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SPECIAL EDUCATION AND AUTISM: FROM EVIDENCE-BASED PRACTICES TO SCHOOL

Débora R. P. Nunes[I]
Carlo Schmidt[II]
TRANSLATED BY MS Traduções[III]

Abstract

In recent years, the literature has shown a significant increase in the enrollment of students with autism in regular classrooms. Among the essential teacher competencies to effectively deal with this demand is the knowledge on Evidence-Based Practices (EBP), conceived as scientifically effective intervention strategies. Knowledge produced by research centers about these practices is not disseminated and incorporated by teachers in the school context. In this scenario, this article aims: to revise the concept of EBP, in the scope of research in Special Education and autism; and identify factors that interfere with the transposition of the knowledge. As a complement, a theoretical-explanatory model of transposition of scientific knowledge beyond the walls of the academy is proposed.

SPECIAL EDUCATION • AUTISM • EVIDENCE-BASED PRACTICES

EDUCAÇÃO ESPECIAL E AUTISMO: DAS PRÁTICAS BASEADAS EM EVIDÊNCIAS À ESCOLA

Resumo

Nos últimos anos, a literatura vem registrando um aumento expressivo do ingresso de alunos com autismo em classes comuns. Dentre as competências docentes essenciais para lidar com essa demanda insere-se o conhecimento sobre práticas baseadas em evidências (PBE), definidas como estratégias interventivas cientificamente eficazes. Assinale-se que o conhecimento sobre as PBE, produzido por centros de pesquisa, não é transposto aos professores, no contexto da escola. Assim, os objetivos deste artigo são revisar o conceito de PBE, no âmbito das pesquisas em educação especial e autismo, e identificar fatores que interferem na mobilização do conhecimento. Como alternativa propositiva, é apresentado um modelo teórico-explicativo de transposição do conhecimento dos muros da academia para o chão da escola.

EDUCAÇÃO ESPECIAL • AUTISMO • PRÁTICAS BASEADAS EM EVIDÊNCIAS

I Federal University of Rio Grande do Norte (UFRN), Natal (RN), Brazil; https://orcid.org/0000-0001-8758-8916; *deborareginanunes@yahoo.com*

II Federal University of Santa Maria (UFSM), Santa Maria (RS), Brazil; http://orcid.org/0000-0003-1352-9141; *carlo.schmidt@ufsm.br*

III *comercial@ciadastraducoes.com.br*

L'ÉDUCATION SPÉCIALE ET L'AUTISME:
DES PRATIQUES FONDÉES SUR DES PREUVES À L'ÉCOLE

Résumé

Au cours des dernières années, la littérature a montré une augmentation significative de l'inscription des élèves autistes dans les classes régulières. Pour répondre à cette demande on trouve parmi les compétences essentielles des enseignants les connaissances sur les pratiques fondées sur les preuves (PFP), définies comme des stratégies d'intervention scientifiquement efficaces. Il faut noter que les connaissances sur les PFP, produites par les centres de recherche, ne sont pas appliquées aux enseignants dans le contexte de l'école. Les objectifs de cet article sont donc d'examiner le concept de PBE dans le contexte de la recherche en éducation spécialisée et autisme et d'identifier les facteurs qui interfèrent dans la mobilisation des connaissances. Comme alternative, un modèle théorique-explicatif de transposition de connaissances des murs de l'académie à l'école est proposé.

ÉDUCATION SPÉCIALE • AUTISME • PRATIQUES FONDÉES SUR DES PREUVES

EDUCACIÓN ESPECIAL Y AUTISMO:
DE LAS PRÁCTICAS BASADAS EN EVIDENCIAS A LA ESCUELA

Resumen

La literatura viene registrando en los últimos años, un aumento expresivo del ingreso de alumnos con autismo en las clases comunes. Entre las competencias docentes esenciales para lidiar con esa demanda, se encuentra el conocimiento sobre Prácticas Basadas en Evidencias (PBE), definidas como estrategias de intervención científicamente eficaces. Se señala que el conocimiento sobre las PBE, producido por universidades y centros de investigación, no se traspone a los profesores en el ámbito escolar. Así, los objetivos de este artículo son revisar el concepto de las PBE en el contexto de las investigaciones en Educación Especial y autismo, así como identificar factores que interfieren en la movilización del conocimiento. Como alternativa, se propone un modelo teórico-explicativo de transposición del conocimiento científico desde los muros de la academia hasta el piso de la escuela.

EDUCACIÓN ESPECIAL • AUTISMO • PRÁCTICAS BASADAS EN EVIDENCIAS

AUTISM IS A CONDITION ESSENTIALLY CHARACTERIZED BY SOCIAL AND COMMUNICATION difficulties that become evident throughout the child's development, beginning in the early years of childhood. People with this syndrome have common traits in the socio-communicative and behavioral areas that highlight their disorder and, at the same time, differ them from other conditions. Currently, autism is understood as a spectrum, including a complex and wide range of characteristics, with different levels of severity and comorbidities with other disorders (BAIO *et al.*, 2018; KOHANE *et al.*, 2012), causing each child to present different challenges for parents, clinicians or educators.

