intellectual functioning. Both home-based and center- or school-based models have been used to deliver these services.	(10/11) 91%
9	**Hastings, R. (2003). Behavioral Adjustment of Siblings of Children with Autism Engaged in Applied Behavior Analysis Early Intervention Programs: The Moderating Role of Social Support. Journal of Autism and Developmental Disorders, 33 (2), 141–150.**	UK	To show the importance of social support in the family and how it affects sibling transition. A secondary goal is to provide preliminary research on how siblings of children with autism who are enrolled in comprehensive ABA early intervention services are adjusting.	Quantitative Research Study focuses on mothers and siblings of 78 young children with autism, range 4–16 years. Respondents ranged from 26 to 51 years, with a mean of 36.76 years old.	In the United Kingdom, a survey with parents of children with autism who are enrolled in comprehensive ABA early intervention services was conducted. A total of one hundred and one parents took part in the study. Mothers were asked to check on one sibling of the child with autism that was nearest in age to the child with autism and was between the ages of 4 and 16. A questionnaire intended to evoke demographic data is included in this study.	The findings by comparing the current population of siblings of young children with autism who are enrolled in comprehensive ABA early intervention services with normative SDQ data provide no evidence of a negative impact on sibling transition. These findings are consistent with previously reported evidence, indicating that participation in comprehensive ABA intervention has little negative impact on parental functioning.	(9/9) 100%
10	**Newcomb E. and Hagopian, L. (2018). Treatment of Severe Problem Behaviour in Children with Autism Spectrum Disorder and Intellectual Disabilities. International Review of Psychiatry, 30 (1), 96-109.**	USA	This integrative approach promotes the usage of (a) behavioral therapies to solve problems caused by social and environmental factors, behavioural histories of reinforcement for problem behavior, and ability deficiencies, and (b) pharmacological agents to address problems caused by neuropsychiatric impairment.	Mixed - method	Different studies were used as a reference and support in the study, including those on problem behavior and prevalence, impact of problem behavior, risk factors and possible causes, transdisciplinary approach to problem behavior, behavior analytic approaches, empirical support for ABA, behavioral assessment, pre-treatment assessment and identifying alternative reinforces, and behavioral treatment. Despite the fact that no control group was used in this study, scores of sibling change were comparable to normative data.	Integrative approach advocates the use of (a) behavioural interventions to address problems that arise from social and environmental variables, behavioural histories of reinforcement for problem behaviour, and skill deficits, and (b) pharmacological agents to address problems originating from neuropsychiatric dysfunction. More analysis is required to see how these interventions interact and how they can be used most effectively.	(9/9) 100%
11	**Nunez-Rodriguez, A., Hernandez, Y. Guzmán, G. Jiménez-Martinez, M.C. (2017). Analysis of Applied Behavior Treatment for Children with Autism Spectrum Disorder. European Psychiatry 41, 218.**	USA	In order to provide evidence-based intervention for autism from this approach in practice.	Integrative systematic review 40 children with ASD, treated for one (1) year at the Victory BRT Institute in Florida, USA.	In reference to a longitudinal approach, an intervention program was designed and implemented to serve 40 children with ASD, who were treated for one (1) year at the Victory BRT Institute in Florida, US. The behaviors targeted for reduction (excess behavioral), are the following: physical aggression, self-aggression and non-compliance. The program began with a baseline (12 consecutive days) with observations at home and others different natural contexts. The last three (3) months of the year consisted of monthly follow-up sessions to monitor the treatment implemented.	Analyses show that the critical level associated with the effect of time-content interaction is strong, so the treatment generated a positive effect by reducing the behaviors targeted in time.	(10/11) 91%
12	**Papatola K. and Lustig S. (2016). Navigating a Managed Care Peer Review: Guidance for Clinicians Using Applied Behavior Analysis in the Treatment of Children on the Autism Spectrum. Behav Anal Pract, 9 (2), 135-145.**	USA	Researchers use their experience as peer reviewers for a managed care company to support ABA providers in talks for managed care. They continue by providing an overview of the managed care peer review process. They go on to discuss the facets of patient need that managed care companies are most involved in. They look at specific strategies that ABA providers should use to boost customer payment authorizations.	Peer review; systematic review A retrospective study designed to determine the rate of comorbid conditions of over 2500 children on the spectrum. Provide an overview of the managed care peer review process.	Providers working with children on the autism spectrum and who are using ABA may need to interact with professional representatives from the MBHCO regarding coverage. These conversations are referred to as clinical reviews. Summarized, based on experience as peer reviewers for a managed care company, practices to help ensure successful advocacy on behalf of the children and families they treat.	The number of children who have been diagnosed with autism continues to rise. Setting and adhering to ethical expectations is essential for success as a behavior analyst. We expect that by adopting these recommendations, ABA providers can find the peer review process to be more collegial, constructive, and, as a result, less daunting or confusing in the future. The recommendations are focused on our expertise as peer testers within a managed care organization.	(10/10) 100%
13	**Pasco, G. (2018). The Value of Early Intervention for Children with Autism. Pediatrics and Child Health, 28 (1), 364-367.**	UK	Show value of early intervention for children with autism	Systematic review	While the data base for the efficacy of treatments for children with autism is small, a number of randomized control trials have demonstrated benefits in a variety of outcome measures, including early social communication in children and maternal communication style in parent-child dyads.	A developmental approach, founded on an interpretation of how language and expression emerge in normal childhood, or techniques based on integrated behavioural analysis are the most common types of behavioral therapies. ABA providers will find the peer review process to be more collegial, collaborative, and ultimately less frustrating or bewildering going forward.	(11/11) 100%

