Review Article

Data-Driven Decision Making (DDDM) from the perspective of Ayres Sensory Integration®

Data-Driven Decision Making (DDDM) sob a perspectiva da Integração Sensorial de Ayres®

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Abstract

Introduction: The Ayres Sensory Integration® (ASI) method has been standing out within Occupational Therapy when implementing its evidence-based practice and, for this reason, it has had great notoriety in Brazil and in the world. To ensure the quality of the services provided, Ayres Sensory Integration® training programs follow some minimum standards, including the use of the Fidelity Measure© and the interpretation of evaluation data to inform clinical reasoning, which can be carried out through the Data-Driven Decision Making (DDDM). **Objective:** Since DDDM is a tool that is still little discussed in Brazil, it is proposed to present its main contributions to the clinical and professional reasoning of occupational therapists and to the generation of evidence. **Method:** This is an integrative and narrative literature review with a quali-quantitative approach, the sample period being the years from 2012 to March 2022. Among the 22 titles found, 13 scientific articles were included in this Review. **Results:** DDDM proved to be a safe and viable tool for use in clinical practice in ASI®, with several contributions such as: client-centered practice, generation of hypotheses, development of personalized activities and intervention, elaboration of appropriate goals for each case and quantification of intervention effectiveness. **Conclusion:** It is a tool that supports evidence-based practice as well as guides the clinical reasoning of occupational therapists through a focus on the use of data-based decision making.

Keywords: Occupational Therapy, Mental Processing, Clinical Decision-Making.

Resumo

Introdução: O método de Integração Sensorial de Ayres® (ISA) vem se destacando dentro da terapia ocupacional ao implementar sua prática baseada em evidências e,

por este motivo, tem tido grande notoriedade no mundo e no Brasil. Para garantir a qualidade dos serviços prestados, os programas de treinamento em Integração Sensorial de Ayres® seguem alguns padrões mínimos, incluindo o uso da Medida de Fidelidade© e a interpretação de dados da avaliação para informar o raciocínio clínico, podendo ser realizada por meio do Data-Driven Decision Making (DDDM). **Objetivo:** Visto que o DDDM é um instrumento ainda pouco abordado no Brasil, propõe-se apresentar suas principais contribuições para o raciocínio clínico e profissional de terapeutas ocupacionais e para a geração de evidências. **Método:** Trata-se de uma revisão integrativa e narrativa de literatura com abordagem quali-quantitativa, sendo o período de amostra os anos de 2012 a março de 2022. Entre os 22 títulos encontrados, foram incluídos 13 artigos científicos nesta revisão. **Resultados:** O DDDM demonstrou ser um instrumento seguro e viável para utilização na prática clínica em ISA®, havendo diversas contribuições, como: prática centrada no cliente, a geração de hipóteses, a preparação e condução de atividades e intervenções personalizadas, elaboração de metas apropriadas para cada caso e quantificação da eficácia da intervenção. **Conclusão:** É um instrumento que fornece suporte à prática baseada em evidências, bem como orienta o raciocínio clínico de terapeutas ocupacionais por meio do foco na utilização de tomada de decisão baseada em dados.

Palavras-chave: Terapia Ocupacional, Processamento Mentais, Tomada de Decisão Clínica.

Introduction

Occupational therapy has placed greater emphasis on generating clinical evidence that supports the effectiveness of different types of practices and interventions used in the occupational therapy process in order to increase client participation and occupational performance (Gee et al., 2017). In addition, the occupational therapy literature has shown the importance of a systematic and data-driven practice that assists in critical thinking, clinical and professional reasoning, and decision-making by occupational therapists (Schaaf, 2015).

The theory and intervention of the Ayres® Sensory Integration method, therefore, has been standing out within occupational therapy by implementing its evidence-based practice and, for this reason, has gained notoriety in the world and in Brazil. It is a service that is much sought after within the profession, especially for the treatment of children and adolescents with Autism Spectrum Disorder (ASD), possibly due to the perception of family members that sensory integration disorders significantly interfere with participation and performance in activities of daily living (Andrade, 2020).

Occupational therapists duly qualified in Ayres® Sensory Integration must follow scientific rigor and direct their interventions according to the Fidelity Measure©, applying the principles of Sensory Integration in clinical practice, using standardized assessments, and guiding clinical and professional reasoning through evaluative data.

In order to support the quality of services provided, evidence-based practice and to guide clinical and professional reasoning within occupational therapy, the Data-Driven Decision Making (DDDM) instrument, operationalized by Schaaf & Mailloux (2015),

can be translated as Data-Based Decision Making. However, in this study, we will use the original term in English. Consisting of eight stages, it is a systematized, replicable process that provides a framework for clinical reasoning through the occupational therapy process, focusing on the use of data to guide and measure results.

The main objective of this study is to carry out a systematic review of the literature on the use of the Data-Driven Decision Making (DDDM) instrument in the Sensory Integration intervention of Ayres®.