Current epidemiological rates show that for every 1,000 live births, 14.7 children have autism, that is, one person diagnosed in every 68 (BAIO *et al.*, 2018). In this scenario, it is common to have students with this syndrome in regular classes, which has increased significantly in recent years in Brazil. This phenomenon requires specific professional training that qualifies teachers in the effective treatment of this clientele (AZEVEDO, 2017; NASCIMENTO; CRUZ; BRAUN, 2016; NUNES; AZEVEDO; SCHMIDT, 2013). Despite the growing production of scientific knowledge about pedagogical practices to assist in the schooling of these students, the national literature reveals gaps regarding the use of resources and the effective intervention strategies implemented at school (AZEVEDO, 2017; NASCIMENTO; CRUZ; BRAUN, 2016), as well as the deficient

teacher training to educate this population (NUNES; AZEVEDO; SCHMIDT, 2013; SCHMIDT *et al.*, 2016).

It is conjectured that academic knowledge that underpins scientifically validated interventional strategies is not being transferred from academia to teaching practices. Thus, the first objective of this paper is to review the concept of evidence-based practice (EBP) in the context of research on special education and autism. Based on this review, the proposal was directed to identify paradigms on knowledge transposition, which describe the teaching practice. Finally, a theoretical model is presented that favors the mobilization of scientific knowledge from the walls of academia to the school floor.

THE PRODUCTION OF KNOWLEDGE IN AUTISM

Donald Cohen, former director of the *Yale Child Study Center*, once stated that when there is no cure, there are over a thousand treatments. Virtual search engines indicate the existence of impressive numbers of interventional practices available to people with autism in the world. Milton (2014), for example, found more than 1,000 interventions described only on the *Research Autism website*, built by UK researchers. In a recent article, Guldberg (2016) reports having identified 38 million *links* in a virtual search by typing in the keywords "intervention" and "autism". Out of curiosity, 503,000 *links* are found by writing in Portuguese the terms "treatment" and "autism" on the Google search *website.*

It is noteworthy that families of people with autism actually use only a portion of the numerous treatments available. Thus, Green *et al.* (2006) identified 111 interventional practices typically adopted by US families in the early 2000s. The replication of this study conducted ten years later by Kelly, Tennant, and Al-Hassan (2016), revealed the adoption of 100 types of treatments by Arab families. Studies also point out that these families adopt between six and seven treatments simultaneously and, in the past, they tried between seven and nine intervention modalities (GREEN *et al.*, 2006; KELLY; TENNANT; AL-HASSAN, 2016). It is therefore estimated that each person with autism could be exposed to more than 15 treatments throughout life. The alarming fact is that many of these practices may not produce any beneficial effect, or even cause harm to the individual and their families.

In this context, for clearer identification of the validity of these interventions for their indication or contraindication in care services, evidence-based practices (EBP) were established. Originating in the health and education areas, EBPs consist of an approach that predicts a protocol of research steps to facilitate the comparison of different findings, to enable the identification between their results (REICHOW; VOLKMAR; CICCHETTI, 2008).

One of the first movements to recognize EBPs began in the 1990s, in the area of Psychology and Medicine, by the *American Psychiatric Association* (APA), and it aimed to identify effective interventions, that is, that had empirical support (LUBAS; MITCHEL; DE LEO, 2016). Thus, an empirically supported intervention

should include five elements: 1) manual with intervention protocol; 2) detailed characteristics of the population attended; 3) two group experiments or a series of case studies; 4) demonstration that the intervention is at least equivalent to another intervention (no to the absence of intervention or waiting list); and 5) demonstration of the effect of the intervention by two independent researchers. In 2005, following several criticisms and reviews, APA began to use the term *evidence-based practices in psychology*. EBPs referred to a decision process that would be made based on clinical knowledge, the best research, and the characteristics of the target population (LUBAS; MITCHEL; DE LEO, 2016).

Education began this movement by creating the redundant term *scientifically based research* coined by the US government (REICHOW; VOLKMAR; CICCHETTI, 2008; SIMPSON, 2005). This new paradigm has already been impacting school practices in several countries, such as Australia, the United States, and England (HEMPENSTALL, 2006; GULDBERG, 2016; WONG *et al.*, 2015). For example, Americans, through the *No Child Left Behind Act* (SIMPSON, 2005), required that schools receiving federal funds selected and implemented only interventional practices that showed evidence of effectiveness[1] (SIMPSON, 2005; WONG *et al.*, 2015).

From this perspective, in the last decade, different groups of researchers have developed methodological guidelines to determine the effectiveness of treatments for populations with autism. The oldest document may be the one published in 2001 by the *National Research Council* (NRC). This US agency has developed an evaluation instrument based on measures of validity and generalization of results. Interventional practices with more evidence of effectiveness would be those investigated in research that: compared different treatments; randomly selected groups of participants; and documented behavioral changes in at least one natural environment.

