ASSESSMENT OF IN-HAND MANIPULATION BY OCCUPATIONAL THERAPISTS IN PAEDIATRIC PRACTICES IN SOUTH AFRICA

by

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Declaration

I, *Annelize Kruger,* declare that the Master's Degree research dissertation in the form of two interrelated publishable manuscripts that I herewith submit for the Master's Degree qualification **'Assessment of in-hand manipulation by occupational therapists in paediatric practices in South Africa'** at the University of the Free State is my independent work and that I have not previously submitted it for a qualification at another institution of higher education.

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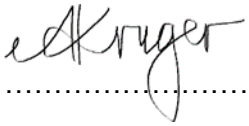

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SOLI DEO GLORIA

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List of acronyms

ACHS	Assessment of Children's Hand Skills
HPCSA	Health Profession's Council of South Africa
IMT-Q	In-hand Manipulation Test – Quality Section
OTASA	Occupational Therapy Association of South Africa
POTP	Physical & Occupational Therapy in Pediatrics
SAJOT	South African Journal of Occupational Therapy
TIHM	Test of In-Hand Manipulation
TIHM-R	Test of In-Hand Manipulation – Revised
TIMS	Test of In-hand Manipulation Skills
T-TIHM	Timed – Test of In-Hand Manipulation
UFS IHM-C	University of the Free State In-hand manipulation – Checklist

Summary

Abstract

Assessment of in-hand manipulation skills is fundamental in determining the appropriate treatment for a child with fine motor delays. For a child, in-hand manipulation is the complex movements required to effectively perform scholastic (e.g. writing), self-care (e.g. buttoning), and play tasks (e.g. puzzle-building), with precision. There is a growing interest in in-hand manipulation; thus, there is an increased effort to develop a modified classification system and various preliminary instruments. Handwriting studies were also performed that recognise in-hand manipulation as an essential performance component. However, there is limited research available that provide insight regarding the assessment of in-hand manipulation among South African occupational therapists.

The main research question was to describe how paediatric occupational therapists in South Africa assesses in-hand manipulation of children. A descriptive quantitative research design was used to answer the proposed research question. The objectives were to describe the paediatric assessment instruments that have been published in literature, the assessment methods used by South African occupational therapists in paediatric practices, their preferences for a suitable instrument and if there were any associations between these results and the different practice sectors that the occupational therapists work in.

This study was conducted in the form of two academic articles. The first study followed a non-empirical approach for a theoretical article, with the scoping review as the chosen method. Emphasis was placed on providing an overview of the different in-hand manipulation instruments described in the literature. Each identified in-hand manipulation instrument was critically evaluated pertaining to what extent the in-hand manipulation components are included in the study, the clinical utility that related to how accessible and practical the instruments were and what psychometric properties were established for each instrument.

The second article used an empirical study approach with a quantitative cross-sectional study design. To ensure that the sample population represented the population of paediatric occupational therapists in South Africa, a non-probable, purposive sampling method was used. The data was collected using an online survey method. Test-retest reliability of the questionnaire was performed to determine the stability of the answers. Hence, the participants were asked to complete the questionnaire a second time, ten days after completing the first round. Ethical approval was obtained, and confidentiality was ensured. The data was analysed by a qualified biostatistician. The questions that tested reliable were further discussed in the

article and indicated which formal and informal methods of assessment were used by paediatric occupational therapists, while also reporting on the contextual and practical aspects of the assessment process. The preferences for a suitable in-hand manipulation instrument for children were also reported and can be used for future studies as instrument design principles.

In addition to the two publishable articles, this dissertation includes a supplementary file section in which the results of the second study's last objective is reported, namely the associations between the different practice sectors (Academic, Community, Private, Public, Public-Private) and the current methods used by occupational therapists and their preferences for suitable instruments. The decision to separate the results was made as the data extracted from the study was too extensive to be discussed in a single empirical scientific article while remaining within the journal guidelines. Therefore, these results were reported on and added to the supplementary file section, with the intention to be discussed in a third article.

Recommendations and clinical implications for practitioners, both South African and globally, are discussed in each article. Areas of future research are identified to advance the professions' body of knowledge and provide valuable guidance when future instrument development research is undertaken.

Keywords

Assessment methods, assessment instruments, in-hand manipulation skills, children, assessment preferences

Chapter 1 **Introduction and orientation to the study**

Introduction

Driven to reach out and explore, a child masters the physical world through object exploration and manipulation [1]. In-hand manipulation is a complex fine motor skill and refers to the process of adjusting an object by movements of the fingers for more effective placement [2,3]. For a child, the successful performance in daily tasks where hand function plays a role, such as writing, cutting, buttoning and eating relies on the development of in-hand manipulation [4–6]. A delay is suspected when a child has difficulty in managing the fine motor tasks typical for his/her age, a tendency to drop items and presents with the inability to handle objects with precision. The impact of poor in-hand manipulation is demonstrated by the ineffective, slow and poor quality of hand movements used by the child when performing different occupational tasks. A child is then characterised as “clumsy”, “refusing to tie shoelaces” or having “messy handwriting” stemming from the inability to have meaningful hand-object interactions and is then referred to an occupation therapist [1,7,8].

The process of assessment follows a referral to accurately determine the source of the difficulty, as this is the foundation for planning the interventions [9–11]. Treatment should follow the identification of an in-hand manipulation delay and later a reassessment to monitor the improvement of the child. Evidence of the effectiveness of the intervention is determined by comparing the different assessment results [12]. Therefore, gathering precise information is critical to the occupational therapy process and requires a clinically sound in-hand manipulation assessment instrument.

Different instruments have been developed and published in literature since the term was coined by Exner in 1986 [8]. However, certain inconsistencies among the instruments published up to 2009 were observed by Pont, Wallen and Bundy [13], who concluded that these difficulties were due to the confusion surrounding the “complex phenomenon” of in-hand manipulation. After the different in-hand manipulation components were clarified by Pont, et al. [13] into the *Modified System of Classification of In-hand manipulation,* the need to develop a definitive in-hand manipulation test was stressed. In recent years, researchers in South Africa and internationally answered this call with publications that attest to the development of new in-hand manipulation instruments. In South Africa, there is limited literature available that details how occupational therapists in South Africa are using these in-hand manipulation assessment instruments or otherwise assessing in-hand manipulation on a clinical level in paediatric practices.

Theoretical framework

The *Modified System for Classification of In-hand Manipulation* [13] classified in-hand manipulation skills into six distinct components. These were described as finger-to-palm translation, palm-to-finger translation, simple shift, complex shift, simple rotation and complex rotation. Each one of these components can also be performed "with stabilisation", meaning one or more, or part of an object is stabilised in the ulnar portion of the hand while another object or part of an object is being manipulated by other digits and generally considered to be more difficult than without stabilisation [9, 13].