Clinical and Professional Reasoning in Occupational Therapy

Clinical reasoning is used to guide, outline, and reflect on the treatment process. Moruno-Millares et al. (2019), based on their research, state that all sources found before the year 2009 concentrate clinical reasoning within the occupational assessment process, similar to medical practice. On the term "clinical reasoning", Kielhofner & Forsyth (2002 as cited in Moruno-Millares et al., 2019) and Schell (2008 as cited in Moruno-Millares et al., 2019) propose the use of the term "professional reasoning", precisely to detach therapeutic reasoning from medical reasoning, given the diversity of occupational therapy fields of action.

Occupational therapists, throughout the entire process, are continuously involved in professional reasoning about a client's occupational performance, allowing them to identify their needs, as well as supporting interventions and outcomes. The construction of this reasoning ensures the most accurate choice and practice of client-centered assessment, intervention, and outcome measurement methods (Schaaf, 2015), and it is important to note that these processes are not separate or parallel (Moruno-Millares et al., 2019; Associação Americana de Terapia Ocupacional, 2020).

From the perspective of sensory integration, it is important to consider, for the construction of professional reasoning, the history of information about the child, both family and school, knowledge of the theoretical basis of the problem, generation of hypotheses and interpretation of observations in practice. Thus, in order to conclude a clinical diagnosis, the observation about the change in behavior and the functional improvement must come from the behaviors and complaints, from the hypotheses generated about the dysfunction of the sensory integration processing, formal evaluations and application of the intervention (Bundy & Lane, 2020). In this process, when using a systematized instrument that structures and guides the occupational therapist's decision-making, such as the DDDM, a greater measurement and clinical evidence base is established in the intervention (Schaaf, 2015).

Ayres Sensory Integration® (ASI)

Dr. Anna Jean Ayres began her research on Sensory Integration (SI) with a view to children's behavior and learning, and thus developed the theory to better "explain the relationships between deficits in the interpretation of body sensations and environment, and difficulties with academic and motor learning" (Bundy & Lane, 2020, p. 2). So, sensory integration, as Ayres says (1972, p. 11), is defined as the "neurological process that organizes the sensations of one's own body and the environment, and makes it possible to use the body effectively within the environment". ASI's theory points out

that it is necessary to have internal motivation for learning and this arises when there is an ideal environment, a challenge in the right measure and fun for engagement, generating an adaptive response. For this, seven sensory systems considered in theory are used: hearing, vision, taste, touch, smell, vestibular and proprioceptive (Bundy & Lane, 2020).

Ayres (1972) hypothesized that some deficits observed in children's behavior could be related to areas of the central nervous system. Although the theory has a greater focus on the vestibular, proprioceptive, and tactile systems, the importance of other senses, such as auditory and visual, is not discarded.

The theory presents three main postulates:

> 1. Learning, in the broadest sense, depends on the ability to process and integrate sensations and use them to plan and organize behavior. 2. A diminished ability to process and integrate sensations can result in difficulty producing appropriate actions, which, in turn, can interfere with learning and behavior. 3. The sensations generated and integrated in the context of a "just right challenge" contribute to improved CNS processing, thus improving learning and behavior (Bundy & Lane, 2020, pp. 4-5, own translation).

Thus, it is understood that the dysfunction of sensory integration processing, whether due to dyspraxia and/or sensory reactivity, also affects the daily occupational performance of children in other areas, such as self-esteem, self-efficacy, values, and beliefs (Bundy & Lane, 2020).

Data-Driven Decision Making (DDDM)

Data-Driven Decision Making (DDDM) was developed by Roseann Schaaf and Zoe Mailloux, occupational therapists, with the purpose of meeting the need for greater measurement of the results of occupational therapeutic interventions. DDDM is characterized by the use of systematic clinical reasoning focused on data, being a standard and exclusive practice of occupational therapy (Schaaf, 2015; Faller et al., 2016). DDDM provides a framework for clinical reasoning through the occupational therapy process, with a focus on using data to guide and measure outcomes (Schaaf, 2015). This instrument, therefore, involves using a systematic process to generate and test clinical hypotheses, develop and adapt replicable, client-centered interventions, as well as measure and report on intervention outcomes (Faller et al., 2016).

In order to organize and guide the clinical reasoning of occupational therapists, this data-driven decision-making process comprises a series of 8 steps (Figure 1) listed by Schaaf & Mailloux (2015) as follows:

Step 1 – Identify participation potentials and challenges: consists of identifying participation potentials and challenges that are affecting the client's ability to engage in desired occupations and activities of daily living, in addition to describing the current level of performance for each participation challenge identified. Participation challenges are derived from the client's occupational history, strengths, and concerns, as well as observation and discussion with the client, family, teachers and key stakeholders (Schaaf, 2015; Faller et al., 2016).

