

Research Article

Sensory based interventions by speech language pathologists

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Abstract.

BACKGROUND: The use of sensory based interventions (SBI) by many parties including speech-language pathologists (SLPs) are evident despite limited proof of their efficacy. Insight into SLPs' implementation, knowledge, and perceptions of SBI are crucial to define and guide such practices in the field of speech-language therapy.

OBJECTIVES: The study aimed to gather information regarding the nature of SBI, knowledge of sensory processing and SBI, and perception of the role and outcomes of SBI as implemented by SLPs.

METHOD: A quantitative survey design was employed. Sixty-five SLPs working in early intervention clinics, public hospital clinics, school settings, and private practice responded to a questionnaire. Results were analysed using SPSS statistical software.

RESULTS: Respondents indicated that they often implement SBI using various sensory activities and equipment. They answered more than half of the questions related to the prevalence and nature of sensory difficulties in children with Autistic Spectrum Disorder (CWASD) accurately. Respondents answered fewer questions regarding the differences between SBI and sensory integration therapy accurately. Regular collaboration with and guidance from occupational therapists (OTs) were reported. Respondents acknowledged the role of SLPs in addressing sensory difficulties in CWASD. Positive outcomes for the implementation of SBI in speech-language therapy were stated.

CONCLUSION: Despite the limited evidence for the efficacy of SBI, SLPs regularly implement such practices to enhance therapy outcomes. The insights gathered from this study support reports of positive outcomes related to SBI. The need for more rigorous efficacy studies, clearer guidelines and specialised training for SLT's in SBI are highlighted.

Keywords: Sensory based interventions, Autistic Spectrum Disorder, speech-language pathologists, sensory difficulties, quantitative survey design, multi-disciplinary collaboration

1. Introduction

Sensory difficulties are present in individuals with Autistic Spectrum Disorder (ASD) across this heterogenic population (Baraneck et al., 2014; Schauder & Benneto, 2016). Atypical processing of sensory information amongst individuals with certain neurodevelopmental disorders including ASD is described as sensory modulation disorder (Tomcheck & Dunn, 2007, Miller et al., 2007). Longstand-

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ing research described five main sensory systems including the tactile, auditory, visual, vestibular and proprioceptive systems (Ayers, 1972). Maladaptive responses to sensory stimuli occur as a result of the nervous system not processing sensory information received from the sensory systems effectively. Hypo-responsive behaviours, hyper-responsive behaviours and sensory seeking behaviours are described as sensory subtypes occurring in the ASD population (Green et al., 2016; Posar & Visconte, 2018; Schauder & Bennetto, 2016; Tomchek & Dunn, 2007; Watson et al., 2011). These difficulties have a profound effect on the development of social competence and joint attention of children with ASD (CWASD) (Dakopolos & Jahromi, 2019; Kojovic et al., 2019). Occupational therapists (OTs) implement Ayers Sensory Integration® (ASI) and sensory based interventions (SBI) to address and manage sensory difficulties in individuals (Posar & Visconti, 2019; Weitlauf, 2017).

In ASI opportunities are created for the child to adapt their responses to sensory input, resulting in improved functioning in relation to environmental demands (Ayers, 1976; Bundy & Lane, 2020; Schaaf et al., 2015). OTs experiencing positive outcomes from using various strategies in ASI guide other professionals including SLPs to use these strategies outside of the context of ASI (Benson et al., 2019). Implementation of such strategies in classrooms, speech therapy or at home are referred to as SBI. It is implemented to provide specific sensory experiences to individuals. Commonly used activities may include brushing, massage, swinging, bouncing on a therapy ball, jumping on a trampoline, riding on a scooter board, crawling through a tunnel, wearing a weighted vest or compression by foam rollers (Barton et al., 2015; Lang et al., 2012; Mills et al., 2016). These strategies are aimed at influencing neural arousal to achieve an appropriate level of alertness and engagement for learning to take place (Benson et al., 2019; Frauwirth et al., 2019; Piller & Barimo, 2019; Posar & Visconti, 2018; Thomson-Hodgetts & Magill-Evans, 2018).

Research regarding the efficacy of SBI remain inconclusive (Bodison & Parham, 2018; Case-Smith et al., 2015; Weitlauf et al., 2017). The use of therapy balls to encourage participation and in-seat behaviour was found effective in some studies (Lin et al., 2012; Mills et al., 2018; Schilling & Schwartz, 2004). Positive effects were indicated following parent implemented SBI for a period of 12 weeks using a variety of sensory activities (Padmanabha,

2018). The intervention group scored significantly higher in areas such as making eye contact, in responding to their names, reduced hyper-activity and sensory seeking behaviours compared to the control group. Other studies found that SBI strategies such as the use of therapy balls, weighted vests, and brushing to have no effect on reducing unwanted behaviours (Bagatell et al., 2010; Davis et al., 2011; Reichow et al., 2010; Tomchek & Koenig, 2016). Vestibular input (VI) in the form of swinging, jumping and spinning is another commonly used SBI described in the research with varying results. Results of a recent study determined that jumping on a small trampoline and spinning on a vestibular plate positively influenced sequence learning in minimally verbal CWASD (Katz-Nave et al., 2020). An increased response time and improved continuity of learning presented in the group that received VI. The researchers contributed the beneficial effect of VS to improved attention and executive functioning achieved due to the neural activation caused by this type of sensory stimulation (Katz-Nave et al., 2020). Researchers were also interested in the effect of VI on communication and language. An early study identified significant verbal gains in the treatment group receiving VI compared to the control group (Kantner et al., 1982). However, Reilly et al. (1983) found no increase in the variety and length of utterances in children who received slow, linear swinging on a platform swing. Ray et al. (1988) and Maddox (1990) reported increased vocal behaviours following VI provided by therapists. An increase in communicative behaviours (Gallagher, 2015; Longerbeam, 2013) and expressive language performance (Preis & McKenna, 2014) were indicated in more recent research by SLPs.