Numerous studies were initially analyzed based on the methodological criteria described by the NRC (2001). Then, the results of the research that met the criteria above were summarized in chapters, dealing with effective practices in the development of communicative, social, cognitive, sensory, motor skills, and adaptive behaviors. Besides, a chapter on strategies to minimize behavioral problems has been included, and another chapter summarizing the characteristics of ten high-quality intervention programs.

Similarly, the *National Professional Developmental Center on Autism Spectrum Disorder* (NPDC) was created in 2007 by the US Office of Educational Programs to promote and disseminate the use of PBE. Its report, published in 2014, updated in 2016, classifies 27 interventions that are, as in the NRC report (2001), divided into two broad classes: comprehensive models and focal practices (WONG *et al.*, 2015). The first ones consist of a set of practices systematized in interventional programs that aim to remedy central deficits in autism. Examples include the *Treatment and*

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1 Effectiveness is understood as the identification of a causal relationship between the introduction of an interventional procedure and changes in target behavior.

Education of Autistic and Related Handicapped Children (TEACCH) (MESIBOV; SHEA; SCHOPLER, 2005), the *Learning Experiences Alternative Programs* (LEAP) (STRAIN; BOVEY, 2008) and the *Early Start* Denver *Model* (ESDM) (DAWSON *et al.*, 2010), which propose the use of interventional strategies that simultaneously deal with socio-communicative and behavioral disorders. In contrast, focal practices are addressed to isolated skills (communication, socialization, adaptive behavior, social skills, among others), or to specific goals of a student with autism, such as behavioral techniques of discrete attempts that focus on the learning of adaptive behaviors, alternative and alternative and expanded skill-oriented communication, sensory therapy designed to remedy sensory problems, and video modeling typically used for social skills teaching (NRC, 2001; WONG *et al.*, 2015).

In addition to the NRC (2001) and NPDC (WONG *et al.*, 2015), guidelines developed by the Scottish Agency| *Scottish* Intercollegiate Guidelines Network (SIGN) and the North American *National Autism Center*| (NAC) are highlighted in international literature. These two groups not only outlined precepts for evaluating research, but they have also created classification systems. Thus, in 2007, SIGN published a document aggregating four degrees of recommendation (A, B, C, and D). Intervention programs classified as "A" were considered more recommended, as they showed reliable evidence of effectiveness; the others (B, C, and D) presented, in descending order, less evidence. Similarly, in 2009, NAC evaluated multiple methodological dimensions of 775 interventional studies (REICHOW; VOLKMAR; CICCHETTI, 2008). Similar to SIGN (2007), practices were classified into four levels of evidence: established, emerging, not established, and ineffective or harmful. It is noteworthy that, as well as NRC (2001), NPDC (WONG *et al.*, 2015) and SIGN (2007), NAC (2009) also assumed the same criteria, evaluating interventional programs derived from experimental research using randomized designs as the most effective.

Limitations are identified in the criteria adopted by these agencies, as well as by other independent groups of researchers (LUBAS; MITCHEL; DE LEO, 2016; SIMPSON, 2005) who over the past decade have sought guidelines for determining EBP in autism. One is the lack of a clear operational method that makes it possible to determine if an intervention is an EBP (REICHOW; VOLKMAR; CICCHETTI, 2008).

As a result, the literature fails to provide a single definition of evidence-based practice, tolerating the coexistence of diverse conceptions. This heterogeneity, for example, allows the same practice to be considered EBP by one agency and not by another. This is the case of sensory integration therapy,[2] understood as a promising practice by Simpson (2005), but not proven by NPDC (WONG *et al.*, 2015), making it difficult for professionals to choose which practices would be the most appropriate to select.

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2 Interventional practice, developed by Jean Ayres, based on a theoretical model that discusses brain-behavior and brain-learning relationships (SHIMIZU; MIRANDA, 2012).

AUTISM KNOWLEDGE: CURRENT TRANSPOSITION MODELS

In addition to the lack of consensus on EBP, studies indicate that interventional practices developed for students with autism, produced in research centers, are not always assimilated by teachers in school contexts (DINGFELDER; MANDELL, 2011; GULDBERG, 2016).

As such, epistemological issues of education as a profession, factors related to teacher training and divergent conceptual models about the transposition of what is produced academically or in schools are some variables that may explain these limitations (NACARATO, 2016; NUNES, 2008; SHULMAN, 1986; STAHMER *et al.*, 2015; TARDIF, 2000).