Step 2 – Conduct a comprehensive assessment: carrying out standardized and systematic assessments in order to identify the reasons that may be interfering with occupational performance and client participation. The assessment must be guided by the therapist's clinical reasoning and theoretical perspective, that is, occupational therapists must select assessment instruments that are in accordance with the theoretical basis or frame of reference used, based on the current needs of the client. The data obtained in the evaluation guide the formulation of hypotheses generated in the next stage (Schaaf, 2015; Faller et al., 2016).

Step 3 – Generate hypotheses: the occupational therapist must link the assessment results to performance and participation issues, in order to create a synthesis of the data and generate hypotheses; the creation of hypotheses is facilitated when there is a synthesis and analysis of the evaluative data (Faller et al., 2016). According to Schaaf (2015), the generation of theoretically oriented hypotheses, that is, those that use evaluative data to identify the factors that affect participation, are fundamental to this process because they provide a link between function and occupation. It is at this stage that occupational therapy professionals can articulate a clear rationale for the intervention and establish objective outcome markers. Furthermore, hypotheses can be tested and confirmed or revised based on concrete data.

Step 4 - Develop and Scale Goals: The occupational therapist should formulate hypotheses and targeted goals that relate the factors identified in the assessment process to the goal areas identified by the client and their family. The fourth step of the DDDM, therefore, consists of developing operationalized targets that explicitly identify the affected and important occupancy areas for the client. This systematic process allows occupational therapists to focus on meaningful activities and goals listed by the client, family, and stakeholders, being a useful strategy for measuring results (Schaaf et al., 2015; Omairi et al., 2022).

Step 5 – Identify outcome measures (proximal and distal): used to monitor progress towards goals. These results are directly related to hypothetical factors that affect participation and include individual and environmental strengths, facilitators, and barriers (Schaaf, 2015; Omairi et al., 2022). Proximal outcomes are the identified factors that affect participation, for example, difficulties in processing and integrating sensory stimuli, decreased motivation, spasticity, movement difficulties, among others (Schaaf, 2015). The distal results "are related to the child's specific participation challenges, identified by the family and/or client, and are closely linked with the functional objectives identified during goal setting" (Schaaf & Mailloux, 2015, p. 89). Proximal sensorimotor factors are linked to improvement in occupation-based distal outcomes (Omairi et al., 2022).

Step 6 – Prepare the intervention: In this step, the occupational therapist must develop and plan the intervention. The intervention must be replicable, that is, can be reproduced and must be based on evidence. All activities that will be developed must be well documented, explaining the frequency, intensity and time course of each strategy or activity (Schaaf, 2015).

Step 7 – Conducting the intervention: in this step, the intervention itself is carried out, that is, the application of previously established activities and strategies.

According to Schaaf et al. (2015), the intervention should be centered on the client, the family and the identification and measurement of important results for them.

Step 8 – Measure results and monitor progress: in the last step of the DDDM, the occupational therapist must collect, display, and analyze the data obtained, using graphs and tables, in order to monitor the progress obtained with the intervention. Hypotheses should be revised and, as necessary, modified based on outcome data (Schaaf, 2015).
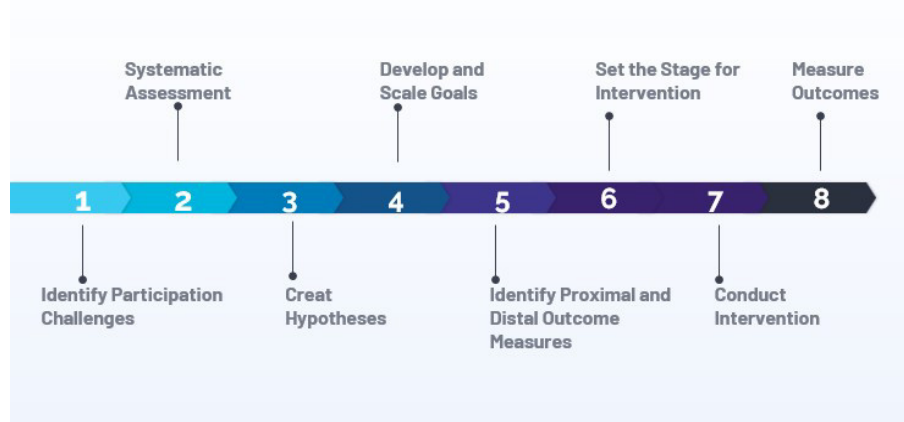

Figure 1. *Data-Driven Decision Making* (dddm) steps. Source: The authors (2022).

Methodology

The study is an integrative review (Mendes et al., 2008) and a narrative literature review (Rother, 2007; Universidade Estadual Paulista, 2015), with a qualitative and quantitative approach. According to Mendes et al. (2008), for the construction of the integrative literature review, it is necessary to go through six distinct steps: 1) establishment of the hypothesis or research question; 2) sampling or literature search; 3) categorization of studies; 4) evaluation of the studies included in the review; 5) interpretation of results; 6) synthesis of knowledge or presentation of the review.