Researchers have called for further investigation into the effectiveness of SBI, as well as clearer guidelines for professionals implementing such practices (Bodison & Parham, 2018; Case-Smith et al., 2015; Preis & McKenna, 2014; Schooling, 2012; Watling & Hauer, 2015; Weitlauf et al., 2017). The positive reports on communication and language holds potential clinical implications for SLPs since they are involved alongside OTs in the assessment and intervention of CWASD (LaFrance et al., 2019; Jordan & Brown Lofland, 2016). SLPs are also expected to understand and manage sensory difficulties in the children they treat (Binns et al., 2019; Piller & Barimo, 2017; Preis & McKenna, 2014; Vitásková & Kytarová, 2017; White et al., 2018). However as in other professions (Kaiser et al., 2020, May

Benson & Koomar, 2010; Mills et al., 2021) clear guidelines regarding the SLPs role and implementation of SBI to support speech-language therapy are not yet available. This situation may lead to SLPs blindly implementing techniques aiming to enhance therapy outcomes (Preis & McKenna, 2014). A small number of international studies investigating implementation and perceptions of SBI by OTs (Benson et al., 2019; Thompson-Hodgetts & Magill-Evans, 2018), para-educators (Kaiser et al., 2020) and parents (Padmanhaba, 2018; Peña et al., 2021) were identified in the research literature. Respondents in these studies reported positive outcomes in focus, participation, behaviour and self-regulation related to the implementation of SBI in CWASD. The current study is the first to investigate the implementation and perceptions of SBI by SLPs. To provide a baseline for identifying areas of knowledge to be expanded on, professional training required, developing scope of practice for SLPs treating individuals with ASD, as well as encouraging interdisciplinary collaboration with OTs, the following research questions were posed: What is the nature of the SBI, the knowledge regarding SBI, perceived outcomes of SBI strategies as well as the perceived role in the implementation of SBI by SLPs in their practices? Furthermore, the study aimed to identify any significant relations between the implementation of SBI and the number of years' experience, work setting, collaboration with OTs and knowledge of respondents. Investigating relations between these factors may highlight challenges in accessibility, training opportunities and gaining practical experience for SLPs required to use SBI in clinical practice.

2. Method

2.1. Ethical considerations

The study was approved by the Research Ethics Committee of the Faculty of Humanities at the University of Pretoria. The study adhered to the ethical principles of autonomy, confidentiality, beneficence, non-maleficence, and distributive justice (HPCSA, 2016). The first item in the questionnaire asked participants for their consent to participate. Confidentiality was maintained by distributing the questionnaire through an anonymous link posted online. All SLPs working with CWASD were invited to participate.

2.2. Study design

A quantitative survey design was used to collect data for this study. This research design allowed the researcher to investigate key information regarding practices, perceptions and knowledge of the studied population online (Story & Tait, 2019).

2.3. Participants

Permission was received from the administrators of the following groups for distribution of the questionnaire via a link to which participants could respond anonymously: Allied Health in South Africa, South African Audiologists and Speech-language pathologists, and Private Practice Growth Club. The link was distributed on these groups in May 2022. The link remained active for a period of 6 weeks for participants to submit their responses.

A total of 81 respondents submitted their responses to the questionnaire to Qualtrics via the anonymous link. After removing the respondents who did not give consent ($n = 5$), those that spent less than one minute from entering the questionnaire to exiting it ($n = 8$), and that only answered yes to the consent question but didn't answer anything else ($n = 3$), 65 respondents were left. Using the Software G*Power version 3.1.9.4 (Faul et al., 2007), for a level of significance of 5%, a sample size of 65 and an effect size of 0.5 (Cohen, 1992) the achieved power is 0.992 which is above the ideal value of 0.8. Participants were qualified SLPs working with CWASD across South Africa. SLPs from a variety of therapy settings were included, namely early intervention centres or clinics, public hospital therapy clinics, schools, and private practices. A description of the biographical information, clinical background and caseloads of respondents are available in Appendix A.

2.4. Materials used for data collection

Information gathered from the research literature (APA, 2013; Ayers, 1972; Baranek et al., 2013; Binns et al., 2019; Bundy & Lane, 2020; Case-Smith et al., 2014; Green et al., 2016; LaFrance et al., 2019; Lane et al., 2019; Padmanabha, 2018; Peña, 2021; Posar & Visconte, 2018; Schauder & Benneto, 2016; Schaaf et al., 2015; Schoen et al. 2019; Simpson et al., 2019; Tomcheck et al., 2014; Watts et al., 2016; Thompson-Hodgetts & Magill-Evans, 2018), together with the sourced surveys related to SLPs and ASD (Benson et al. 2014; Gillon et al., 2017; Schwartz &

Drager, 2008) supported the development of an original questionnaire to meet the objectives of this study (Appendix B). Qualtrics XM software was used to design the questionnaire layout, distribute the questionnaire electronically as well as to capture and analyse data.

2.5. *Validity and reliability*

The statements in the questionnaire were based on current research in the field of SBI in CWASD to ensure content validity. To identify possible mistakes or ambiguities in the questionnaire a single participant, an OT certified in Ayers Sensory Integration Therapy® with more than 10 years' experience in working with CWASD, was recruited to participate in a pilot study (Ruel et al., 2016). The participant in the pilot study revealed that the questions and statements in the questionnaire were relevant to achieve the research objectives. The participant agreed with the accuracy and interpretation of statements. Three statements were added in relation with proprioceptive activities as the participant recommended investigating SLPs knowledge of such activities possibly having both a calming and arousing effect. Concern was raised regarding the length of the questionnaire. It was confirmed that it was necessary to include many items for each theme of the Likert-scale type questions in order to be able to apply Cronbach's Alpha (Field, 2018).

Cronbach's alpha was applied to enhance the internal consistency and scale reliability (Field, 2018). Cronbach alpha is a measure of internal consistency for an instrument. Cronbach values above 0.7 are acceptable (Field, 2018) and indicate that the instrument (questionnaire) is reliable. A number of Likert-scale type questions or statements related to a single theme is required to perform Cronbach values in survey research (Field, 2018). For the Likert-scale type questions in the current study's questionnaire the Cronbach values were 0.93 for the theme investigating perceived outcomes of SBI, and 0.739 for the theme investigating the perceived role of SLPs in the implementation of SBI. All Cronbach alpha values calculated for the questionnaire in this study are above 0.7, indicating reliability.

Applicability of the research was enhanced by obtaining a representative sample of South African SLPs that participated in the study.

A strobe checklist was completed (von Elm et al., 2008) to guide comprehensive reporting of all relevant information.

2.6. *Data processing and analysis*

Statistical analysis of data was conducted by a statistician associated with the Department of Science, Mathematics and Technology Education of the University of Pretoria. The data captured by Qualtrics were exported to the Statistical Package for the Social Sciences (SPSS) version 26. SPSS was used for all data analysis. A level of significance of 5% was used. In order to find statistically significant associations between two categorical variables, the Chi-square test was used. If the p -value was less than 0.05, the association was statistically significant.