These components of in-hand manipulation develop at varying stages in a child's life and can also be influenced by client factors such as age, interest and the value added to acquiring a skill, and contextual factors, such as the cultural and social exposure to a skill that will have an impact on the developmental process. Engaging in object manipulation is absent during the first twelve months of an infant's life because of neurological maturation that has not yet developed optimally [3]. At twelve months manipulation skills start to develop at an increased rate. This is noticed as a toddler's prehension skills start to improve and is evident in a more controlled pincer grasp and coordinated placement. A rapid development occurs between the ages of three years to six years[13]. Information on object manipulation in older children is limited, although characteristically finger movements become faster and variation in movement patterns decrease between six to 12 years of age [1], at which age the child can perform all the components, yet not at the speed and quality of an adult [2,14]. The accuracy and time to complete a movement continue to improve up until the age of 15 years as the child's hands grow, further allowing for improved adjustment of an object in relation to the grip size of the hands [2,15].

The development of in-hand manipulation is a valuable building block for school readiness and independent living. In-hand manipulation is an essential skill that enables a child to manipulate instruments and objects in a meaningful way in order to successfully participate in scholastic, self-care and play tasks in an age-appropriate manner. When there is a developmental delay of in-hand manipulation skills, a child will often present with effective reach-, grasp- and release hand function, but will struggle to execute refined and complex tasks. This can lead to an increased frustration to attempt the tasks, that further contributes to the problem, as mastery of the skills related to hand-object interaction is use-dependent. Difficulty in the effective manipulation of objects then result in either the continual use of two hands even though one hand would have sufficed, or the child starts to avoid the task that demands in-hand manipulation [2].

It is imperative then that a comprehensive evaluation of a child's hand skills include the assessment of in-hand manipulation. When deciding on what instrument to use, a clinician should consider what instrument has a good fit to the clinical setting and who the intended population is. The instrument should preferably also measure all six components of in-hand manipulation and have established psychometric properties that are in line with the intended purpose of the study. A standardised instrument should ideally be either norm- or criterion-referenced and be contextually relevant to the intended population. Different frameworks exist for the clinician to critically evaluate instruments and make an informed decision, either by using the *Instrument Evaluation Framework* [16], the *Outcome Measure Rating Form Guidelines* [17,18], the criteria for *Test Critique* [19], or the set of considerations discussed by Kielhofner [20].

Currently, limited information is available on the existing methods used by occupational therapists in paediatric clinical settings when assessing or screening in-hand manipulation. Two recent survey studies performed on how South African occupational therapists assess poor handwriting in the private sector, and what assessment instruments therapists use in paediatric practices was done to ascertain how clinicians engage in the assessment process. However, neither of these surveys revealed the use of a specific hand function (including in-hand-manipulation) assessments [21,22]. This further supports the need to reflect on whether occupational therapists in South Africa are assessing in-hand manipulation, and how they would assess this concept and in what clinical setting.

Research question, aim and objectives

The use of descriptive research is common in occupational therapy studies when determining the behaviour and other characteristics of a particular population group and often used in survey research when there is no manipulation of an independent variable [20]. McMillan and Schumacher emphasise the importance of descriptive research as it "provides valuable data, particularly when first investigating an area" [23:215]. This study, therefore, intends to describe the behaviour and characteristics of occupational therapists in South Africa towards the assessment of in-hand manipulation in paediatric practices as reflected in the following research questions. Hence, the formulation of the research study was grounded in a descriptive research approach and answered the following questions of "how" and "what".

The main aim of this study was:

- to describe how paediatric occupational therapist in South Africa assesses in-hand manipulation of children.

The objectives of this study were:

- to describe the paediatric in-hand manipulation assessment instruments available in published literature.
- to describe the current methods used by paediatric occupational therapists to assess in-hand manipulation of children;
- to describe what the preferences of paediatric occupational therapists were regarding a suitable in-hand manipulation assessment instrument for children;
- to make associations between the assessment methods used and preferences and the practice sectors of the occupational therapists.
- to determine the test-retest reliability of the questionnaire.

Research design and methodology

For the methodology of this dissertation an applied research approach was used to guide the decision-making process. The purpose of applied research is to focus on a problem common to the field of occupational therapy, and in the case of this study, it related to the assessment methods available and how clinicians were assessing in-hand manipulation skills in children. An applied research approach study has the potential to inform the service delivery practices of practitioners by influencing how they think about assessment choices in this respect [23].

The literature chapter of this dissertation was substituted by a literature review study. From the fourteen different types of literature reviews [24], the scoping review was chosen as the most appropriate, as in-hand manipulation is still an emerging subject with a little available literature relating to the different instruments. In a scoping review, the focus can be on the key attributes of the subjects reviewed, namely the instruments in publications, with an analytical reinterpretation of the literature required to provide an extensive and detailed review of the literature landscape[25,26].

The main study followed a quantitative cross-sectional study design. A quantitative method expects the researcher to maintain an objective stance. A cross-sectional study design enabled the researcher to describe the current practices and opinions of the occupational therapist working in paediatric practices in South Africa, without the manipulation of any variable or intervention[27]. Furthermore, a quantitative method also refers to how data is collected and analysed. According to McMillan and Schumacher, it involves the quantification, or the transformation of an observational aspect into numerical data, for manipulation using

statistics [23]. Different statistical approaches were used to interpret and analyse the sets of empirical data obtained from the study.

Data collection was done by using an online, self-completion questionnaire. This method was fast, cost-effective and convenient to the participant [20]. The questionnaire was developed bearing in mind the guidelines given by McMillan and Schumacher who highlighted that "unless the research will have an important direct impact on programs or individuals, it is unusual for the researcher to systematically establish reliability and validity prior to conducting the study" [23:133]. The emphasis to follow common practice was followed by developing an instrument that was based on reliable indicators from literature sources to ensure theoretically sound content. While allowing a panel of experts to review the questionnaire and the pilot study participants to comment on the content and face validity of the questionnaire. To strengthen the creditability of the results, the test-retest reliability of the questionnaire was determined. This form of reliability aimed to establish the temporal stability of the construct that was measured, namely the methods used and preferences of occupational therapists in South Africa when assessing in-hand manipulation. During the execution of the test-retest procedure, the different errors of administration were minimised by using an online survey that remained consistent, while the memory-effect was limited by providing participants with an adequate time interval between the administrations [28,29].

The decision to use a non-probable, purposive sampling method for this study was motivated by McMillan and Schumacher's [23] statement that this method guides the researcher to "deliberately approach the sample population based on the predetermined criteria in order to be representative of the population" which in the case of this study referred to all the occupational therapists working in paediatric practices in South Africa. The sample population was approached through various methods of distribution within the time frame set out to collect the data.