The reconceptualization of teaching as a profession anchored in scientific knowledge is perhaps one of the most critical factors. The focus of this discussion, which began in the Anglo-Saxon countries in the late 1980s, focuses on the proposition that there is a set of knowledge and skills that teachers must acquire to act competently in teaching situations (ALMEIDA; BIAJONE, 2007; SHULMAN, 1987). This knowledge, centered on academic, theoretical, and scientific knowledge, underpins the professionalization of teaching work (SHULMAN, 1987; TARDIF, 2000). In the education of students with autism, this model is disseminated by research organizations, such as the *Council for Exceptional Children* (CEC) (2009), which devotes an exclusive chapter on competencies and skills to be developed by teachers of these students, in a guidance handbook for special education teachers.

Nationally, it is worth mentioning Technical Note no. 24/2013/MEC/Secadi/DPEE, which, although shyly, lists a set of teaching competencies to work with students with autism (BRASIL, 2013). It is interesting to note that both documents - CEC and Technical Note no. 24 - refer, directly or indirectly, to the use of EBP. CEC (2009) explicitly indicates that one of the competencies to be developed by the teacher is to demonstrate a commitment to implement evidence-based practices. The Technical Note describes the use of a specific EBP to indicate the "acquisition of theoretical-methodological knowledge of Assistive Technology focused on Alternative/Augmentative Communication"[3] as competence to be developed by the teacher (BRASIL, 2013, p. 3, our translation).

It is important to emphasize that, in Brazil, there are no regulatory documents that require the implementation of EBP in schools. Moreover, as Nascimento, Cruz, and Braun (2016) warn, there are few documents produced by the Ministry of Education that deal specifically with educational strategies for students with autism.

Guidelines, as proposed by CEC (2009), suggest that teachers should employ scientifically valid knowledge, which sometimes overlaps with the tacit knowledge of the everyday practice. In addition to criticism of this issue, pointed out by authors such as Shulman (1986, 1987), Tardif (2000), Tardif and Moscoso

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3 In the original: "aquisição de conhecimentos teórico-metodológicos da área da Tecnologia Assistiva voltados à Comunicação Alternativa/Aumentativa".

(2018) and Guldberg (2016), there are questions about what knowledge would be those in the context of EBPs. In the absence of a consensus on what constitutes an EBP, doubt hovers over the practices that must be taught in undergraduate courses in pedagogy or special education so that the teacher becomes a "competent professional".

When teachers select one or a set of EBP as an intervention tool, other barriers are identified, such as inadequate teacher training or difficulties transposing interventional models developed in laboratory settings into school contexts. In the first case, Stahmer *et al.* (2015) warn of the ineffectiveness of a frequent practice: training on interventional strategies through short *workshops* or textbooks, without the necessary theoretical deepening. Besides the superficiality of the content approached, this non-dialogical model prevents the teacher from clarifying doubts when entering the real teaching contexts.

In Brazil, the gaps in teacher training to work with students with autism seem even more pronounced. In an integrative review of 22 studies on pedagogical practices developed with these students in regular school, Azevedo (2017) observed that less than 20% of educational agents had special education training, and no specific autism training was reported. In the study by Schmidt *et al.* (2016), more than half of the 29 teachers of students with autism did not have any further education, besides the degree in Pedagogy.

This phenomenon seems to be the result of national policies on teacher education for inclusive education and special education that, as warned by Fonseca-Janes, Silva Júnior and Oliveira (2013), dismissed the pedagogue - previously qualified in Pedagogy courses in one or more disabilities - from work in special education. Indeed, through the extinction of qualifications in Pedagogy courses – advocated by Resolution CNE/2006 (BRASIL, 2006) –, teachers of special education were gradually replaced by teachers without the same level of education. From this perspective, the training of *teachers specializing in special education*, as defined by Resolution CNE/2001 (BRASIL, 2001), began to occur primarily at the postgraduate level, in *lato sensu* courses (MICHELS, 2011; FONSECA-JANES; SILVA JR.; OLIVEIRA, 2013). This kind of training, supported by the National Policy of Special Education in the Inclusive Education Perspective (BRASIL, 2008), enables this teacher to attend the students who are the target audience of special education, through the specialized educational attendance (SEA), in the context of the multifunctional resource rooms. It is up to him/her to elaborate, in articulation with the regular education teacher and other agents, an attendance plan to be implemented in the regular teaching context (BRASIL, 2009). However, the problem lies in the training of this specialized teacher, who, as recorded in the literature, is unaware of interventional practices that favor the schooling of these students in the regular classroom (PASIAN; MENDES; CIA, 2017).

In addition to the gaps in teacher education that affect the incorporation of EBP in the school context, it is noteworthy that most research on these practices is developed in laboratory environments, making it difficult to transpose to natural contexts, such as school (GULDBERG, 2016; STAHMER *et al.*, 2015). As

a result, teachers tend to ignore such practices (DINGFELDER; MANDELL, 2011; NUNES, 2008; TARDIF, 2000), or to combine distinct strategies to meet classroom demands (DINGFELDER; MANDELL, 2011; STAHMER *et al.*, 2015). From this perspective, practices that reach schools may not be the same as those developed in controlled environments. Perhaps this is one of the factors that explain the limited impact of these interventions on the cognitive, social, and adaptive functioning of learners with autism in naturalistic contexts (CHASSON; HARRIS, NEELY, 2007). The problem, therefore, lies in how to mobilize EBPs, in other words, to identify a more effective model of transposing scientific knowledge into teaching practice.