The Shapiro-Wilk test was used to test for normality as it is known to have more power in detecting differences from normality (Field, 2018). Since the p -value is not greater than 0.05, the percentage of correct answers is not normally distributed. Thus, the nonparametric Spearman correlation was used instead of the parametric Pearson correlation to investigate relationships between variables. If the p -value is less than 0.05, the correlation was found statistically significant.

3. Results

3.1. *Nature of SBI implemented by SLPs*

Half of the SLPs who responded indicated often implementing SBI (50%; $n=29$). Thirty one percent of respondents ($n=18$) indicated occasionally implementing SBI. Only 5% ($n=3$) of respondents never implement SBI when working with CWASD. Significant relationships were identified between implementation of SBI (dependent variable) and work setting as well as the province (county or state) where respondents worked (independent variable). More than half of the studied population always consult the OT involved in the treatment of the child (56.9%; $n=33$), with only a small percentage never consulting an OT before treatment (8.6%; $n=5$). Occasional consultation of an OT was indicated by 6.9% of respondents ($n=4$), while 27.6% of respondents ($n=16$) indicated that they would often consult an OT when treating a shared client.

The majority of respondents (56.9%; $n=37$) indicated implementing jumping, 43.1% ($n=28$) swinging, 50.8% ($n=33$) bouncing, 76.9% ($n=50$) sensory toys, and 58.5% ($n=38$) sensory boxes. A smaller number used adjusted seating (33.8%; $n=22$) and oral-sensory stimulation (36.9%; $n=24$). Only

21.5% ($n = 14$) of respondents make use of weighted equipment, 15.4% ($n = 10$) perform weight bearing exercises, 18.5% ($n = 12$) massage their clients, and 15.4% ($n = 10$) use scooter boards. The main indicated reasons for implementing SBI included making sessions more enjoyable (58.5%; $n = 38$), increasing focus and concentration (70.8%; $n = 46$), increasing communicative behaviours (72.3%; $n = 47$) as well as to manage unwanted behaviours (58.5%; $n = 38$). The majority of respondents (69%; $n = 40$) always target language and communicative skills while implementing SBI, while 24.1% ($n = 14$) often incorporate these targets. Most respondents occasionally require assistance when implementing SBI (50%; $n = 29$). 36.2% ($n = 21$) of respondents often require assistance, and 10.3% ($n = 6$) always require assistance when implementing SBI.

3.2. Knowledge of SLPs regarding sensory difficulties in CWASD and SBI

On a scale consisting of the options 'poor', 'fair', 'good', and 'excellent', 42.1% ($n = 24$) of respondents reported that they only have a fair knowledge of sensory difficulties in CWASD. A small number (5.3%; $n = 3$) of respondents indicated having excellent knowledge of these difficulties. 78.1% ($n = 45$) of respondents have never received any formal training in the implementation of SBI to support speech-language therapy. Only 7% ($n = 4$) of the respondents always feel confident when implementing SBI, whereas 52.6% ($n = 30$) feel so occasionally, and 31% ($n = 20$) often feeling confident. When respondents were requested to indicate which sources of training they accessed to gain knowledge in the treatment of children with sensory difficulties, the following were identified: working collaboratively with an OT (81.5%; $n = 53$), self-study or literature review (61.5%; $n = 40$), attending professional training courses (43.1%; $n = 28$), special interest groups (26.2%; $n = 17$). Only 3.1% ($n = 2$) indicated their graduate studies and 6.2% ($n = 4$) their post-graduate studies as a source of training in sensory difficulties.

Participants' knowledge in the areas of sensory difficulties and the implementation of SBI were further investigated by participants indicating the truthfulness of a series of statements. The mean percentage of correct answers for the prevalence and nature of sensory difficulties (Q23-39) were 68.3%. For the next theme on the discrimination between sensory integration therapy and SBI (Q40-53; Q55-57), 45.6% of respondents correctly distinguished

between these two different treatment approaches. 64.2% of correct answers were captured in statements related to sensory strategies implemented in therapy (Q58-72; Q54). Kruskal-Wallis (KW) test was run to investigate whether there were significant differences between the universities as well as the number of years' experience groups (1-5 years, 6-10 years, more than 10 years) and the percentage correct answers in this section. No significant differences were found.

3.3. SLPs role in the implementation of SBI

SLPs perceptions of their role in the implementation of SBI were investigated by requesting participants to indicate to what extent they agreed with a series of statements. The highest percentage of respondents indicated strong agreement with the statements supporting the role of SLPs in addressing sensory difficulties in individuals they treat (Q 26, Q 33, Q 36). Strong agreement was also indicated in statements describing the necessity to collaborate with OTs to is necessary to guide and enhance the outcomes of SBI implemented in therapy (Q 28, Q 32, Q 35, Q 39). Respondents mostly agreed that it is necessary for SLPs to attend and have access to theoretical as well as practical training in SBI (Q 31, Q 34, Q 37). Most respondents indicated strong agreement with statements suggesting SLPs need to access and implement various sensory equipment to provide sensory experiences to the children they treat (Q 27, Q 29, Q 38). Table 1 summarises the results of SLPs perceptions of their role in addressing sensory difficulties and implementing SBI.

3.4. SLPs perceptions regarding outcomes of SBI

In the final section of the questionnaire SLPs' perceptions related to the outcomes of SBI were investigated. Once again, respondents were required to indicate their level of agreement with a series of statements. The highest percentages of participants strongly agreed that SBI enhanced therapy outcomes (Q 40, Q 43, Q 45). Furthermore, respondents strongly agreed with positive outcomes in relation to engagement and responsiveness (Q 41, Q44, Q 53), behaviour (Q 42, Q 46, Q 50) and communication (Q 48, Q 51, Q 54). Most respondents strongly agreed that they would recommend the use of SBI to other SLPs (Q 45, Q 47, Q 52). Table 2 outlines the responses to the statements regarding SLPs perceptions regarding the outcomes of SBI.