Ethical approval for the main study was obtained from the Health Sciences Research Ethics Committee of the University of the Free State (reference UFS-HSD2018/0358/2905) *(Addendum A)*. Information about the study was e-mailed to the participants *(Addendum B)* and repeated on the first page of the questionnaire, before the participant's consent was obtained at the start of the questionnaire. Participants who did not meet the inclusion criteria as determined by a set of questions that followed the consent section did not qualify to complete the remainder of the questionnaire. Participant's information was kept strictly

confidential by the researcher throughout the course of the study and securely stored on a password-protected laptop.

Overview of article 1

Topic: In-Hand Manipulation Assessment Instruments for children: A Scoping Review

The study followed the Arksey and O'Malley *six-stage scoping review framework* to answer the guiding research question of *"What is known from the literature, about paediatric in-hand manipulation assessment instruments?".* The focus of this article was to provide a broad and descriptive review of the published literature in an organised and logical manner.

The six stages started by first identifying a research question that can guide the manner in which relevant studies could be identified. Thereafter an article selection process was performed to identify the eligible articles. From this, a charting process was followed to identify the specific instruments in the published articles. Following this, the instruments were each summarised and discussed according to the three key concepts; 1) components of in-hand manipulation included, 2) clinical utility aspects of applicability and practicality, and the 3) psychometric properties.

The nature and extent of the research evidence relating to in-hand manipulation were provided in this article. This aided the dissemination of the research findings. Recommendations were made to address the research gaps that were identified.

Overview of article 2

Topic: Assessment of in-hand manipulation by occupational therapists in paediatric practices in South Africa

In this article, most of the findings of the main study were answered and discussed. The current in-hand manipulation assessment methods used were described, as well as the preferences of occupational therapists in paediatric practices regarding a suitable instrument

The study used a quantitative, cross-sectional study design with a non-probable, purposive sampling method. The participants completed an online questionnaire that was compiled by the researcher from indicators found in the literature *(Addendum C)*. The questionnaire was

piloted, and the test-retest reliability of the questionnaire was determined. The unreliable questions were not included in the article and listed in *Addendum D* for reference. The questions that tested reliable were retained, analysed and further discussed in the article. The questionnaire contained closed-ended questions from which the participant could select an answer(s) with a non-compulsory 'other' option provided with spaces for text, to allow the participants to add information not included by the final questionnaire. The answers to the open-ended questions were analysed and reported on in *Addendum E.*

The results of the study discussed the demographics of the participants and their practice profiles, the current assessment methods that referred to the use and familiarity of formal instruments, the use of informal assessment methods, and the practical and contextual aspects relating to an assessment. Lastly, the preferences of the participants relating to a suitable instrument were discussed.

As the results had a high test-retest reliability correlation, it reflected positively on the consistency and generalizability of the answers obtained [19]. Recommendations were made for the clinical practice and to guide future research.

Overview of supplementary files

The supplementary files present the results obtained from the data analysis that was too extensive to include in the second article. The results relating to the last study objective were reported, namely, to make associations between the assessment methods used and preferences and the practice sector that the occupational therapists were working in.

From the questionnaire, five practice sectors in which the participants worked in were identified. The questions that tested reliable were compared according to these five groups, *Academic, Community, Private, Public and both Public-Private.* Associations that are made between the five practice sectors reflect the inherent differences of each practice sector and inferences can be to the availability of resources (time, and equipment), diverse population groups receiving treatment and the differences in culture and language barriers between client and therapist. International studies that have explored the different uses of assessment tool among occupational therapists have similarly highlighted the different practice sectors of the participants [30,31.] However, this study is dissimilar in categorizing the population into five distinct groups, compared to only two (public or private) as seen in similar South African studies [21, 22]. These groups were compared by means of 95% confidence intervals using the Chi-square test, as well as, the Fisher's exact test when the sample size was too small. A

statistically significant association was present when the p-value was less than or equal to 0.05 (≤0.05). The results are tabulated and reported on, although not assessed.

To conclude, the two articles and supplementary files discussed in this dissertation can potentially both inform the clinical practice and contribute to the body of occupational therapy knowledge.

Chapter layout

The chapters in this dissertation are ordered as follow:

Chapter 1, *Introduction and orientation to the study*, provides a broad overview of the study and the problem statement that leads up to the study aim and objectives. An outline of the two articles and supplementary files are given, the methodological considerations of each, the ethical consideration and chapter layout.

Chapter 2 covers *Article 1: In-Hand Manipulation Assessment Instruments for children: A Scoping Review.* The chapter includes a note to the reader, the abstract and keywords of the study, as well as the publishable manuscript compiled according to the POTP journal guidelines.

Chapter 3 covers of *Article 2: Assessment of in-hand manipulation by occupational therapists in paediatric practices in South Africa.* The chapter includes a note to the reader, the abstract and keywords of the study, as well as the publishable manuscript that has been compiled according to the SAJOT journal guidelines.

Chapter 4, *Supplementary files* contain the results obtained from the data analysis that was too extensive to include in the second article. The chapter includes a note to the reader and the tabulated results followed by a brief description of the data trends.

Chapter 5, *Conclusion, recommendations and closure* is the final chapter of the dissertation in which the objects of the study and how they were met are reviewed. The main findings from each article are provided along with the recommendations from the study according to the different occupational roles of clinician, researcher and educator.

Chapter 6 contain all the *Addendums* that include the ethical approval letter, information letter distributed to the participants and the questionnaire used in the main study. The unreliable questions that were excluded from the discussion of Article 2 are listed, and the data analysis of the open-ended questions are tabulated. The author guidelines of the two respective articles are added, as well as proof of language editing and the Turnitin summary report.

Concept clarification

Assessment instrument: is a specific instrument used by an occupational therapist during the evaluation process [12] to measure and document a child's abilities and to inform a clinical opinion that will guide the treatment planning and outcome measure used for the intervention process[19,32].

Child: according to the definition of the South African Children's Act of 2005, a child is as a person under the age of 18 years[33].

Dexterity: is often used interchangeably with terms such as hand skills, manual dexterity, fine motor skills or fine motor coordination and refers in general to the different patterns of hand movement. These patterns are classified by Exner as the ability to reach, grasp, carry, voluntarily release, in-hand manipulation and bilateral hand use [2].

Informal assessment: an assessment that provides the therapist with information, but have no precise comparison to a norm or a criterion, and is not quantitative [19]. It relies mostly on the assessor's judgment and skilled observations, and thus tends to be subjective and may -imply observer bias [7].

In-hand manipulation is a component of fine motor skills and is defined as the process of adjusting an object by movements of the fingers for more effective placement in one hand. It consists of six components, namely finger-to-palm translation, palm-to-finger translation, simple shift, simple rotation, complex shift and complex rotation. All of these components can be performed with- or without holding onto another object in the same hand which is referred to as "with stabilisation" [13].

Paediatric practice: refers to any practice area directed at delivering occupational therapy services to children and their families in a variety of settings including schools, clinics, and homes [12].

Practice-based evidence: defined as the process of generating evidence from everyday practice and relies on clear and accurate documentation of the information generated in relation to the specific child, services and interventions in practice in order to be used for research purposes [34].