18	**Virués-Ortega J. (2010). Applied Behavior Analytic Intervention for Autism in Early Childhood: Meta-analysis, Meta-regression and Dose-response Meta-analysis of Multiple Outcomes. Clin Psychol Rev, 30 (4), 387-399.**	Spain	To see whether intensive and long-term integrated behavior analytic (ABA) approaches for young children with autism are successful.	Meta – analysis; systematic review A total of 323 subjects were included in 18 studies in the intervention groups. The participants mean age ranged from 22.6 to 66.3months. ABA intervention produced positive effects in all 18 studies	An inverse variance weighted random-effects meta-analysis was used to measure pooled effect sizes for each result of significance. The I2 metric was used to determine heterogeneity. Sensitivity tests were carried out by limiting the study to controlled trials, intervention model (UCLA model, general ABA), and distribution style (clinic-based, parent managed). Egger's test was used to determine publication bias.	In children with autism, long-term intensive ABA intervention resulted in (positive) mild to significant outcomes in terms of intellectual functioning, language learning, everyday living ability growth, and social functioning. Nonverbal IQ, social functioning, and everyday life skills were all outperformed by language-related results (IQ, responsive and articulate language, communication).	(10/11) 91%
19	**Yu Q., Li E., Li L. and Liang W. (2020). Efficacy of Interventions Based on Applied Behavior Analysis for Autism Spectrum Disorder: A Meta-Analysis. Psychiatry Investig.17 (5), 432-443.**	Korea	To do a thorough review of the evidence for using ABA-based approaches to treat different symptoms in children with autism spectrum disorder (ASD).	Meta – analysis; systematic review 14 randomized control trials of 555 participants were included in this meta-analysis. participants were between the ages of 0 and 18 years old. Search was limited to journals in English and Chinese.databases were searched from the earliest indexed date to December 24, 2018.	Subgroup tests were performed to compare the efficacy of ABA and the early start denver model (ESDM), image exchange communication systems (PECS), and discrete trial testing after eliminating any outlying trials (DTT).	This meta-analysis involved 14 randomized clinical trials with 555 participants. The findings indicated that socialization, engagement, and expressive language results for children with ASD may be promising indicators for ABA-based therapies. However, there were no major impacts on autism general symptoms, expressive vocabulary, adaptive behaviour, everyday life abilities, IQ, verbal IQ, nenverbal IQ, limited and repeated behavior, motor and cognition. Autism and Developmental Disabilities: Autism and Related Outcomes was the title of the report, which was written in the journal Autism and Developmental Disabilities: Autism and Related Outcomes.	(10/11) 91%
					were some of the words used throughout the quest. First, only sources from 2010 and later were considered.		

Appendix 3. Quality assessment with JBI critical appraisal checklist for systematic reviews and research synthesis.