Table 1
SLPs perceptions of their role in addressing sensory difficulties and implementation SBI in the children they treat

SLPs have a role in addressing sensory difficulties in the children they treat					
Question	Strongly Agree	Somewhat Agree	Neither agree nor disagree	Somewhat disagree	Strongly disagree
Q 26	57.1% (n = 20)	42.9% (n = 15)	–	–	–
Q 33	77.1% (n = 27)	20.0% (n = 7)	–	2.9% (n = 1)	–
Q 36	45.7% (n = 16)	37.1% (n = 13)	5.7% (n = 2)	8.6% (n = 3)	2.9% (n = 1)
Collaboration with OT is necessary to guide and enhance the outcomes of SBI implemented in therapy					
Question	Strongly Agree	Somewhat Agree	Neither agree nor disagree	Somewhat disagree	Strongly disagree
Q 28	100% (n = 35)	–	–	–	–
Q 32	–	–	–	11.4% (n = 4)	85.7% (n = 30)
Q 35	88.6% (n = 31)	8.6% (n = 3)	2.9% (n = 1)	–	–
Q 39	94.3% (n = 33)	2.9% (n = 1)	–	2.9% (n = 1)	–
Necessity of and access to theoretical and practical training related to SBI					
Question	Strongly Agree	Somewhat Agree	Neither agree nor disagree	Somewhat disagree	Strongly disagree
Q 31	22.9% (n = 8)	8.6% (n = 3)	5.7% (n = 2)	31.4% (n = 11)	31.4% (n = 11)
Q 34	71.4% (n = 25)	25.7% (n = 9)	–	2.9% (n = 1)	–
Q 37	77.1% (n = 27)	17.1% (n = 6)	2.9% (n = 1)	2.9% (n = 1)	–
SLPs are required to access and implement various sensory equipment to provide sensory experiences to the children they treat					
Question	Strongly Agree	Somewhat Agree	Neither agree nor disagree	Somewhat disagree	Strongly disagree
Q 27	57.1% (n = 20)	42.9% (n = 15)	–	–	–
Q 29	61.8% (n = 21)	32.4% (n = 11)	2.9% (n = 1)	2.9% (n = 1)	–
Q 38	91.4% (n = 32)	5.7% (n = 2)	2.9% (n = 1)	–	–

Table 2
SLPs perceptions regarding outcomes of SBI

SBI enhance therapy outcomes					
Question	Strongly Agree	Somewhat Agree	Neither agree nor disagree	Somewhat disagree	Strongly disagree
Q 40	64.7% (n = 22)	29.4% (n = 10)	5.9% (n = 2)	–	–
Q 43	79.4% (n = 27)	17.6% (n = 6)	2.9% (n = 1)	–	–
Q 45	79.4% (n = 27)	17.6% (n = 6)	–	–	2.9% (n = 1)
Children are more engaged and responsive when SBI are incorporated in speech-language therapy					
Question	Strongly Agree	Somewhat Agree	Neither agree nor disagree	Somewhat disagree	Strongly disagree
Q 41	73.5% (n = 25)	26.5% (n = 9)	–	–	–
Q 44	42.4% (n = 14)	36.4% (n = 12)	18.2% (n = 6)	–	3.0% (n = 1)
Q 53	52.9% (n = 18)	29.4% (n = 10)	14.7% (n = 5)	2.9% (n = 1)	–
Implementation of SBI result in improved behaviour					
Question	Strongly Agree	Somewhat Agree	Neither agree nor disagree	Somewhat disagree	Strongly disagree
Q 42	70.6% (n = 24)	29.4% (n = 10)	–	–	–
Q 46	67.6% (n = 23)	32.4% (n = 11)	–	–	–
Q 50	73.5% (n = 25)	23.5% (n = 8)	–	2.9% (n = 1)	–
SBI increase communicative behaviours					
Question	Strongly Agree	Somewhat Agree	Neither agree nor disagree	Somewhat disagree	Strongly disagree
Q 48	67.6% (n = 23)	23.5% (n = 8)	5.9% (n = 2)	2.9% (n = 1)	–
Q 51	61.8% (n = 21)	26.5% (n = 9)	8.8% (n = 3)	2.9% (n = 1)	–
Q 54	50% (n = 17)	32.4% (n = 11)	17.6% (n = 6)	–	–
I would recommend the implementation of SBI to other SLPs					
Question	Strongly Agree	Somewhat Agree	Neither agree nor disagree	Somewhat disagree	Strongly disagree
Q 45	81.8% (n = 27)	15.2% (n = 5)	3.0% (n = 1)	–	–
Q 47	61.8% (n = 21)	26.5% (n = 9)	8.8% (n = 3)	2.9% (n = 1)	–
Q 52	90.9% (n = 30)	9.1% (n = 3)	–	–	–

4. Discussion

SBI are implemented with the intention to influence CWASD's state of arousal during therapy, in the classroom or at home in order for the child to attend, participate, and learn more effectively (Case-Smith et al., 2015; Lane et al., 2019; Reynolds et al., 2017). This study confirms that even though limited empirical evidence for the efficacy of SBI exists, many therapists continue to implement such strategies in practice as they find it beneficial (May-Benson & Koomar, 2010; Preis & McKenna 2014). A discussion of the results of the study according to the objectives now follows.

4.1. Nature of SBI implemented by SLPs

Most respondents indicated that they often implement SBI. Respondents from the Free State implemented SBI significantly more often than those from Kwa-Zulu Natal. This finding may be explained by possible differences in service delivery models across states. Accessibility to interdisciplinary collaboration, specialised equipment and individual therapy services are influenced by various factors e.g., government funding, availability of posts and caseload distribution may explain this finding (Thomson-Hodgetts & Magill-Evans, 2018). Furthermore, respondents based in early intervention settings indicated implementing SBI significantly more often than respondents working in paediatric clinics in public hospitals (p -value of 0.032). One possible explanation may be that early intervention centres provide regular therapy services whereas paediatric clinics in public hospitals operate on a monthly consultative service model due to long waiting lists (Guler et al., 2018). Furthermore, early intervention settings tend to be private institutions and may therefore be better equipped to provide SBI compared to state public hospital clinics. OTs providing community service in the public sector indicated limited resources and lack of mentorship as challenges to service provision (van Stormbroek & Buchanan, 2016). Respondents' motivation for implementing SBI was the next factor to be determined. When comparing work setting to respondents' involvement in joint collaborative therapy with an OT, no significant differences between settings were found.

As with OTs (Benson et al., 2019; Thompson-Hodgetts & Magill-Evans, 2018), para-educators (Kaiser et al., 2020) and parents (Padmanhabha, 2019; Peña et al., 2021) from international studies,

South African SLPs implement SBI to increase focus, concentration, participation and reduce unwanted behaviours. Additionally, SLPs in the current study's main motivation for implementing SBI was to increase communicative behaviours. This motivation together with the finding that most respondents indicated always incorporating language and communicative targets while implementing SBI, supports the recommendation that SBI should be implemented to enhance and not replace traditional therapy targets (Schooling, 2012).