Psychometric properties: refers to the reliability and validity of an instrument that is used in practice which should be established to ensure that an instrument accurately and dependably measures the variables it set out to measure [20].

Standardised assessment: refers to an assessment instrument that is designed to measure a child's abilities in relation to the norm for their age group or a criterion and has uniformed

procedures for administration and scoring. Standardised assessments have undergone a process of development to ensure that the data is collected in a systematic and accurate manner and has psychometric rigidity. Standardised assessments can include normative data to a specific population group and are, therefore, not always internationally appropriate in all clinical settings[19].

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Chapter 2 **Article 1: In-Hand Manipulation Assessment Instruments for children: A Scoping Review**

Note to the reader

It is the author's intention to submit this article to the *Physical & Occupational Therapy in Pediatrics* (POTP) journal for the following reasons: Firstly, this study aligns with one of the journal's aim to deliver reviews of instruments that can be used by therapists involved in the developmental and physical rehabilitation of infants, children and youth. Secondly, the journal's international audience includes both physiotherapists and occupational therapist. This is important, as in-hand manipulation has been predominantly researched by occupational therapists, but the most recent instrument developed was by physiotherapists in India [11]. Hence the professional scope of practice may vary in different countries and is this article directed to address 'qualified health professionals' as a collective. Thirdly, no similar study has to date been published in the journal. From the initial contact made with the editor of the journal, positive feedback has been received.

The journal welcomes scoping reviews and provide specific guidelines for the publication of this form of literature review and are included in *Addendum F*. Structuring of the content of the article strictly followed the journal guidelines. In short; the most important structural guidelines are namely: American spelling style must be consistently used throughout. The abstract limit is 200 words. The word count is limited to approximately 3500 words (15 typed pages). The combined total number of tables and figures may not exceed six. Tables are to be labelled at the top and figures at the bottom and carry Arabic numerals. The APA citation style (author-date) is required. The text requirements are Times New Roman, size 12, and double-line spacing. Numbering the pages are required.

The current article's length is 15 pages, with a word count of 5948 words, excluding the tables and figures, and reference list. The abstract length is 175 words, and there are five tables and one figure. This complies with the journal requirements.

This study followed a non-empirical approach and will address the first study objective of this dissertation, namely, *to describe the paediatric in-hand manipulation assessment instruments available in published literature.*

Abstract

Accurate assessment of in-hand manipulation is imperative when treating children with fine motor delays. A clinically suitable instrument for in-hand manipulation is required to inform the pediatric developmental and rehabilitation context. Critically evaluating the available instrument is required to make an informed decision and to direct future research. ***Aim:*** To do a literature review on in-hand manipulation assessment instruments. ***Methods:*** The Arskey and O'Malley six-stage scoping review was conducted. Twelve databases were sourced for articles published between January 1990 and July 2018. After identifying 31 eligible articles that met the inclusion criteria, the data of the articles were charted. ***Results:*** Ten in-hand manipulation assessment instruments were identified and summarised according to 1) the constructs of in-hand manipulation included, 2) clinical utility aspects of applicability and practicality, and 3) psychometric properties. ***Conclusion:*** At the time of the review, none of the instruments had comprehensively completed the instrument development process up to the point of standardisation with established psychometric properties. Recommendations for further research are made in order to develop a gold standard in-hand manipulation assessment instrument.

Keywords

In-hand manipulation; fine motor skills; assessment instruments

Introduction

In-hand manipulation is the process of adjusting an object in a person's hand for more effective placement after it has been grasped (Exner, 2006, p. 255; Exner, 2010, p. 275) These movements of the fingers, without touching another surface, is considered to be one of the most complex fine motor skills to develop (Exner, 2006, p. 255). This concept was predefined in 1984, when Elliot and Connolly, researchers in the field of psychology, laid the foundation on understanding how the hand manipulate objects in their *Classification of Intrinsic Hand Movements* (1984). In 1986, Exner, an occupational therapist, built on their work and first coined the term 'in-hand manipulation skills' in the *Classification of In-hand Manipulation Skills* (1986). In 2003, Pont, Wallen and Bundy, occupational therapists, compared and integrated these two classification systems in the *Modified System for Classification of In-hand*

Manipulation, and further clarified the different in-hand manipulation skills into six distinct components: Finger-to-palm translation to achieve stabilisation, palm-to-finger translation, simple shift, complex shift, simple rotation, and complex rotation (2009).

The impact of poor in-hand manipulation on a child's functional participation is manifested in the proficiency and quality with which they participate in play, self-care and scholastic tasks (Brown & Link, 2016; Case-Smith, 1995; Cornhill & Case-Smith, 1996; Exner, 1990; Feder et al., 2005; Visser et al., 2016). A child who is referred to a clinician is often characterised as being "clumsy", "refusing to tie shoelaces" or having "messy handwriting" (Cornhill & Case-Smith, 1996). Identifying in-hand manipulation as an underlying component (Creek, 2003; Laver Fawcett, 2013) will enable the clinician to plan and implement an appropriate and effective treatment plan. For this, a clinically sound in-hand manipulation assessment instrument is required. When the different in-hand manipulation components were clarified by Pont et al. (2009, pp. 13–14), the need to develop a definitive in-hand manipulation test was stressed.

The first in-hand manipulation assessment instrument, as described in the literature, was developed in 1986 by Exner (1990). From 1990 until 2004, Exner published several articles on the development of the *In-hand Manipulation Test (IMT)* (Exner, 1990; 1993; Miles Breslin & Exner, 1999; Smith-Zuzovsky & Exner, 2004). In 1993, Jewell and Humphry developed an instrument, and in 1995 expanded on the *Observational Protocol of In-hand Manipulation* (Humphry, Jewell & Rosenberger, 1995; Jewell & Humphry, 1993). In 1997, Pehoski, Henderson and Tickle-Degnen reported on a test that assessed rotation and translation movements in children, which later became known as the *unnamed test of Pehoski* (Pehoski, Henderson & Tickle-Degnen 1997a; Pehoski et al., 1997b). From 1996 until 2002, Case-Smith compiled an assessment tool, the *Test of In-hand Manipulation (TIHM),* which she used to explore the relationship between aspects of in-hand manipulation and fine motor performance in children (Case-Smith, 1991; 1995; 1996; 2000; 2002; Cornhill & Case-Smith, 1996). Later, in 2008 Pont, Wallen, Bundy and Case-Smith, refined the *TIHM* into the *TIHM-Revised (TIHM)*. After proposing the modified in-hand manipulation framework in 2009, Pont et al. reflected on the assessment instruments that had been reported in the literature and referred to them as "experimental work" that are still in the preliminary stages of tool development. In recent years, publications of new assessment instruments have rekindled the interest in in-hand manipulation. In 2014, with a follow-up study in 2016, Visser et al. developed the *UFS IHM*

Checklist (Visser et al., 2014; 2016). In 2015, De Vries, Van Hartingsveldt, Cup, Nijhuis-van der Sanden and De Groot. adapted the test by Pont et al. into the *Timed-TIHM*. In 2016, Raja, Katyal and Gupta (2016), physiotherapists, have taken up the torch in researching in-hand manipulation and have developed the *Test of In-hand manipulation Skills (TIMS)*. In 2018, Klymenko et al. (2018) developed an assessment that is suitable for an adult population with impaired hand function.