What the international literature has suggested so far is that the Linear Paradigm of Knowledge Transposition prevails in the context of EBPs for populations with autism (GULDBERG, 2016; LUBAS; MITCHEL; DE LEO, 2016). In this model, the scientific community develops and validates educational practices that teachers must reliably apply (NUNES, 2008).

However, the Brazilian scenario is not very favorable to this principle due to two factors. First, because ideological issues – far more than scientific ones – seem to determine the teaching methods to be adopted in Brazilian schools. This is particularly observed in the field of interventional reading strategies (MORAIS; LEAL; ALBUQUERQUE, 2009; NUNES; WALTER, 2016; SEABRA; DIAS, 2011). Pedagogical practices disseminated by government agencies, such as the Ministry of Education, and Brazilian universities fail to consider contemporary interventional models, supported by scientific research (OLIVEIRA, 2010; SEABRA; DIAS, 2011; NUNES; WALTER, 2016).

Secondly, as Nacarato (2016) points out, the paradigm of[4] technical rationality was strongly contested in the 1990s, being, under the influence of Donald Schön, replaced in contemporary times by the idea of the reflective teacher, who is the protagonist of his/her practice. This concept, which values the knowledge that emerges from teaching action and reflection, has influenced the policies and practices of teaching in national (NACARATO, 2016) and international (TARDIF; MOSCOSO, 2018) contexts. It is interesting to note, for example, that the document on the National Curriculum Guidelines for Teacher Education, published in 2002, makes no mention of the use of EBP. On the other hand, the text makes explicit that "privileged didactic strategies" must be those derived from "action-reflection-action" (BRASIL, 2002). Considering the precarious teacher training of teachers to deal with students with autism, the quality of this "action" for further "reflection" is questionable.

Although Schön claim was not to depreciate scientific knowledge, there is radicalization in the national context of this proposal in the field of inclusive special education, particularly in the schooling of students with autism. Thus, the linear paradigm seems to have been replaced by the pragmatic model of

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4 Direct application of the knowledge produced in scientific contexts to the daily problems and tasks of professional practice.

knowledge transposition. In this model, the knowledge that emanates from teaching practice is considered functional and valid, regardless of research or theories (SHULMAN, 1986; NUNES, 2008). In fact, in a review conducted by Azevedo (2017), only ten of the 22 studies analyzed dealt with the use of EBP. It is noteworthy that in these studies, no reliability measures were found on the use of such practices, nor the transposition of non-validated interventional models in Brazil was questioned. In general, teachers seemed to perform EBP adaptations that often bore little resemblance to those described in the original manuals.

This practice may be a reflection of how EBP is disseminated among teachers in Brazil. We cite, for example, the disclosure of the TEACCH method (*Treatment and Education of Autistic and Related Communication Handicapped Children*) by the Ministry of Education, in booklet format, for early childhood teachers (BRASIL, 2003). In this guiding document, the theoretical and methodological assumptions of TEACCH are superficially described. Moreover, there is no research data on the effectiveness of the strategies proposed, nor the profile of the students who could benefit from them. Finally, although the Revised Psychoeducational Profile (PEP-R), one of the assessment tools used by this program, has been validated for the Brazilian population (LEON, 2002), the document makes no mention about this research.

Several studies suggest gaps in teacher education, particularly the lack of exposure to curriculum content on the education of students with autism (AZEVEDO, 2017; BARBERINI, 2016; NUNES; AZEVEDO; SCHMIDT, 2013; NASCIMENTO; CRUZ; BRAUN, 2016; SCHMIDT *et al.*, 2016). Not knowing "what" or "how to teach," many of these teachers end up adopting common-sense practices. In this example, a recent national study that investigated pedagogical practices for students with autism was illustrated with teachers' statements such as: "there are no resources, but the teacher's common sense to go after, study and try to understand the student with autism to make him/her learn"[5] (BARBERINI, 2016, p. 52, our translation). It is relevant to emphasize that practices implemented only from the "common sense" of those who use them sometimes fail to consider the scientific aspect, the empirically evaluated the effectiveness of the resource. Jesus and Germano (2013) reinforce this idea, emphasizing that the teacher needs a theoretical and scientific basis not only from his/her empirical and personal experience, derived from the trial and error method.