Thus, to carry out the searches, the selected databases were LILACS, MEDLINE, PubMed and the CAPES Journal Portal. As descriptors, a combination of terms was used: Data-driven (data-based), Decision Making and Ayres Sensory Integration®. In consultation with the librarian of the Health Library at the Botanical Campus, Federal University of Paraná – UFPR, it was recommended that the search be carried out by separating each term, using the Boolean operator AND, thus obtaining the search strategy: (date-driven AND decision AND making AND Ayres AND sensory AND integration).

The inclusion criteria adopted were: the obligation for the article to present at least one of the descriptors in the title and/or abstract and/or keyword; having been published between 2012 and March 2022; having explained the work of the occupational therapist with the Ayres® Sensory Integration method; having mentioned the contribution of

Data-Driven Decision Making (DDDM) or describe its steps; the publication being in English, Spanish or Portuguese and available in full. The following exclusion criteria were established: theses, dissertations, articles that are not related to Sensory Integration by Ayres® and duplicates.

Some important scientific articles in the literature on the subject were not located by the descriptors that were previously defined, being included through manual scanning, precisely because they are relevant studies, consistent with the subject addressed and prepared by the main authors in this field, such as Roseann C. Schaaf, who developed the instrument.

It is noteworthy that the searches were carried out in the second half of October 2021, by two different examiners, with an estimated time of 15 days between searches. And a new search was carried out in the first half of March 2022. Due to the theme being recently explored in Brazil, finding a strategy that encompasses the majority of studies with relevance to the theme within the cited databases was one of the challenges encountered, because, in addition to the few publications available with this search strategy, we observed that many of the articles that appear are not from the health area or do not talk about sensory integration. Another point to be highlighted is that, even without using the language filter strategy, the findings were 99% in English, only 1 article in Spanish and 0 articles in Portuguese. For this reason, we used the Google translation feature, in the complete document option, to provide greater assurance of correct understanding of the information described in the articles in English and Spanish.

The selection of studies was carried out after reading all the articles found in full. For the composition of the integrative review, scientific articles were selected that explained in the body of the text the work of the occupational therapist with the Ayres® Sensory Integration approach, mentioned DDDM or described its stages, as already mentioned in the inclusion criteria. For the identification and organization of the selected studies, an Excel spreadsheet prepared by the authors was used as a collection resource, which included information on descriptors, title, database, journal, link, authors, reference, year of publication, location performance, sample, study objectives, methodology used, main results, relevant aspects, and observations.

The evaluation of the quality of the studies included a critical, careful, and detailed reading of the selected articles. The pair of examiners paid attention to the objectives, methodology and results of each article read and were in constant exchange regarding the main conclusions of the studies and relevant information of each one. The analysis made it possible to identify which articles were consistent with the theme and the previously established inclusion criteria. In this process, important attention was given to the types of studies, which resulted in the sample including randomized controlled clinical trials, systematic review, and case studies, for example.

The categorization was defined after the complete reading, favoring the observation of this material in its conjuncture, avoiding oblique lines of the study, defining 5 categories in total. Thus, the amount of research that talks about the DDDM instrument and, in addition to other aspects, about which stages of the instrument were most approached, creating the groupings, was evidenced.

Based on the results, the research findings were discussed among the authors based on a critical reading and focused on the main thematic points of each study. The findings with the emphasis of each study were summarized in the creation of Table 1.

Results

With the search strategy performed, a total of 22 studies were found, 1 from Medline, 1 from PubMed and 20 from the CAPES Journal Portal. Of these findings, 2 were excluded due to duplicity. No articles were found in LILACS. All other articles were selected for reading the title and abstract (n=20), 9 were excluded for not having at least one of the descriptors in the title and/or abstract and/or keyword, and also because they were not studies of occupational therapy, Ayres® Sensory Integration and did not mention Data-Driven Decision Making (DDDM) or describe its stages.