Taking all these instruments into consideration, the question is: how do clinicians decide on what instrument to use? A process of instrument evaluation is advised by some authors to ensure a good fit to the clinical setting (Laver Fawcett, 2013). A way of critically evaluating instruments is by using the *Instrument Evaluation Framework* by Rudman and Hannah (1998), the *Outcome Measure Rating Form Guidelines* as proposed by Law (CanChild, 2004; Law, 1987), the criteria for *Test Critique* as elaborated on by Laver Fawcett (2013), or the set of considerations discussed by Kielhofner (2006).

Furthermore, a clinically sound assessment instrument should also display characteristics of a systematic and comprehensive instrument development process (Benson & Clark, 1982; Law, 1987; Rudman & Hannah, 1998). In this case, it should cover all the aspects of the construct being assessed, namely in-hand manipulation. It should also have established psychometric properties (Schoneveld, Wittink & Takken, 2009; Van de Ven-Stevens, Munneke, Terwee, Spauwen & Van der Linde, 2009). Lastly, it should be standardised as a norm-referenced instrument that is contextually relevant to the intended patient population (Rudman & Hannah, 1998).

However, to date, there are no reviews that have critically appraised and mapped out all the published in-hand manipulation assessment instruments according to an instrument evaluation process to determine if they do comply with all the requirements of a sound assessment instrument. For this reason, it is currently difficult to inform clinical decision making and practice, from all the available instruments described above. Furthermore, specific identified research gaps and areas for further development and refinement in current instruments are needed to direct future research (Arksey & O'Malley, 2005; Joanna Briggs Institute, 2019).

Therefore, the purpose of this scoping review is to summarize and provide a broad overview of the different in-hand manipulation assessment instruments described in the literature.

Methodology

Scoping reviews are a form of knowledge synthesis suitable to map out the literature landscape of an emerging topic. It is a useful tool of evidence reconnaissance, as it can provide a broad overview of a topic and thereby identify the gaps in the evidence, clarify key concepts, and report on the types of evidence that can inform practice (Arksey & O'Malley, 2005; Joanna Briggs Institute, 2019). The *six-stage scoping review framework* described by Arksey and O'Malley (2005) was used to conduct the review.

Stage 1: Identifying the research question

The research question is the starting point and should be sufficiently extensive to ensure comprehensive coverage (Levac, Colquhoun & O'Brien, 2010). This article's guiding research question was: *What is known from the literature, about pediatric in-hand manipulation assessment instruments?*

Stage 2: Identifying the relevant studies

The parameters of a scoping review study must be determined after becoming familiar with the content to ensure that a topic is covered comprehensively (Arksey & O'Malley, 2005). A literature search was performed in collaboration with a medical librarian on twelve electronic databases (Academic Search Ultimate, MEDLINE, CINAHL, PsycINFO, Health Source: Nursing/Academic Edition, CAB, MasterFILE Premier, ERIC, Health Source - Consumer Edition, SocINDEX, SPORTDiscuss, and Academic Search Ultimate) using a combination of the following keywords: "*in-hand manipulation", "fine motor", "handwriting", "dexterity", "hand function", "hand therapy", "hand injury", "hand rehabilitation", "tool", "instrument", "outcome", "performance", "assessment", "measurement", "evaluation", "psychometric", "clinimetric", "applicable", "utility", "reliability", "validation", "validity", "shift", "translation", "rotation", "child", "paediatrics".* In addition, a general search was conducted on Google and Google Scholar with the same keywords. The reference lists of key publications were then consulted. Articles were limited to those peer-reviewed journals published in English, between January 1990 and July 2018. Eligibility was based on the inclusion criteria that an assessment instrument had to refer to in-hand manipulation and that the participants were 18 years or younger, hence children.

Stage 3: Selecting articles

This process by which the articles were selected is outlined in Figure 1. The search done on the electronic databases yielded 895 abstracts while the Google Scholar search further contributed 63 records to the total of 958 records found of which 12 duplicates were excluded. Records included articles, theses and unpublished dissertations. After reviewing the titles and abstracts of the 946 records, 899 irrelevant records were excluded. Key journals were hand-searched, and 30 additional records were added from the reference lists. Eligibility was determined after reviewing the full-text of 77 records after which 45 records were excluded. The remaining 31 published articles were included in the scoping review. Ten in-hand manipulation assessment instruments were identified from the charting process.

(INSERT FIGURE 1)