In contrast with studies investigating the use of SBI by OTs, para-educators and parents indicating most often using massage, joint compression, oral sensory equipment, trampolines and deep pressure activities (Kaiser et al., 2020; Peña et al., 2021; Thompson-Hodgetts & Magill-Evans, 2018), the most commonly used SBI by the SLPs participating in the current study were jumping, swinging, bouncing, sensory toys and sensory boxes. Less commonly used were oral-sensory stimulation, adjusted seating, weighted equipment, weight bearing exercises and massage. This may be due to the selected activities providing movement (vestibular input). Such activities have been linked to an increase in communication (Ayers & Mailloux, 1981; Fallon, 1994; Longerbeam, 2013; Preis & McKenna, 2014). The selected sensory play activities may have been chosen due to the opportunities such activities lend to target language and communication (Sussman, 2012). Selection of certain activities or equipment may also relate to the availability of such equipment or resources in different work settings.

4.2. Knowledge of SLPs regarding sensory difficulties in CWASD and SBI

Both the OTs in the study by Benson et al. (2014), as well as the SLPs from the current study, indicated the need for advanced education and training in SBI to improve confidence in the use of such interventions. Although it is concerning that most respondents in this study have not received any formal training in relation to sensory difficulties and SBI, the results have highlighted the value of multi-disciplinary collaboration with OTs to support and guide knowledge and skill development in sensory difficulties in CWASD and the implementation of SBI. Other sources commonly accessed to gain knowledge included self-study/literature reviews, attending professional training courses and special interest groups. As with school-based OTs (Benson et al., 2014), only

a small number of respondents regarded their university studies as a source of sufficient training related to sensory difficulties in children.

No significant statistical differences were identified between the percentage of items answered correctly in the 'knowledge of SBI' and respondents' years of experience or the universities they qualified from. Despite a lack of formal training reasonable knowledge were indicated regarding sensory difficulties in CWASD and SBI strategies. Participants achieved a slightly lower mean percentage of correct answers when responding to questions regarding the differences between SBI and sensory integration therapy. This may be due to SLPs in the current study indicating that they mainly gaining knowledge in clinical practise from working with OTs rather than from formal theoretical training. These findings highlight the need for SLPs to receive formal training regarding sensory difficulties and strategies to address these difficulties to enhance therapy outcomes. An introduction to this topic is suggested in pre-graduate university training. In-depth post-graduate training in the theoretical as well as practical implementation of SBI should be available for SLPs working in this field.

4.3. *SLPs role in the implementation of SBI*

Most respondents strongly agreed that SLPs have a role in addressing the sensory difficulties in the children and should access a variety of equipment and activities to do so. These findings provide practice-based evidence for the use of SBI. However, further research investigating the efficacy of SBI in relation to language and communicative targets are required for reviewing and expanding current scope of practice guidelines and developing training programmes for SLPs.

The highest percentages of positive responses with any of the statements in the current study were related to the value and necessity of collaboration with OTs when sharing clients with sensory difficulties (Q 81 : 100%; Q 84 : 85.7%; Q87 : 88.6%; Q91 : 94.3%). The main source of training in sensory difficulties and SBI were also indicated to be from working alongside OTs, as opposed to para-educators indicating a trial-and-error approach to implementing SBI (Kaiser et al., 2020). The positive findings regarding collaborating with OTs in the current study are in line with the recommendations from the American Occupational Therapy Association (AOTA) stating that OTs should thoroughly assess children with sensory

difficulties before SBI strategies are recommended. Furthermore, these guidelines stipulate that OTs are responsible to guide and train parents and professionals in the implementation of SBI (Frauwirth et al., 2019).

4.4. *SLT perceptions regarding outcomes of SBI*

As in previous studies investigating parents, teachers, and therapists' perceptions regarding the outcomes of SBI many positive effects were perceived by the SLPs in the current study (Benson et al., 2019; Kaiser et al., 2020; Padmanhabha, 2019; Peña et al., 2021; Thomson-Hodgetts & Magill-Evans, 2018). The majority of respondents strongly agreed that implementing SBI during speech-language therapy increased engagement, responsiveness and communicative behaviours and decreased unwanted behaviours. As with OTs (Thomson-Hodgetts & Magill-Evans, 2018), SLPs positive experiences in the outcomes of SBI were reflected in their strong agreement in recommending such interventions to other SLPs working with children with sensory difficulties. The study by Benson et al. (2014) indicated that the more experienced the OTs in this study were, the more likely they were to recommend SBI as an intervention. No significant differences in years of experience in working with CWASD and recommendation of SBI were identified in the current study. It may therefore be concluded that SLPs implementation of SBI relate largely to their work setting and related accessibility to equipment and interdisciplinary collaboration with OTs. Increased knowledge and confidence as more experienced practitioners do not necessarily result in SLPs implementing SBI more often. Nor does inexperience appear to deter therapists from using SBI on a regular basis.

Most respondents in the current study as well as the previously discussed survey studies (Benson et al., 2014; Kaizer et al., 2020; Padmanhabha, 2019; Peña et al., 2021; Thomson-Hodgetts & Magill-Evans, 2018) indicated that they experienced positive outcomes related to SBI. However, researchers and practitioners need to be cautious of the phenomenon of confirmation bias when relating perceived positive outcomes to efficacy of SBI. This phenomenon may occur when respondents are invested in the outcomes studied (Mcraay, 2015).

The insights from the findings of this study confirm the gap between clinical practice and empirical research in the implementation of SBI not only by SLPs, but OTs, parents and educators alike (Bar-

ton et al., 2015; Case-Smith, Weaver & Friestad, 2015). Furthermore, the study draws attention to the need for training SLPs in sensory difficulties and SBI and SLPs acknowledgement of their role in addressing sensory difficulties in the children they treat.

4.5. *Clinical implications and recommendations*

The findings of this study confirm that many SLPs from a variety of settings regularly implement SBI. They perceive positive outcomes and would recommend SBI to other SLPs.

The results also indicated the valued role of collaborative intervention with OTs in guiding and training SLPs in SBI. These collaborative practices have not been clearly defined and documented. SLPs may play a valuable role in further exploring and documenting the principles and benefits of joint intervention. SLPs are called upon to initiate high quality efficacy studies in collaborative practices with OTs.