After reading in full all the selected studies (n=11), 0 in Portuguese, 1 in Spanish and the others in English, 3 were excluded, as 2 were not related to the theme and the other for not addressing specifically regarding Ayres® Sensory Integration and DDDM. However, the latter is an interesting material regarding the clinical and professional reasoning of occupational therapy, being, for this reason, used only in the theoretical foundation of this research. Thus, based on this search strategy, 8 scientific articles were included as part of the sample (Figure 2).
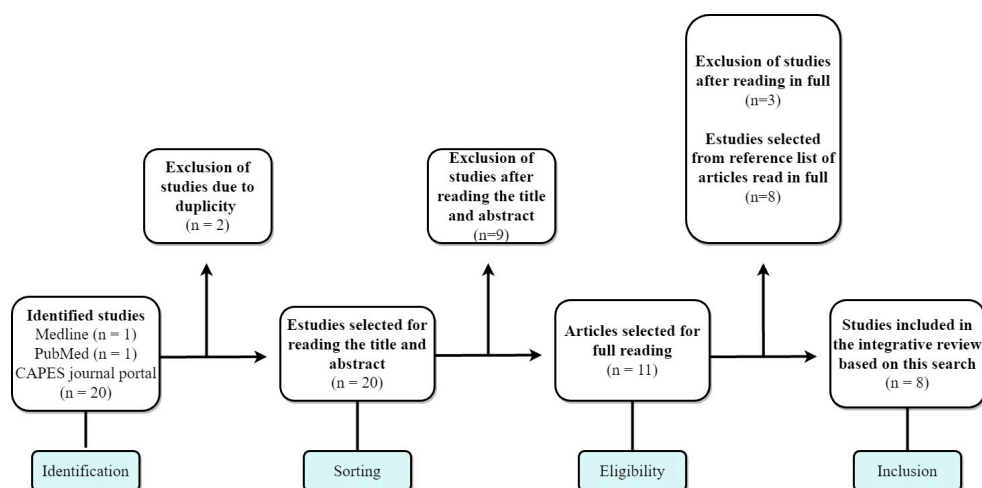
Figure 2. Study selection flowchart. Source: The authors (2022).

The studies selected based on the search strategy correspond to the years of publication from 2014 to 2022. With the exception of articles (n=2) that are included in the Journal of Autism and Developmental Disorders and in F100Research, all others (n=6) are found in The American Journal of Occupational Therapy (AJOT). Occupational therapist Roseann C. Schaaf stands out as the author of 6 studies, out of the 8 selected.

Some important studies in the literature on the subject were not located by the search strategy. However, as they are relevant scientific articles, consistent with the subject discussed and elaborated by the main authors of the subject, such as Roseann C. Schaaf, some of these studies (n=5) were included in this review through manual scanning. The articles included correspond to the years of publication from 2012 to 2018, and, in addition to The American Journal of Occupational Therapy, some articles are included in the Autism and Occupational Therapy International journals.

Based on the search strategy, manual scanning and critical reading of all studies, 13 scientific articles were included in this integrative literature review. The publications

were carried out between the years 2012 to 2022 and correspond to Randomized Controlled Clinical Trials (n=2), Systematic Review (n=1), Case Studies (n=4), Experimental Research (n=2), Study Quasi-Experimental (n=2), Scientific Dialogue (n=1) and Exploratory Research (n=1).

Based on the in-depth reading of the articles, it was possible to define the following categories: 1) Studies with children and adolescents with Autistic Spectrum Disorder (ASD); 2) Description of all DDDM steps; 3) Emphasis on one or more steps; 4) Contribution to the clinical reasoning of the occupational therapy professional; 5) Advancement of best practices in occupational therapy.

With the categorization of the articles, it was possible to observe that most of the studies focus on the pediatric area, specifically with children and adolescents with ASD (n=9), as shown in Figure 3. Some of the studies describe all stages of DDDM (n=6), while others emphasize one or more of its steps. Some of these steps were highlighted in publications, including steps 2, 3, 4, 5 and 8, which correspond, respectively, to: conducting a comprehensive assessment (A3; A5; A8; A10); generate hypotheses (A1; A2; A3; A7; A10; A12); develop and scale goals (A1; A3; A5; A8; A10; A11; A12); identify proximal and distal outcome measures (A1; A3; A4; A5; A11; A12; A13) and measure outcomes and monitor progress (A3; A4; A7; A5). Since there are more articles that describe isolated steps than all, and in those that describe all steps, it was possible to observe greater emphasis on some of the steps.

All articles selected for this integrative literature review (n=13) present the contributions of Data-Driven Decision Making (DDDM) to the clinical reasoning and decision making of the occupational therapy professional. And, most of them (n=10), discuss the advancement of best practices within the profession from the use of this instrument, as shown below (Figure 3).
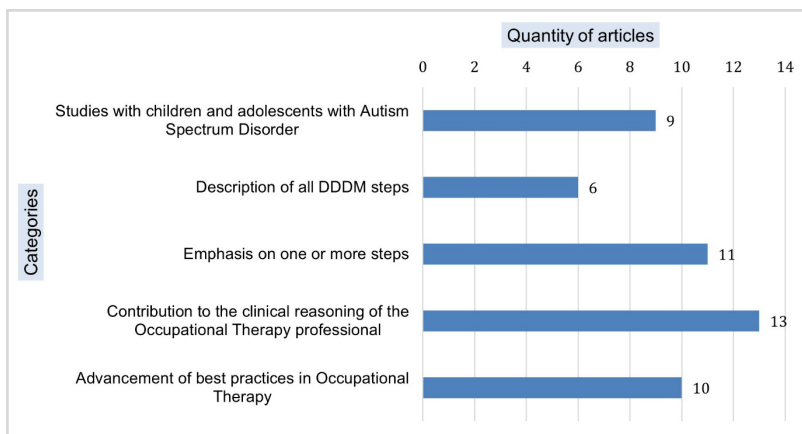

Figure 3. Quantity of articles per category. Source: The authors (2022).