The linear paradigm is severely criticized for ignoring situational variables, as well as the teacher's life history, emotions, and culture (SHULMAN, 1986; TARDIF, 2000; NUNES, 2008; TARDIF; MOSCOSO, 2018). Moreover, in this model, research that determines teaching practice is conducted without the necessary questioning as to whether such interventions would be effective for all students, or, on the other hand, whether those interventions considered as non-EBP would be ineffective. In this sense, such a model ignores the knowledge produced by

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5 In the original: "não existem recursos, e sim o bom senso do professor em ir atrás, em estudar e tentar entender o aluno com autismo para fazê-lo aprender".

the "reflection in and about the action", that is, the Schönian postulate that emphasizes the teaching protagonism, the idea that the professional situations experienced by the teacher are singular, and they fundamentally require a reflective action (TARDIF; MOSCOSO, 2018).

When we observe that research is used in a generalizing way, not only to inform but also to restrict teacher intervention options, the ineffectiveness of this model becomes clearer. It is important to point out that the criticism pointed out here is not intended to disqualify the efforts of agencies to translate research for their application, but rather to warn teachers about the care in generalizing EBPs to the detriment of valuing their daily experience.

The pragmatic model, because it overestimates tacit knowledge, can prevent the systematization of practice and the evaluation of its effects. The absence of a clear operational definition of the strategies employed makes it impossible to replicate an intervention procedure (NUNES, 2008). As a result, it becomes impracticable to establish causal relationships, preventing an interventional procedure from actually being considered effective.

THE PROPOSAL OF A KNOWLEDGE MOBILIZATION MODEL

From the previously outlined scenario, it is urgent to adopt a theoretical and explanatory model that focuses on essential aspects of EBP mobilization in the field of autism. Initially, it is essential to consider that the decision to accept, adopt, and use a new practice does not occur instantaneously, but through a process that can be didactically described by the Diffusion of Innovation Theory (ROGERS, 2003). In this model, derived from sociology, the decision-making process consists of five steps: knowledge, persuasion, decision, implementation, and confirmation. In the school context, this dynamic would occur as follows: in the first stage, managers would become familiar with the new pedagogical proposal; based on this exposure, they would develop, in the second phase, beliefs and attitudes about the intervention; then, in the subsequent step, they would decide whether to use it or not; then the teachers would come, who, in the fourth step of the model, would implement the practice with their students - at this stage, teachers would typically innovate the proposal by reinventing or modifying the original model; and finally, in the confirmation (or maintenance) phase, innovation would become institutionalized, making managers and teachers decide for its continuation or abandonment.

It is not guaranteed that an innovative practice, even if it is good or superior to a traditional model, will be adopted. The incorporation of a new practice, as elucidated in the model above, depends on a complex set of variables intrinsic to the social context (ROGERS, 2003). Thus, the perception of managers and teachers regarding the potential advantages brought by the new idea, the level of complexity of its implementation and the compatibility of the model with the school reality are some of the variables to be considered. Additionally, it cannot be neglected that the proposed intervention model is consistent with

the values, beliefs, life histories, and demands of those who will implement it (ROGERS, 2003; DINGFELDER; MANDELL, 2011).

Based on this scenario, it is valid to rescue the dynamic transposition paradigm, a theoretical and explanatory model outlined by Lubas, Mitchel and De Leo (2016), which integrates the reality of teaching practice with the specifics of autism. One of the main points of this model is the fact that it expands the linear paradigm by postulating that, between the selection of EBP to be used and the pedagogical practice, two variables must be considered: student characteristics and teaching knowledge.

According to Dingfelder and Mandell (2011), many teachers believe that their students with autism have greater impairment than the students described in scientific studies and thus they tend to assess that innovative practices will not be effective in their classrooms. Based on such beliefs, in the dynamic model proposed by Lubas, Mitchel, and De Leo (2016), the student's specificities and context are key points to consider when selecting EBP. Thus, concerning students, four variables are analyzed: their chronological age, the characteristics of the autism spectrum presented by them, the existence of comorbidities, and the environment.

As for the student's age, it is important to consider that the selection of interventional strategies should consider both chronological and developmental ages, which are not always the same in autism. As a neurodevelopmental disorder, the characteristics of this condition are topographically different throughout development, which implies the appropriate choice of EBP to each case. For example, some EBPs are playful, involving strategies for developing shared attention through playing (VISMARA; BOGIN, 2009). The nature of this strategy assumes that playing is a developmental task that meets both the chronological specificities and the student's current developmental skills, and it is, therefore, more appropriate as a classroom practice for early school students than for those in high school.

Considering the heterogeneity of symptoms in autism, it is impracticable for the same interventional procedure to be used equally for two individuals. In this sense, it is essential to specify the characteristics of the student to adopt interventional practices that best fit their demands (THOMPSON, 2011). For example, it is known that learners without functional speech and with impaired motor imitation ability benefit little from the use of manual communication systems, such as sign language. In this case, research recommends the use of assisted communication systems, such as *tablets* and alternative communication boards (SCHLOSSER; WENDT, 2008).