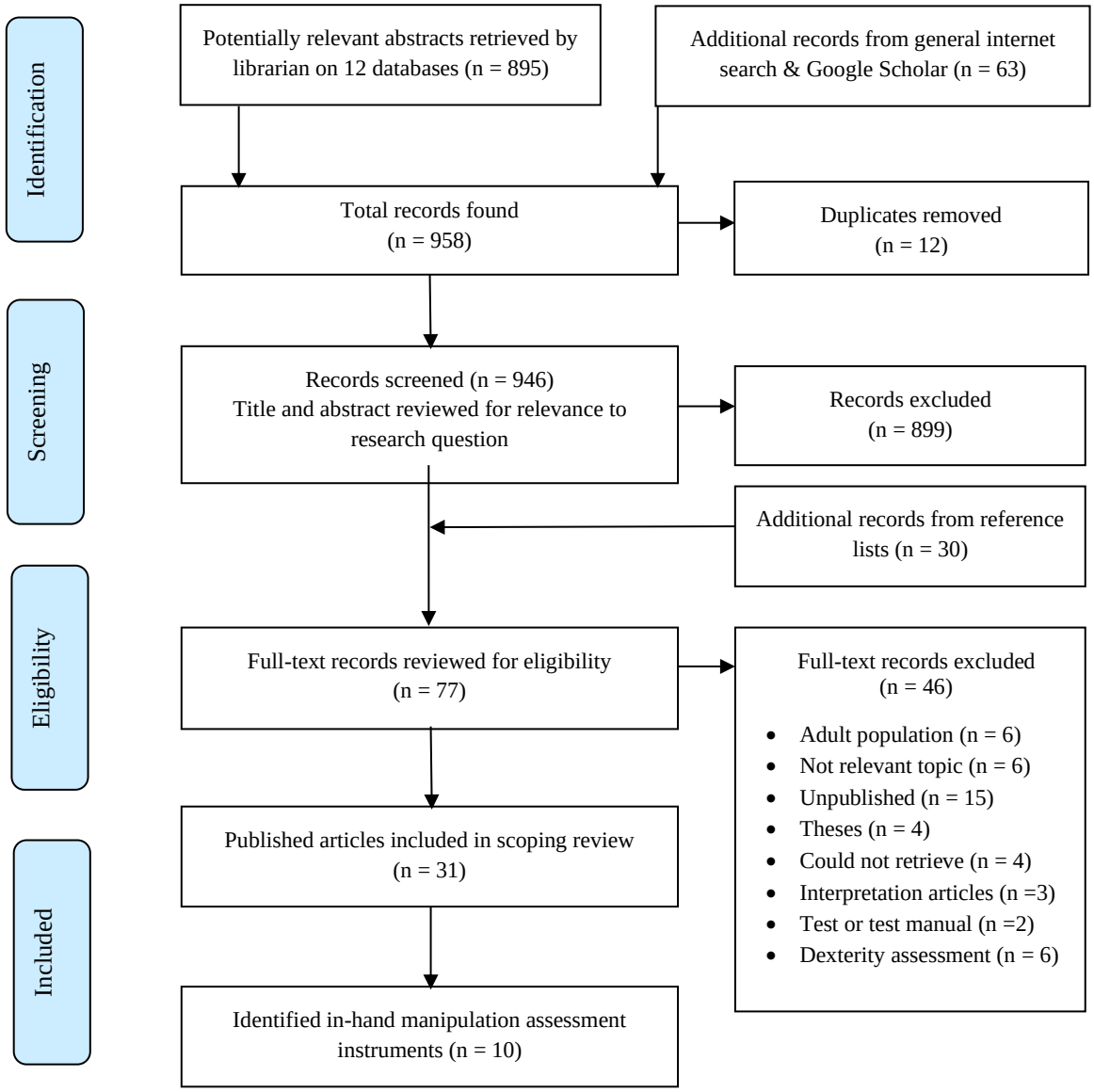

Figure 1: Article selection process

Stage 4: Charting the data

The process of charting the data must provide a descriptive and logical summary of the results (Joanna Briggs Institute, 2019). Ten in-hand manipulation assessment instruments were identified and were then chronologically organised according to the name of the instrument discussed in the article, the number of articles published of the assessment instrument and the articles' detail (authors, year and country) as illustrated in Table 1. **(INSERT TABLE 1)**

Table 1: Overview of the publications of in-hand manipulation assessment instrument

No.	Name of the instrument	Abbreviation	No. of articles published	Authors and year of publication	Country of the corresponding author
1.	In-hand Manipulation Test – Quality section	IMT-Q	4	Exner (1990; 1993); Miles Breslin & Exner (1999); Smith-Zuzovsky & Exner (2004)	Ohio, USA
2.	Test of In-Hand Manipulation	TIHM	6	Case-Smith (1991;1995; 1996; 2000; 2002); Cornhill & Case-Smith (1996)	Ohio, USA
			2	Feder et al. (2005); Feder, Majnemer, Bourbonnais, Blayney & Morin (2007)	Quebec, Canada
			1	Bazyk et al. (2009)	Ohio, USA
3.	Observation Protocol of In-hand manipulation	*n/a*	2	Jewell & Humphry (1993); Humphry et al. (1995)	North Carolina, USA
4.	Unnamed test of Pehoski	*n/a*	3	Pehoski et al. (1997a, 1997b) ; Denton, Cope & Moser (2006)	Boston, USA
5.	Unnamed test of Bonnier	*n/a*	1	Bonnier, Eliasson & Krumlinde-Sundholm (2006)	Stockholm, Sweden
6.	Test of In-Hand Manipulation – Revised	TIHM-R	2	Brown & Link (2016); Pont et al. (2008)	Queensland, Australia
7.	Assessment of Children's Hand Skills	ACHS	6	Chien, Brown & McDonald (2009; 2010; 2011a; 2011b; 2012); Chien, Scanlon, Rodger & Copley (2014)	Victoria, Australia
8.	University of the Free State – In-hand Manipulation Checklist	UFS IHM-C	2	Visser et al. (2014; 2016)	Bloemfontein, South Africa
9.	Timed-Test of In-Hand Manipulation	T-TIHM	1	De Vries et al. (2015)	Haren, Netherlands
10.	Test of In-hand Manipulation Skills	TIMS	1	Raja et al. (2016)	Sikkim, India

Stage 5: Collating, summarizing and reporting the results

To provide a broad overview of the ten in-hand manipulation assessment instruments, the following three key concepts will be reported on; 1) the in-hand manipulation components included in the assessment instrument, 2) the clinical utility of the instrument, and 3) the psychometric properties that have been researched. The results are tabulated, followed by a description of the literature trends.

The headings of the tables were determined after becoming familiar with the data (Arksey & O'Malley, 2005; Levac et al., 2010). The components of in-hand manipulation were based on the *Modified System for Classification of In-hand Manipulation* (Pont et al., 2009). The parameters for clinical utility, that were grouped under applicability and practicality were constructed after consulting the *Test Critique* criteria by Laver Fawcett (2013), the *Instrument Evaluation Framework* (Rudman & Hannah, 1998), and the *Outcome Measure Rating Form Guidelines* (CanChild, 2004; Law, 1987). The psychometric properties that have been researched were presented in the sequence in which validity and reliability should be tested as proposed by Benson and Clark in their *Guide for Instrument Development and Validation* (1982).

Stage 6: Consultation

Unfortunately, the attempt to consult with Exner, the leading authority on in-hand manipulation who developed both the *IMT-Quality* and *IMT-Speed* assessment instruments as part of her doctoral degree, was unsuccessful. Based on the most recent published article, fifteen graduate projects and manuscripts were also performed but are unpublished (Smith-Zuzovsky & Exner, 2004). Regrettably, these dissertations are not available outside of the Townson State University as confirmed through personal e-mail communication with the Librarian of UFS in 2018. The main author of the *UFS In-hand Manipulation Checklist,* Visser, provided guidance and direction in procuring and evaluating the articles that related to in-hand manipulation. Contact with the main author of the *Test of In-hand Manipulation Skills*, Kavitha Raja, enabled the researcher to purchase the manual and prefabricated version of the instrument as well as an additional video of how to administer the activities to an adult.

Results

From the initial 958 records identified, 31 eligible articles were included in the charting process through which ten in-hand manipulation assessment instruments were identified. The results are reported according to the three key concepts; 1) components of in-hand manipulation included, 2) clinical utility aspects of applicability and practicality, and the 3) psychometric properties.