Even though guidelines and training opportunities for SLPs in sensory difficulties and SBI are limited, it is important to ensure ethical implementation of such interventions in clinical practice. It is recommended that SLPs will take responsibility in seeking further training and information as well as mentorship from OTs specialising in this area to ensure ethical conduct.

4.6. *Strengths and limitations*

The current study is the first study investigating the implementation of SBI by SLPs. Although scarce studies investigating the efficacy of SBI have been conducted by SLPs, no previous studies have included SLPs as respondents in survey research related to SBI. The study highlighted important issues related to training, accessibility, practice-based evidence and efficacy in the implementation of SBI by SLPs.

Although a representative sample of SLPs responded, only South African SLPs were included. The small sample size limits the generalisation of the findings in this study. Respondent fatigue (O'Reilly-Shah, 2017) needs to be considered due to the length of the survey in the current study. The length of the questionnaire may have caused respondents to get tired causing a deterioration in the quality of their responses.

4.7. **Future research**

Available research studies in the implementation of SBI is limited. Therefore, further research in the efficacy of SBI is required to ensure that clinicians base their clinical decisions on the best evidence available for such practices. Most of the studies that are available did not include sufficient information regarding duration of treatments, internal variables and measurement of outcomes (Murdock et al., 2013). Researchers are urged to carefully consider the quality indicators in efficacy studies (Bodison & Parham, 2018). As a profession closely involved in providing assessment and intervention for individuals with various neurodevelopmental disorders, SLPs are called upon to contribute to the evidence base for the practices they find beneficial. Without further research by SLPs regarding the influence of SBI on communication and language of the population they treat, support for such interventions in pre-graduate training and scope of practice documents will remain limited.

Including a research design that allows the researcher to collect qualitative data e.g., interviews or focus group discussions may be valuable in providing further insights into respondents' perceptions and experiences. Including a larger international sample of participants in a future qualitative research study may be valuable in comparing the implementation of SBI by SLPs from different countries.

Survey studies investigating the perceptions of para-professionals, teachers, parents and OTs in relation to SBI are available (Benson et al., 2014; Kaizer et al., 2020; Padmanabha, 2019; Peña et al., 2021; Thomson-Hodgetts & Magill-Evans, 2018). However as to our knowledge the perceptions of individuals with ASD receiving SBI have not been studied. A study investigating the experience and perceptions of individuals receiving SBI may be valuable in providing further insight into the influence of these interventions.

5. **Conclusion**

This study aimed to investigate the implementation of SBI by SLPs in CWASD. SLPs from various work settings across South Africa responded to an online questionnaire. The findings provide valuable insights into SLPs' implementation of SBI in CWASD contributing to practice-based evidence for the implementation of SBI. Further research by SLPs

related to the efficacy of SBI in their practices are recommended.

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Competing interests

The authors have declared that no competing interests exist.

Author contributions

The first author conceived of the presented idea, developed and interpreted the theory and results of the study. The second and third authors guided and verified the methods and supervised the proposed theory, methods and findings of this work. The fourth author analysed and interpreted the data statistically.

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Data availability statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Disclaimer

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Appendix A

Table A1:
Biographical information of respondents

Clinical setting		State of work		University where qualification was obtained		Years of experience working with CWASD	
Pediatric clinic at public hospital	8% (<i>n</i> = 7)	Eastern Cape	6.4% (<i>n</i> = 4)	University of Cape Town	29.2% (<i>n</i> = 19)	1–5 years	44.6% (<i>n</i> = 29)
School	36.4% (<i>n</i> = 32)	Free State	7.7% (<i>n</i> = 5)	University of Durban-Westville	6.2% (<i>n</i> = 4)	6–10 years	21.5% (<i>n</i> = 14)
Early intervention setting	8% (<i>n</i> = 7)	Gauteng	48.4% (<i>n</i> = 31)	University of Pretoria	23.1% (<i>n</i> = 15)	More than 10 years	
Private practice	42% (<i>n</i> = 37)	Kwa-Zulu Natal	12.5% (<i>n</i> = 8)	University of Stellenbosch	12.3% (<i>n</i> = 8)		33.8% (<i>n</i> = 22)
Other (did not specify)	5.7% (<i>n</i> = 5)	Limpopo	1.6% (<i>n</i> = 1)	University of the Witwatersrand	24.6% (<i>n</i> = 16)		
		North-West	3.1% (<i>n</i> = 2)	University of Limpopo	1.5% (<i>n</i> = 1)		
		Western Cape	20.3% (<i>n</i> = 13)	University of Kwa-Zulu Natal	1.5% (<i>n</i> = 1)		
				Wichita State University	1.5% (<i>n</i> = 1)		

Table A2:
Clinical background of respondents

Regularity of treating CWASD		Number of children on caseload		Provision of joint collaborative therapy	
Occasionally	9.2% (<i>n</i> = 6)	Up to five	24.6% (<i>n</i> = 16)	Never	4.6% (<i>n</i> = 3)
Often	55.4% (<i>n</i> = 36)	Up to ten	36.9% (<i>n</i> = 24)	Occasionally	33.8% (<i>n</i> = 22)
Always	35.4% (<i>n</i> = 23)	Up to twenty	23.1% (<i>n</i> = 15)	Often	36.9% (<i>n</i> = 24)
		More than twenty	15.4% (<i>n</i> = 10)	Always	24.6% (<i>n</i> = 16)

Table A3:
Client-related information of respondents

Age range of CWASD treated		Presence of sensory difficulties in CWASD treated		Means of communication used by CWASD treated		Severity of symptoms of CWASD treated	
1–5 Years	39.8% (<i>n</i> = 47)	Occasionally	6.3% (<i>n</i> = 4)	Body manipulation, gestures, and eye gaze with no functional language use	37% (<i>n</i> = 51)	Mild	29.2% (<i>n</i> = 42)
6–9 Years	39.8% (<i>n</i> = 47)	Often	48.4% (<i>n</i> = 24)	Verbal production of words, phrases or sentences in a functional manner	40.6% (56)	Moderate	39.6% (<i>n</i> = 57)
10–15 Years	16.8% (<i>n</i> = 20)	Always	45.3% (<i>n</i> = 29)	Augmentative and assistive communication system	22.5% (<i>n</i> = 31)	Severe	31.3% (<i>n</i> = 45)
16–18 years	3.4% (<i>n</i> = 4)						

Appendix B: Questionnaire

Implementation of sensory based intervention (SBI) by speech-language pathologists (SLPs) in children with Autistic Spectrum Disorder (CWASD)

Thank you for participating in the research survey. This survey consists of five sections: 1. Professional background, 2. Nature of SBI implemented during CI, 3. Knowledge of sensory deficits and SBI, 4. Perceptions of the SLPs role in providing SBI during CI and 5. Perceptions of the outcomes of SBI in relation to CI.