In addition to the variance in the expression of typical autism characteristics in the language, communication, and social areas, individual differences also depend on the student's medical and psychiatric comorbidities. A study that evaluated more than 14,000 people with autism found that they have higher rates of comorbidities such as eczema, allergies, asthma, ear and respiratory infections, gastrointestinal problems, sleep disorders, and seizures than for the typical

population (KOHANE *et al.*, 2012). Epilepsy, whose prevalence ranges from 6% to 27%, is more recurrent in the early years of life and adolescence, which requires provision for intervention as an appropriate environment to respond to possible seizures at school (JESTE; TUCHMAN, 2015). Besides, specific knowledge about this comorbidity, in addition to autism, is essential, as the teacher may disregard the absence episodes common to children with these characteristics, or even confuse them with behavioral intention, engendering mistaken interventions.

Adding to the student's intrinsic characteristics, environments such as school, home, or play areas also vary considerably from the level of support available to the geographic location. Differences in social support and family socioeconomic status, the level of parental stress, as well as the physical and structural characteristics of the school attended by the student, interfere with the availability of resources and it may affect the entire intervention framework (LUBAS; MITCHEL; DE LEO, 2016). The literature warns of the possibility of these factors interfering in the results of interventions, which corroborates the importance of such variables being considered as an integral part of EBP (SIMPSON, 2005; THOMPSON, 2011).

If the goal of recognizing a particular interventional strategy as an EBP is to mobilize this knowledge into practice, then research should provide sufficient information to allow its replication. In this hypothesis, the use of single-case research designs (SAMPAIO *et al.*, 2008) would seem to be the most appropriate, since this methodology allows the provision of more detailed information about the individual aspects of the participating child, such as the symptoms, the environmental characteristics, and comorbidities, facilitating the individualization of teaching. With these data, the teacher would be better able to evaluate the differences between the child, subject of the research, and his/her student to predict and adapt the intervention according to his/her knowledge.

By highlighting teaching knowledge as an essential variable, the dynamic transposition paradigm (LUBAS; MITCHEL; DE LEO, 2016) highlights important aspects of the teacher for the appropriation of EBPs. The first point emphasized is that the teacher is a critical reader of the proposed practices, incorporating his own knowledge and knowledge of the individual characteristics of each student as to their intervention actions. The second aspect concerns the valuation of trial and error behavior, that is, understanding that EBP will be assimilated if teachers can test it and continually adjust it to the child's demands and context throughout the intervention.

Although the dynamic paradigm of Lubas, Mitchel and De Leo (2016) bring important contributions that can enable the transposition of knowledge beyond the walls of academia, it fails to define the specificities of teaching "knowledge." Thus, we suggest integrating, to the nonlinear perspective of the dynamic paradigm, the knowledge bases proposed by Shulman (1986, 1987).

According to this author, teaching practice is influenced by both the content of knowledge and the way this content is structured. In the first case, Shulman (1986) highlights three types of knowledge: the pedagogical content,

the curriculum, and the educational context. The first concerns the teacher's ability to transform knowledge of academic content into pedagogically accessible forms for the student. According to the author, these are the most effective ways of representing ideas, including the most powerful analogies, illustrations, demonstrations, and examples. This implies building alternative ways of exposing concepts so that they are understandable to a heterogeneous group of learners, considering their specificities and experiences (SHULMAN, 1986). These forms of representation, developed at the intersection between content and pedagogy, emanate from both teaching practice and knowledge from scientific studies.

Curriculum knowledge is represented by a set of programs designed to teach specific topics through the use of diverse instructional materials. It involves that knowledge that allows the teacher to elaborate, adapt, and apply pedagogical proposals, recognizing the sequence that must be given to the content and the level of complexity of the activities/tasks. From the cognitive perspective of Shulman (1986), it is essential that the teacher is not only proficient in the subject he/she teaches, but also knows effective strategies for teaching it. It is highlighted here the formative aspect of the teacher, more specifically the access that he/she had (or did not have) in his/her training to the contents of the field not only of education but also of special education. The full degree courses in special education include, in their curriculum, the knowledge that exposes students to the development of theoretical-methodological alternatives in inclusive practices, forging the basis of curriculum knowledge proposed by Shulman.

Finally, knowledge of the educational context brings an ecological perspective to the understanding of the social and cultural particularities of the school setting. This implies knowing not only the microsystem, composed of the group of students in the classroom, but also the mesosystem, which involves the school's administrative dynamics and management aspects, as well as the macrosystem, constituted by the social and cultural particularities of the community where the institution is allocated (SHULMAN, 1986).

The three types of knowledge described can be structured as propositions, cases or strategically. The first one, also called propositional, scientific, theoretical, or informational knowledge, is organized into principles, maxims, and norms. The principles emerge from philosophical studies or scientific investigations, corresponding in part to what the dynamic transposition paradigm calls knowledge coming from EBP. The maxims refer to stored knowledge from experience, what Lubas, Mitchel, and De Leo (2016) call practical wisdom, and Tardif (2000) calls knowledge from experience. Finally, norms refer to values, ethical, moral, and ideological issues that, as Rogers (2003) and Dingfelder and Mandell (2011) emphasize, affect behavior. These propositions, not explicit in the model of Lubas, Mitchel and De Leo (2016), work not because they are scientifically true or because they have practical results, but because they are morally and ethically correct (SHULMAN, 1986).