Discussion

Based on the analysis of the results, it was found that the studies are concentrated in the pediatric area. Most studies are focused on analyzing the effectiveness of Ayres® Sensory Integration Therapy for children and adolescents with Autism Spectrum

Disorder (ASD). This factor may be associated with the fact that 45% to 90% of children with ASD demonstrate difficulties in processing and integrating sensations, affecting participation in daily activities (Ben-sasson, 2008 and Leekam, 2007 as cited in Costa & Silva, 2020).

The selected articles discuss the use of Data-Driven Decision Making (DDDM) in the clinical practice of occupational therapists who use the ASI® method. While part of the studies only describes one or two of its stages, others present the eight stages in more detail, applied to examples and case studies. These help in understanding the application of the instrument, serving as a strong theoretical basis for this research.

Some steps in particular were highlighted in the publications, namely: 2, 3, 4, 5 and 8. However, little emphasis was given to steps 1 (identifying potentials and challenge of participation), 6 (preparing phase for intervention) and 7 (conducting the intervention), often being coupled in another step.

Based on the reflections arising from the studies, according to Parham et al. (2019), May-Benson et al. (2018) and Schaaf et al. (2014), the DDDM allows for a comprehensive and systematic assessment of sensory processing, the strengths and challenges of the child's participation, helping to identify the family's objectives with occupational therapy and based on this, in the formulation of individualized intervention strategies. Schaaf (2015) points out that, although many children with ASD have difficulties in processing and integrating sensory information, not all of their behaviors are related to sensory factors. Thus, the use of evaluative data is extremely important to identify whether sensory factors are really linked to participation challenges.

May-Benson et al. (2018) point out that occupational therapists should recognize that an initial assessment instrument may not be useful as an outcome measure. Many assessment measures are developed as diagnostic tools and may have inadequate reliability, validity, or sensitivity. The authors also state that the careful selection of these measures is fundamental for the advancement of existing evidence and practices within the ASI®. Among the assessments used by the studies included in this review, we can highlight: the Sensory Profile (Dunn, 1999); the Sensory Integration and Praxis Test – SIPT (Ayres, 1989); the Sensory Processing Measure – SPM (Parham & Ecker, 2007) and the Pediatric Assessment of Disability Inventory – PEDI (Haley, 1992).

Alkhalifah et al. (2022) and Andelin et al. (2021) highlight the relevance of using Data-Driven Decision Making to formulate hypotheses about processing and sensory integration factors that affect occupational performance and client participation. Still according to the authors, the hypotheses help in the development of individualized sensory-motor activities to address these factors. Parham et al. (2019), Faller et al. (2016) and Schaaf et al. (2012, 2014) add that the survey of hypotheses is based on the findings and data from the evaluation, which allow determining an appropriate approach and intervention goals for each case.

The occupational therapist's role in goal development and scheduling, according to May-Benson et al. (2018), is to assist the client in identifying functional and performance areas of occupations that can be improved with occupational therapeutic intervention. Parham et al. (2019) state that the establishment of goals should be related to the factors identified in the evaluation process and, especially, to the expectations of the family and the goals identified by the parents. Most of the studies use GAS (Goal

Attainment Scaling) within this stage. May-Benson et al. (2018) and Schaaf et al. (2014) point out that the results were better and more significant when using individual measures of occupational performance, such as GAS.

In the Ayres® Sensory Integration intervention, changes in proximal factors such as sensory and motor skills are seen as a means of improving functioning in distal factors such as: occupational performance, quality of life and participation. As with most occupational therapy interventions, distal outcomes are of primary importance (May-Benson et al., 2018). DDDM helps, according to Alkhalifah et al. (2022) and Schaaf et al. (2015, 2018) to identify the underlying sensory processing and integration challenges to the challenges of participating in Activities of Daily Living (ADLs), allowing occupational therapists to assess the link between such factors and propose an individualized intervention plan that is linked to the client's priorities and the family. This corroborates, according to Omairi et al. (2022), the original thought of Ayres, in which sensory functions, when integrated, provide an important basis for satisfactory occupational performance.

Faller et al. (2016) also add that the identification and measurement of results at the proximal and distal levels allow therapists to monitor the effectiveness of the intervention and also validate the reasoning. When proximal and distal outcomes show simultaneous improvements, the hypothesis not only provides support for occupational therapy intervention, but also creates a bridge between practice and research. When the results show no change, the hypothesis can be revised, the approach altered or the theoretical principles that guide the evaluation and practice modified.