Consent

1. Do you consent to take part in this research study by completing the survey below?

No	1
Yes	2

Professional background

2. What setting do you work in? (Please check all that apply).

School setting	1
Paediatric clinic at hospital	2
Early intervention centre	3
Private practice	4
Other (please specify):	5

3. Which state do you work in?

Eastern Cape	1
Free State	2
Gauteng	3
KwaZulu Natal	4
Limpopo	5
Mpumalanga	6
Northern Cape	7
North West	8
Western-Cape	9

4. Which University did you qualify from?

University of Cape Town	1
University of Durban – Westville	2
University of Pretoria	3
University of Stellenbosch	4
University of the Witwatersrand	5
Other (please specify):	6

5. How many years of experience do you have working with CWASD?

1–5 years	1
6–10 years	2
More than 10 years	3

6. How often do you provide therapy for CWASD?

Occasionally	1
Often	2
Always	3

7. How many CWASD do you currently provide regular therapy to?

Up to 5	1
Up to 10	2
Up to 20	3
More than 20	4

8. What ages of CWASD do you work with? Please check all that apply.

1–5 years	1
6–9 years	2
10–14 years	3
15–18 years	4

9. What means of communication do the CWASD that you work with use? Please check all that apply.

Preverbal/Minimally verbal (Using no words or only a few words that are not produced for functional communication)	1
Verbal (Using phrases and sentences in a functional communicative manner)	2
Augmentative and assistive technology (may include the use of switches, picture exchange, speech generating devices etc.)	3

10. How would you describe the cognitive ability of the CWASD that you work with?

High functioning	1
Low functioning	2
Both high and low functioning	3

11. Are you involved in providing joint collaborative speech-language therapy and occupational therapy?

Never	1
Occasionally	2
Often	3
Always	4

12. In your opinion, how often do the CWASD that you treat present with sensory difficulties?

Never	1
Occasionally	2
Often	3
Always	4

Nature of SBI implemented during CI

13. How often do you implement SBI during CI?

Never	1
Occasionally	2
Often	3
Always	4

14. Please indicate all types of SBI and SBI equipment that you using during CI?

I do not use sensory equipment	1
Swinging	2
Jumping/Bouncing	3
Massage	4
Brushing	5
Ball seat	6
Weighted equipment e.g. vests, balls or blankets	7
Weight bearing exercises e.g. yoga	8
Scooter board	9
Sensory toys (toys with lights, spinning toys etc.	10
Sensory play e.g. sensory boxes filled with sand or noodles	11
Oral sensory stimulation	12
Other (please specify):	13

15. Do you collaborate with the occupational therapist (OT) involved with the treatment of the child before implementing SBI during CI?

Never	1
Occasionally	2
Often	3
Always	4

16. Do you target language and communication while performing SBI strategies?

Never	1
Occasionally	2
Often	3
Always	4

17. Do you require assistance when implementing SBI during CI?

Never	1
Occasionally	2
Often	3
Always	4

18. What is your goal when implementing SBI during CI (Please tick all that apply)?

To achieve optimal arousal	1
To make sessions more enjoyable	2
To manage unwanted behaviours	3
To increase communication and vocal behaviour	4
To encourage in-seat behaviour	5
To treat sensory sensitivities e.g. tactile defensiveness	6
To target motor planning	7
To increase body-awareness	8
Other (please specify):	9

Knowledge of sensory deficits and SBI

19. How would you rate your knowledge of sensory difficulties in ASD and the use of SBI?

Very poor	1
Poor	2
Fair	3
Good	4
Excellent	5

20. Have you received any formal training in using SBI strategies when providing speech-language therapy?

No	1
Yes	2

21. Please indicate all sources and methods that were accessed to gain knowledge in the treatment of children with sensory dysfunctions.

Working collaboratively with an occupational therapist	1
Self-study/literature review	2
Graduate studies	3
Post-graduate studies	4
Attending professional training courses	5
Special interest groups	6
Attending a theory course in Ayers Sensory Integration Therapy®	7
Other (please specify):	8

22. Do you feel confident in providing therapy to children with sensory difficulties?

Never	1
Occasionally	2
Often	3
Always	4

23. Please indicate whether the following statements are true or false.

	<i>Sensory deficits in CWASD</i>	True	False	Don't know
a.	Most CWASD present with sensory deficits.	1	2	3
b.	Atypical responses to sensory stimuli are included in the diagnostic criteria for ASD.	1	2	3
c.	CWASD rarely present with hypo-responsive and hyper-responsive behaviour in response to sensory stimuli.	1	2	3
d.	Sensory difficulties in CWASD may depend on race, culture or socio-economic status.	1	2	3
e.	Sensory deficits in CWASD affect joint attention.	1	2	3
f.	Only some CWASD present with sensory deficits.	1	2	3
g.	Sensory deficits in CWASD do not affect social competence.	1	2	3
h.	CWASD often present with hypo-responsive and hyper-responsive behaviour in response to sensory stimuli.	1	2	3
i.	CWASD usually present with accompanying sensory processing difficulties.	1	2	3
j.	Atypical responses to sensory stimuli are not included in the diagnostic criteria for ASD.	1	2	3
k.	Joint attention in CWASD are not influenced by sensory deficits.	1	2	3
l.	Sensory difficulties in CWASD does not depend on race, culture or socio-economic status.	1	2	3
m.	A diagnosis of ASD includes the presence of atypical responses to sensory stimuli.	1	2	3
n.	Engaging in social interactions are compromised by the presence of sensory processing difficulties.	1	2	3
o.	Being over alert or seeking sensory input are often observed in CWASD.	1	2	3
p.	A higher incidence of ASD occur in communities of low-socio economic standing.	1	2	3
q.	Sensory difficulties in CWASD predict social developmental outcomes.	1	2	3
r.	Sensory processing difficulties affect CWASD's ability to take part in a joint activity.	1	2	3