		1	2	3	4	5	6	7	8	9	10	11	12	13
	JBI Critical appraisal checklist for Systematic Reviews and research synthesis	**Blenner et al. 2011**	**Brunner et al. 2009**	**Dawson & Bernier 2013**	**Foxx 2008**	**Harris & Delmolino 2021**	**Peters-Scheffera b et al. 2010**	**Nunez-Rodriguez et al. 2017**	**Pasco 2018**	**Sanchack et al. 2016**	**Shire et al. 2014**	**Spreckley, et al 2008**	**Virués-Ortega 2009**	**Yu et al. 2020**
1	**Is the review question clearly and explicitly stated?**	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
2	**Were the inclusion criteria appropriate for the review question?**	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
3	**Was the search strategy appropriate?**	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	U	Y
4	**Were the sources and resources used to search for studies adequate?**	Y	Y	Y	Y	U	Y	Y	Y	U	Y	Y	Y	Y
5	**Were the criteria for appraising studies appropriate?**	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
6	**Was critical appraisal conducted by two or more reviewers independently?**	U	Y	Y	U	Y	Y	Y	Y	Y	Y	Y	Y	Y
7	**Were there methods to minimize errors in data extraction?**	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
8	**Were the methods used to combine studies appropriate?**	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
9	**Was the likelihood of publication bias assessed?**	Y	Y	Y	Y	Y	Y	U	Y	Y	Y	Y	Y	Y
10	**Were recommendations for policy and/or practice supported by the reported data?**	Y	U	Y	Y	Y	U	Y	Y	Y	U	Y	Y	Y
11	**Were the specific directives for new research appropriate?**	Y	Y	Y	Y	Y	Y	Y	Y	U	Y	U	Y	U
	TOTAL	10	10	11	10	10	10	10	11	9	10	10	10	10
	92%	91%	91%	100%	91%	91%	91%	91%	100%	82%	91%	91%	91%	91%
	Legend: **Y = Yes, N = No, U = Unclear, NA = Not applicable**	Included	Included	Included	Included	Included	Included	Included	Included	Included	Included	Included	Included	Included

Appendix 4. Quality assessment with JBI critical appraisal checklist for qualitative research

		1	2	3
	JBI Critical appraisal checklist for Qualitative Research	**Denne et al. 2017**	**Dillenburger et al. 2012**	**Papatola et al. 2016**
1	**Is there congruity between the stated philosophical perspective and the research methodology?**	Y	Y	Y
2	**Is there congruity between the research methodology and the research question or objectives?**	Y	Y	Y
3	**Is there congruity between the research methodology and the methods used to collect data?**	Y	Y	Y
4	**Is there congruity between the research methodology and the representation and analysis of data?**	Y	Y	Y
5	**Is there congruity between the research methodology and the interpretation of results?**	Y	Y	Y
6	**Is there a statement locating the researcher culturally or theoretically?**	Y	Y	Y
7	**Is the influence of the researcher on the research, and vice- versa,**	Y	Y	Y
8	**Are participants, and their voices, adequately represented?**	Y	Y	Y
9	**Is the research ethical according to current criteria or, for recent studies, and is there evidence of ethical approval by an appropriate**	Y	Y	Y
10	**Do the conclusions drawn in the research report flow from the analysis, or interpretation, of the data?**	Y	Y	Y
	TOTAL	10	10	10
	1	100%	100%	100%
	Legend: **Y = Yes, N = No, U = Unclear, NA = Not applicable**	Included	Included	Included

Appendix 5. Quality assessment with JBI critical appraisal checklist for Quasi- Experimental studies.

		1	2	3
	JBI Critical appraisal checklist for Quasi – experimental studies (Non – randomized experimental studies)	**Hastings 2003**	**Goin-Kochel et al. 2007**	**Newcomb & Hagopian 2018**
1	**Is it clear in the study what is the 'cause' and what is the 'effect' (i.e. there is no confusion about which variable comes first)?**	Y	Y	Y
2	**Were the participants included in any comparisons**	Y	Y	Y
3	**Were the participants included in any comparisons receiving similar treatment/care, other than the exposure or intervention of interest?**	Y	Y	Y
4	**Was there a control group?**	Y	Y	Y
5	**Were there multiple measurements of the outcome both pre and post the intervention/exposure?**	Y	Y	Y
6	**Was follow up complete and if not, were differences between groups in terms of their follow up adequately described and analyzed?**	Y	Y	Y
7	**Were the outcomes of participants included in any comparisons measured in the same way?**	Y	Y	Y
8	**Were outcomes measured in a reliable way?**	Y	Y	Y
9	**Was appropriate statistical analysis used?**	Y	Y	Y
	TOTAL	9	9	9
	89%	100%	100%	100%
	Legend: **Y = Yes, N = No, U = Unclear, NA = Not applicable**	Included	Included	Included