Within the occupational therapy process, the Associação Americana de Terapia Ocupacional (2020) has highlighted the relevance of measuring evaluative data and the use of objective outcome measures that help monitor the progress of the intervention towards meeting goals. According to Faller et al. (2016) and Parham et al. (2019), DDDM provides a useful strategy for incorporating outcome measurement into daily practice, allowing to determine to what extent the objectives were achieved and to quantify the effectiveness of the intervention, validating clinical reasoning.

May-Benson et al. (2018) add that, as part of the DDDM, this progress monitoring process involves several steps. The therapist must first identify which outcomes to measure, as well as the time period and frequency of data collection. Data collection forms should be developed and determined how and where data will be collected. Once data is collected, the occupational therapist must determine how to present the results in a visual format (line or bar graphs, tables, etc.). This information will be used to analyze the child's progress, review hypotheses and the intervention plan. Another relevant point regarding the documentation of results is highlighted by Schaaf et al. (2018) and Faller et al. (2016), being useful measures for monitoring families and therapists regarding the progress resulting from the intervention. Parents indicate that measuring outcomes and displaying outcome data is helpful to them in terms of staying informed about their child's progress. Displaying results can therefore be a useful strategy for communicating with parents and other stakeholders.

As new evidence continues to expand and evolve the practice of occupational therapy, the DDDM has been used consistently as a practical and systematic instrument relevant to the clinical application of the ASI® intervention (May-Benson et al., 2018; Bellefeuille et al., 2013). And, according to Faller et al. (2016), Schaaf et al. (2015) and

Schaaf (2015), practices such as these can increase the evidence in occupational therapy and help determine which types of occupational therapy interventions are appropriate for each client.

Studies such as that by Schaaf et al. (2012) and Schaaf et al. (2018) demonstrated that the use of replicable intervention measures and protocols, as well as well-designed interventions show positive results. This provides a growing body of scientific evidence that supports the effectiveness and adherence to the principles of ASI® Therapy, contributing to the advancement of best practices for children with sensory processing difficulties.

And although the occupational therapy profession has placed greater emphasis on generating evidence to support the effectiveness of different types of practices and interventions used in the occupational therapy process, according to Gee et al. (2017) and Schaaf (2015), the literature demonstrates that professionals have not reported which frames of reference were used to guide clinical reasoning or decision-making in the intervention. In addition, there are few reports of using evidence and data to measure their interventions (Schaaf, 2015). Below is a table that summarizes the findings of this research (Table 1).

Table 1. Integrating summary.

Article identification	Title	Author(s)	Year	Emphasis
A1	Case Report: ASI intervention on a child with autism in Saudi Arabia	Alkhalifah et al.	2022	The 8 steps of Data-Driven Decision Making (DDDM) were used to apply the intervention in ASI®. The article states that the use of the distal and proximal results were helpful in demonstrating the link between underlying sensory integration challenges to occupations and ADLs. They also state that the use of DDDM was relevant for the formulation of hypotheses.
A2	Effectiveness of occupational therapy using a sensory integration approach: A multiple-baseline design study	Andelin et al.	2021	The article highlights the relevance of using the DDDM to generate hypotheses about the processing and sensory integration factors that affect the child's motor performance. The hypotheses helped in the development of sensorimotor activities individually adapted to address these factors.
A3	Occupational Therapy Interventions for Children and Youth With Challenges in Sensory Integration and Sensory Processing: A Clinic-Based Practice Case Example	Parham et al.	2019	The DDDM allows a comprehensive assessment of sensory processing and integration to be performed. The use of evaluative data contributes to raising hypotheses about the factors that affect occupational performance and participation. It contributes to setting goals, being relevant for measuring results and monitoring progress.

Table 1. Continued…

Article identification	Title	Author(s)	Year	Emphasis
A4	Efficacy of occupational therapy using Ayres Sensory Integration®: A systematic review	Schaaf et al.	2018	This research demonstrated that the use of replicable measures and intervention protocols encourage evidence-based practice and greater fidelity to the ASI® Therapy, contributing to the advancement of best practices for children with ASD with sensory processing difficulties.
A5	Identifying and Measuring Outcomes in Ayres Sensory Integration	May-Benson et al.	2018	This article discusses the use of DDDM to identify and measure distal and proximal results in ASI®. It emphasizes that identifying and measuring the results of participation and performance of occupations is an important component in the occupational therapy process. It highlights that in the ASI® intervention, changes in proximal factors, such as sensory and motor skills, are seen as a means of improving functioning in distal factors, such as: occupational performance, quality of life and participation. As with most occupational therapy interventions, distal outcomes based on participation are of primary importance. It also highlights the importance of a careful selection of outcome measures for advancing existing evidence and practices within the ASI®.
A6	The Development of a Measurement Tool Evaluating Knowledge Related to Sensory Processing among Graduate Occupational Therapy Students: A Process Description	Gee et al.	2017	The article describes that although there are resources available for occupational therapists to guide their interventions within the ASI®, such as the DDDM, this process has not been widely reported in the literature. And, although occupational therapy has placed greater emphasis on generating evidence, at undergraduate level there is little focus on how to teach students about a formalized process that determines when and how to use evidence-based interventions, highlighting the need for continuing education.
A7	Application of data-driven decision making using Ayres Sensory Integration® With a child with autism	Faller et al.	2016	The article points out that the structured format of the DDDM facilitated the use of the systematic process by the occupational therapist and provided a method for describing the reasoning process, including a data-based rationale for treatment decisions. The process allowed the occupational therapist to engage in a client-centered practice, individualizing the intervention to target specific underlying sensorimotor factors identified through the collection and analysis of assessment data. The DDDM allows the occupational therapist to systematically and clearly document the results and is useful to inform parents about the progress made with the ASI® intervention, increasing the evidence regarding the effectiveness of this method.