24. Please indicate whether the following statements are true or false.

	<i>Treating sensory deficits in CWASD</i>	True	False	Don't know
a.	Sensory integration therapy is commonly implemented by occupational therapist to treat sensory deficits.	1	2	3
b.	Sensory integration therapy and SBI are the same thing.	1	2	3
c.	OTs support teachers and other professionals in implementing sensory integration therapy.	1	2	3
d.	SBI is often adult directed.	1	2	3
e.	SBI is based on sensory integration therapy.	1	2	3
f.	SBI can be implemented in any context or environment.	1	2	3
g.	OTs support teachers and other professionals in implementing SBI.	1	2	3
h.	The focus of SBI is to facilitate optimal neural arousal.	1	2	3
i.	SBI is child directed.	1	2	3
j.	Sensory integration therapy can be implemented in any context or environment.	1	2	3
k.	Sensory integration therapy can be implemented by any professional working with CWASD.	1	2	3

l.	Sensory integration therapy is based on using isolated sensory interventions in various environments outside of the clinic.	1	2	3
m.	Children direct SBI.	1	2	3
n.	SBI strategies can be used outside the context of sensory integration therapy to alert a hypo-responsive child.	1	2	3
o.	Sensory integration therapy is clinic-based and uses sensor -rich experiences targeting children's adaptive responses to sensory stimuli.	1	2	3
p.	SBI strategies can be used to calm an over-active child.	1	2	3
q.	Sensory integration therapy can be implemented in the classroom.	1	2	3
r.	The focus of sensory integration therapy is to facilitate optimal neural arousal.	1	2	3
s.	Clinicians, teachers and parents direct SBI.	1	2	3

25. Please indicate whether the following statements are true or false.

	<i>SBI strategies</i>	<i>True</i>	<i>False</i>	<i>Don't know</i>
a.	Fast, rapid movement are alerting.	1	2	3
b.	When a child presents as hypo-responsive, a crunchy snack may be considered to increase alertness.	1	2	3
c.	Applying deep pressure may calm an over-aroused child.	1	2	3
d.	Slow linear movement is alerting.	1	2	3
e.	Weight bearing exercises may be considered when a child presents as hyper-responsive or hypo-responsive.	1	2	3
f.	Sucking activities may have a calming effect.	1	2	3
g.	When a child presents as hyper-responsive deep pressure activities should be considered.	1	2	3
h.	Slow linear movement may calm hyper-responsive children.	1	2	3
i.	Riding down a ramp on a scooter board may alert a hyper-responsive child.	1	2	3
j.	Biting crunchy foods may have a calming effect.	1	2	3
k.	Brushing is used to treat tactile defensiveness.	1	2	3
l.	Deep pressure activities can be calming as well as alerting.	1	2	3
m.	Sitting on a ball seat may result in children with sensory difficulties being able to complete table-top activities more successfully.	1	2	3
n.	When a child presents ad hypo-responsive slow linear swinging should be considered.	1	2	3
o.	Sucking activities may have an alerting effect.	1	2	3
p.	SBI strategies can be used outside the context of sensory integration therapy to alert a hypo-responsive child.	1	2	3
q.	Jumping on a trampoline provides vestibular and proprioceptive input.	1	2	3
r.	SBI strategies can be used to calm an over-active child.	1	2	3
s.	Sensory integration therapy can be implemented in the classroom.	1	2	3
t.	The focus of sensory integration therapy is to facilitate optimal neural arousal.	1	2	3
u.	Clinicians, teachers and parents direct SBI.	1	2	3

The role of SLPs in implementation of SBI

Please indicate your level of agreement with the following statements:

	Strongly disagree	Agree	Neutral	Agree	Strongly agree	
26.	SLPs have a role in addressing sensory difficulties in children they treat.	1	2	3	4	5
27.	SLPs require access to a variety of equipment that can provide sensory experiences to children they treat.	1	2	3	4	5
28.	OTs may provide valuable information to support SLPs in the management of children with sensory difficulties.	1	2	3	4	5
29.	SLPs may use swings, therapy boards and scooter boards to incorporate SBI in speech-language therapy.	1	2	3	4	5
30.	SLPs may use swings, therapy balls and scooter boards to provide sensory experiences appropriate to the children they treat.	1	2	3	4	5
31.	SLPs require training only in the theoretical aspects of SBI.	1	2	3	4	5
32.	It is not necessary for SLPs and OTs to collaborate regarding SBI in shared clients.	1	2	3	4	5
33.	SLPs may implement sensory activities to facilitate improved therapy outcomes.	1	2	3	4	5
34.	SLPs should have access to certified Ayers sensory integration therapy (ASI®).	1	2	3	4	5
35.	Interdisciplinary therapy leads to better outcomes for CWASD.	1	2	3	4	5
36.	SLPs are expected to manage sensory deficits affecting children's performance in therapy.	1	2	3	4	5
37.	SLPs require formal training in both theory and practical aspects of sensory difficulties and treatment to equip them in providing more effective intervention.	1	2	3	4	5
38.	Using equipment to provide specific sensory input according to children's sensory needs may support speech-language therapy.	1	2	3	4	5
39.	SLPs have a responsibility to refer children with sensory deficits to an OT trained in sensory integration therapy.	1	2	3	4	5

Outcomes of SBI

Please indicate your level of agreement with the following statements:

	Strongly disagree	Agree	Neutral	Agree	Strongly agree	
40.	Combining SBI with other approaches are more effective than only using other forms of input.	1	2	3	4	5
41.	Children appear to be more engaged when SBI are incorporated in speech-language therapy.	1	2	3	4	5
42.	CWASD display less disruptive behaviour when SBI are incorporated during CI.	1	2	3	4	5
43.	Supporting CWASD's sensory needs during CI lead to better therapy outcomes.	1	2	3	4	5
44.	Sitting on a therapy ball may encourage on-task behaviour.	1	2	3	4	5
45.	SLPs should consider using SBI to support CI.	1	2	3	4	5
46.	CWASD are more cooperative when CI is supported by SBI.	1	2	3	4	5
47.	I would recommend using SBI to support CI.	1	2	3	4	5
48.	CWASD appear to be more communicative when SBI is implemented during CI.	1	2	3	4	5
49.	CWASD benefit from SBI used during CI.	1	2	3	4	5

50.	CWASD appear calmer and more content when speech-language therapy is supported by SBI.	1	2	3	4	5
51.	CWASD are more imitative when SBI are implemented during CI.	1	2	3	4	5
52.	I would advise SLPs working with CWASD to receive training in SBI.	1	2	3	4	5
53.	Movement help CWASD to be more responsive.	1	2	3	4	5
54.	CWASD are more vocal when SBI strategies are being implemented during CI.	1	2	3	4	5

Thank you sincerely for your participation and contribution to this research study.