According to the author, most of the knowledge stored by the teachers during the initial training is on a propositional basis. This kind of theoretical

knowledge is advantageous as it simplifies complex contents. On the other hand, it can be difficult to rescue, especially because it is decontextualized. It is in this perspective that Shulman (1986, 1992) suggests that propositional knowledge is complemented by case knowledge, understood as a kind of knowledge developed from a specific event, well documented, thoroughly described and theoretically analyzed. This case, which is later mentioned by the teacher, works as an example to solve problems in similar future situations. It provides teachers with conduct alternatives in specific social and cultural contexts. The promising effects of using cases as a formative strategy[6] are discussed in Shulman's (1992) work. The case method, as an intervention model, helps the teacher to group experiences, enabling reflective practice, and valuing theoretical knowledge. Thus, it is a pedagogical strategy that transforms propositional knowledge into narratives that enable strategic knowledge (SHULMAN, 1992; FENSTERMACHER, 1994).

Knowledge of relevant propositions and specific cases forms the structural basis of teaching knowledge since they are "stored" knowledge (FENSTERMACHER, 1994). When these types of knowledge fail to provide practical or theoretical solutions, strategic knowledge is triggered. According to Shulman (1986), this third type of knowledge arises from analyses and reflections triggered by challenging situations. It aims to find new solutions for practice, and it is later stored in the form of propositions (propositional knowledge) or narratives (case knowledge).

Considering the model of Shulman (1986), it is conjectured that an EBP will only be incorporated into the teacher's repertoire if it is adjusted to his/her knowledge base, the characteristics of the student, and the demands of the context. This statement is based on two arguments. First, as elucidated, the teacher's behavior is influenced by the knowledge of pedagogical, curricular, and contextual content built throughout the professional formation. Thus, if teacher education courses fail to address topics related to the characterization of learners with autism spectrum disorder (ASD) and empirically validated strategies, it is unlikely that EBP will be analyzed, adapted or incorporated into the teacher's repertoire.

The second argument concerns the way knowledge is structured. When propositions fail to solve practical problems, the teacher triggers alternative forms of knowledge. In this sense, it is promising to consider case knowledge, since it favors reflection on practices, including scientifically validated ones. Based on this argument, the case method, defended by Shulman (1992), is highlighted as a formative strategy in teacher education programs for students with autism.

Finally, it is necessary to value the teaching protagonism manifested in strategic knowledge. It is in the innovative action of the teacher that, taking into account the situational variables, new strategies are adjusted, modified, and created. Unlike the linear paradigm, the scientific community should

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6 The case method is a pedagogical strategy implemented to transform propositional knowledge into narratives that enable pedagogical action (SHULMAN, 1992).

help the teacher to systematize this new knowledge, considering its validity and comprehensiveness. This dynamic favors that this new knowledge, after empirically tested, is stored in the form of propositions.

This model, strongly influenced by Schön's ideas, encourages the approach between teachers and researchers, culminating in new research practices in education. As pointed out by Tardif and Moscoso (2018), in this context, collaborative researches, based on the co-construction of knowledge between researchers and teachers, gain notoriety.

FINAL CONSIDERATIONS

The schooling of students with autism in regular classes has been challenging, demanding from the teacher the knowledge and the incorporation of effective intervention strategies. Although international research agencies are evaluating and selecting scientifically validated practices such as EBP, studies indicate that they are still poorly known and/or employed by teachers in school contexts. This scenario reveals the distance between research development and their appropriation by teachers. It is noteworthy, due to the precarious teacher education and educational policies themselves, that this phenomenon is even more critical in the national context.

To fill this gap, a dynamic knowledge transposition model was presented that enriches the pragmatic paradigm and expands the linear perspective of the simple implementation of an EBP in the natural work environment. In this model, which aims to rescue the teaching protagonism and the contextualization of their pedagogical practices, emphasizing situational variables, and the knowledge about the specificities of autism. These elements favor the incorporation of EBP in school settings, not only enabling the use of empirically validated strategies in the education of students with autism but also forging innovative practices, developed from adaptations or modifications to meet classroom demands.

Given this perspective, new challenges are brought to light for both research and pedagogical practice. Regarding the first one, attention is drawn to the way researchers can conduct their research, presenting it in a way that facilitates the comprehension and its use by teachers. At the same time, the studies would meet an academically adequate theoretical and methodological rigor and the practical nature of the procedures required for their use in classrooms. On the other hand, teachers need to be sufficiently trained to evaluate the research to select the one that best meets the needs of their students. In the Brazilian scenario, the lack of public policies that warn of the use of EBP in schools is also highlighted. As previously noted in this article, Brazilian government agencies and universities fail to disseminate and/or encourage the use of interventional models supported by scientific research.

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