Components of in-hand manipulation

The different instruments were evaluated according to the presence of the six in-hand manipulation components and reported on in *Table 2.* Short definitions of the components are included to orientate the reader. In cases where an author made changes to the assessment instrument over the course of the instrument's development, the most recent description of the assessment instrument was included in the tables. **(INSERT TABLE 2)**

Table 2: Components of in-hand manipulation included by assessment instruments

No.	Name of the instrument	Abbreviation	IN-HAND MANIPULATION COMPONENTS						
			Translation Finger-Palm	Translation Palm-Finger	Simple Shift	Complex Shift	Simple Rotation	Complex Rotation	Stabilisation
1.	In-hand Manipulation Test – Quality section	IMT-Q	✓	✓	×	✓	✓	✓	✓ All items performed with and without stabilisation
2.	Test of In-Hand Manipulation	TIHM	✓	✓	×	×	×	✓	± Only translation items performed with stabilisation
3.	Observation Protocol of In-hand manipulation	*n/a*	✓	✓	×	×	×	✓	± Only translation items performed with stabilisation
4.	Unnamed test of Pehoski	*n/a*	✓	✓	×	×	×	✓	×
5.	Unnamed test of Bonnier	*n/a*	×	×	×	✓	×	✓	×
6.	Test of In-Hand Manipulation – Revised	TIHM-R	✓	✓	×	×	×	✓	± Only translation items performed with stabilisation
7.	Assessment of Children's Hand Skills	ACHS	✓	✓	±	±	±	±	×
8.	University of the Free State – In-hand Manipulation Checklist	UFS IHM-C	✓	✓	✓	×	✓	✓	✓ All items performed with and without stabilisation
9.	Timed-Test of In-Hand Manipulation	T-TIHM	✓	✓	×	×	×	✓	±Only translation items performed with stabilisation
10.	Test of In-hand Manipulation Skills	TIMS	✓	✓	±	±	✓	✓	✓ All items performed with and without stabilisation

The component is ✓ included, × excluded , ± partially included

Finger-to-palm translation	An object is moved from the fingertips and pad of the thumb into the palm of the hand in order to stabilise and store an object in the palm of the hand (Pehoski et al., 1997b, p. 719; Pont et al., 2009, p. 9).
Palm-to-finger translation	An object is moved from its stabilised position in the palm to the tips of the fingers and is commonly used to retrieve an object from storage within the palm (Pehoski et al., 1997b, p. 719; Pont et al., 2009, p. 9).
Simple rotation	An object is rotated through one-fourth or one-half of its axis (Raja et al., 2016, p. 242) while the thumb moves independently and all the involved fingers act as a single unit (Pont et al., 2009, p. 10).
Complex rotation	An object is rotated about one or more of its axes, by 180-360 degrees, which requires independent and isolated finger movements (Pont et al., 2009, p. 11).
Simple shift	An object is moved linearly by simultaneous flexion or extension of the thumb and fingers as a single unit (Pont et al., 2009, p. 8).
Complex shift	An object is moved linearly by individual finger movements, as a result of the digits being repositioned on the object (Pont et al., 2009, p. 9).
Stabilisation	When one or more, or part of an object is stabilised in the ulnar portion of the hand while another object or part of an object is being manipulated by other digits, using any one of the other forms of in-hand manipulation (Pont et al., 2009, p. 11).

According to the results, all the assessment instruments included a complex rotation component. The *unnamed test of Pehoski*'s rotation task was grouped as complex, in contradiction to Denton, Cope and Moser that referred to the movement as simple rotation (2006), as the movement of turning a peg aligned with the definition and example provided by Pont et al. (2009) as complex rotation. Both *IMT-Q* (Smith-Zuzovsky & Exner, 2004) and *UFS IHM-C* (Visser et al., 2016) included all the in-hand manipulation components, except for a component of shift. The *unnamed test of Bonnier* differed from the other assessment instruments in that it only assessed complex shift and complex rotation. The *ACHS* could potentially assess all the components of in-hand manipulation, provided that the items chosen could elicit all the components of in-hand manipulation and during the scoring, a distinction was made between the complex and simple parts of the shift and rotation tasks. Similarly, the *TIMS* did not distinguish between simple and complex shift component when scoring (Raja et al., 2016).

Clinical utility

The data obtained regarding the clinical utility of instruments, specifically referring to aspects of applicability and practicality, are summarised in Tables 3 and 4.

Applicability

The applicability (Table 3) of an instrument indicates its purpose (Rudman & Hannah, 1998), how appropriate it is for a particular population group (Kielhofner, 2006) (age ranges, research population and inclusion/exclusion criteria) and its accessibility (Laver Fawcett, 2013) (training, access and source of the article). **(INSERT TABLE 3)**

Table 3: Applicability of the in-hand manipulation assessment instruments

No.	Name of the instrument	Abbreviation	CLINICAL UTILITY: APPLICABILITY						
			Purpose	**Age ranges**	**Research population**	**Inclusion/exclusion criteria**	**Training**	**Access and source of the article(s)**	**Availability and cost**
1.	In-hand Manipulation Test – Quality section	IMT-Q	Descriptive	3y 0m - 8y 11m	Typical children and children with fine motor delays, spastic diplegia and born prematurely	Inclusion: skills to follow basic directions Exclusion: Cognitive delays and younger than 18 months.	Required	Open access from *AJOT* (4/4 articles)	On request for permission and use
2.	Test of In-Hand Manipulation	TIHM	Descriptive Predictive	4y 0m-6y 11m	Children with tactile defensiveness, decreased tactile discrimination, developmental delay, spastic diparesis cerebral palsy; Fragile X, mental retardation and with moderate fine motor delays	None	None	Open access from *AJOT* (7/9 articles) Closed access from *Wiley Online Library* and *POTJ* (2/9 articles)	On request for permission and use. Equipment requirements are a prefabricated 9-HPT™ with prices from publishers ranging from USD 38 - 73
3.	Observation Protocol of In-hand manipulation	*n/a*	Descriptive Evaluative	2y 0m-7y 11m	Typical children	None	None	Open access from *AJOT* (1/2 article) Closed access from *Taylor and Francis Online* (1/2 article)	On request for permission and use
4.	Unnamed test of Pehoski	*n/a*	Descriptive Evaluative	3y 0m-6y 11m	Typical children Adults as a controlled group	None	Researchers were trained	Open access from *AJOT* (3/3 articles)	On request for permission and use
5.	Unnamed test of Bonnier	*n/a*	Evaluative	13y 0m-18y 11m	Children with hemiplegic cerebral palsy	Inclusion: children with hemiplegic cerebral palsy	None	Closed access from *Taylor & Francis Online* (1/1 article)	On request for permission and use
6.	Test of In-Hand Manipulation – Revised	TIHM-R	Predictive Evaluative	3y 0m-6y 6m	Typical children	Exclusion: significant impairment of vision, hearing, motor, or cognitive skills and/or insufficient understanding of English to complete the test	Researchers were trained in a 2-hour workshop	Open access from *AJOT* and *BJOT* (2/2 article)	On request for permission and use. Equipment requirements are a prefabricated 9-HPT™ with prices from publishers ranging from USD 38 - 73
7.	Assessment of Children's Hand Skills	ACHS	Predictive Evaluative	2y 0m-12y 11m	Typical children, children with disabilities	None	Researchers were trained over 2 days (12 hrs in total). Recommends 'self-learning' training	Open access from *Wiley Online Library, AJOT, BJOT* and *Journal of Rehabilitation Medicine* (5/6 articles) Closed access from *ScienceDirect* (1/6 article)	Appendix in the article. On request for permission and use.
8.	University of the Free State – In-hand Manipulation Checklist	UFS IHM-C	Descriptive	4y 0m-7y 11m	Typical children	Exclusion: physical, cognitive or emotional disabilities as a result of autism, cerebral palsy or attention deficit disorder	None	Open access from *Scielo South Africa* (2/2 articles)	On request for permission and use