Table 1. Continued…

Article identification	Title	Author(s)	Year	Emphasis
A8	Linking sensory factors to participation: establishing intervention goals with parents for children with autism spectrum disorder	Schaaf et al.	2015	According to this article, the DDDM is a structured process that helps occupational therapists link identified parent priorities to underlying factors (proximal) that may be affecting occupational performance and participation (distal). Once these factors are related, they guide the design and selection of intervention strategies that target priority areas. The DDDM makes it possible to identify the family's goals, strengths, and challenges of child participation, through a systematic assessment to formulate the hypothetical factors that affect participation. From this, the professional formulates targeted goals that link the factors identified in the assessment process to the goal areas identified by the parents. The process, therefore, creates evidence through practice, which is evidence-based.
A9	Creating Evidence for Practice Using Data-Driven Decision Making	Schaaf	2015	The main implication of DDDM in occupational therapy, according to the article, is the scientific validation of the profession, since DDDM is a mechanism for generating evidence through practice and the use of data. It also points out that, although the TO literature presents the importance of an evidence-based, systematic and data-oriented practice, professionals do not use these mechanisms to guide and measure their interventions. Among some identified barriers are: lack of time, knowledge and skills, and the belief that evidence may limit their ability to provide client - or family-centered care.
A10	An intervention for sensory difficulties in children with autism: A randomized trial.	Schaaf et al.	2014	The article demonstrates that the use of the DDDM allows for the individual customization of treatment activities through evaluative data and the formulation of hypotheses about the sensorimotor factors that affect the child's functional behaviors. The results of the article provide preliminary support for the effectiveness of a manual intervention designed to address sensory information processing and integration difficulties for children with ASD.
A11	Occupational therapy based on Ayres Sensory Integration in the treatment of retentive fecal incontinence in a 3-year-old boy	Bellefeuill et al.	2013	It presents the intervention process based on DDDM, showing that it can be used with children with diagnoses other than ASD. The case study demonstrates the use of systematic reasoning systems using the DDDM as an example for generating evidence during clinical practice. Emphasizes proximal and distal results and hypotheses.
A12	Occupational therapy and sensory integration for children with autism: a feasibility, safety, acceptability and fidelity study.	Schaaf et al.	2012	The data-driven intervention process was extremely valuable to the occupational therapists, allowing them to implement the intervention with high fidelity. In addition, the manual protocol provided guidance to the therapist throughout the process, maintaining fidelity to the principles and practices described in the ASI® Fidelity Measure©. The scaled, standardized method of documenting the individual's progress toward goals was helpful in identifying changes in performance and participation linked to sensory integration and processing. The protocol, therefore, proved to be safe, acceptable, and feasible to be administered with children with autism.

Table 1. Continued…

Article identification	Title	Author(s)	Year	Emphasis
A13	Emerging as Leaders in Autism Research and Practice: Using the Data-Driven Intervention Process	Schaaf & Blanche	2012	The study identified that the data-driven intervention process allows occupational therapists to systematically identify and test their clinical reasoning by providing data on intervention effects. Ultimately, this process allows therapists to validate occupational therapy interventions.

Source: The authors (2022).

Conclusion

Among the main contributions of the DDDM, it can be highlighted that this process encourages the occupational therapist's engagement in a client-centered practice, since the goals are directed to the factors identified in the evaluation process to the areas of goals identified by the client and their family. The comprehensive evaluation, as well as the formulated hypotheses, favor the identification and relationship between sensory factors and the challenges of participation; it allows monitoring progress towards goals and informing parents, family members and interested parties about the main results resulting from the intervention, thus quantifying the effectiveness of the treatment, and validating clinical reasoning.

The implications of these findings refer to the advancement of best practices in occupational therapy and Ayres® Sensory Integration, providing, through daily clinical practice, a growing body of scientific evidence regarding the effectiveness of this method and with strong fidelity to the structure and to the process. Thus, this proved to be a safe, acceptable, and viable instrument to be administered in Ayres® Sensory Integration Therapy and applied in other areas of occupational therapy practice, in order to guide the implementation of personalized, replicable and measurable interventions.

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