9.	Timed-Test of In-Hand Manipulation	T-TIHM	Predictive Evaluative	5y 0m-6y 11m	Typical children with good and poor paper-and-pencil task performance	Exclusion: limiting medical diagnosis or visual or auditory impairment	Researchers were trained	Open access from *Wiley Online Library* (1/1 article)	On request for permission and use. Equipment requirements are a prefabricated 9-HPT™ with prices ranging from USD 38 – 73 from publishers
10.	Test of In-hand Manipulation Skills	TIMS	Descriptive Evaluative	3y 6m-9y 6m	Typical children, CP, Developmental Coordination Disorder, Down Syndrome	Exclusion: any history of upper limb surgery, severe sensory loss (auditory or visual) or unable to understand test instructions.	None	Open access from *International Journal of Health & Allied Sciences* (1/1 article)	Appendix in the article. Publisher (USD $80)

AJOT – American Journal of Occupational Therapy; POTJ – Physical and Occupational Therapy Journal; BJOT – British Journal of Occupational Therapy

Descriptive	Description of the person's current functional status with a focus on identifying strengths and limitations. Often used to provide baseline data for treatment planning and clinical decision making. (Rudman& Hannah, 1998)
Predictive	Undertaken in order to predict the future ability or state of a client or to predict a specific outcome in the future. (Rudman& Hannah, 1998)
Evaluative	Used to detect a change in functioning over time and undertaken to monitor a client's progress during rehabilitation and to determine the effectiveness of the intervention. (Rudman& Hannah, 1998)

The intended purposes of these instruments ranged between descriptive, evaluative, predictive, or a combination of these. Where the purpose was not clearly stated, the researcher classified the instruments based on the definitions from literature (Laver Fawcett, 2013, pp. 96–101; Rudman & Hannah, 1998). Seven instruments incorporated an aspect of evaluation in combination with either describing or predicting the child's in-hand manipulation skills. The age groups for nine assessment instruments ranged between the ages of two to 12 years, except for the *unnamed test of Bonnier* that was designed specifically for adolescents. The research populations for eight of the assessment instruments included typical developing children as this formed the first stage of instrument development. Children with various conditions and fine motor delays were included by six of the assessment instruments, while the *unnamed test of Pehoski* also included an adult controlled group (Pehoski et al., 1997a; Pehoski et al., 1997b). Six instruments indicated inclusion or exclusion criteria, with the general exclusion criteria being children with cognitive delays or visual- or auditory deficits (De Vries et al., 2015; Pont et al., 2008; Raja et al., 2016; Smith-Zuzovsky & Exner, 2004; Visser et al., 2016). Five assessment instruments did not indicate the need for clinician training (Case-Smith 1996; Bonnier, Eliasson & Krumlinde-Sundholm 2006; Humphry, Jewell & Rosenberger 1995; Visser et al. 2016; Raja, Katyal & Gupta 2016), while the *unnamed test of Pehoski* (Pehoski et al., 1997a; Pehoski et al., 1997b), *TIHM-R* (Pont et al. 2008) and *ACHS* (Chien et al., 2014) reported having trained the researchers who executed the studies. Even so, no formal training is required for the *ACHS* (Chien et al., 2012) compared to the *IMT-Q* (Exner, 1993) for which it is a pre-requisite. Five of the 31 articles were closed access (Bonnier et al., 2006; Chien et al., 2011b; Feder et al., 2005; Feder et al., 2007; Jewell & Humphry, 1993) which requires a clinician who is not subscribed to the journal to buy the articles. Nine of the instruments are available for use with permission from the authors.

Practicality

The aspects of *Practicality* (Table 4) refer to the inclusions of the manual (the extent that the administration and scoring instructions and equipment requirements are standardised) (Laver Fawcett, 2013; Rudman & Hannah, 1998), the different administration aspects, the measurement scale used (Kielhofner, 2006) and scorable aspects of in-hand manipulation. **(INSERT TABLE 4)**

Table 4: Practicality aspects of in-hand manipulation assessment instruments

No.	Name of the instrument	Abbreviation	CLINICAL UTILITY: PRACTICALITY										
			Manual Inclusions	**Administration**				**Measurement scale**	**Scorable Aspects**				
				Method	**No of items to administer**	**Time to administer**	**Hand(s) administered to**		**Quality of movement**	**Additional movements**	**Frequency of movement**	**Time to complete**	**Item(s) Dropped**
1.	In-hand Manipulation Test – Quality section	IMT-Q	Articles contain insufficient information. Formal manual in the process of development and reported to contain detailed instructions, with presentation, scoring and interpretation instructions.	Formal Mechanistic tasks	55	15-20 minutes	Only dominant hand	Ordinal scale	✓ 5-point rating scale (0 = no in-hand manipulation and 4 = smooth, efficient movement and uses the distal finger pads)	✓ Six substitution pattern(s) not specified were scored	×	×	± Additional observation, number of drops recorded but not scored
2.	Test of In-Hand Manipulation	TIHM	Instructions and presentation described in articles. No scoring sheet or interpretation of results provided. Equipment requirements are a prefabricated 9-HPT™	Formal Mechanistic tasks	5	Not specified	Only dominant hand. Actively discourage non-dominant hand	Ordinal Scale	×	✓ Counted and scored the times the peg was stabilized on another surface	×	✓ Scored in seconds	✓ Counted and scored
3.	Observation Protocol of In-hand manipulation	*n/a*	Standardised materials and instructions, also scoring sheet described in the article. No specific instructions or interpretation of the results provided.	Formal Mechanistic and functional tasks	13	Not specified	Only dominant hand	Ordinal scale	×	✓ Alternative manipulation strategies not specified, recorded	✓ Frequency scored	✓ Scored in seconds for functional tasks	✓ Counted and scored
4.	Unnamed test of Pehoski	*n/a*	Instructions and presentation described in articles. No scoring sheet or interpretation of results provided.	Formal Mechanistic tasks	5	10 minutes	Only dominant hand. Actively discourage non-dominant hand	Ordinal scale	✓ 3-point rating scale (1 = mature; 3 = immature)	×	×	✓ Scored in seconds for rotation task	✓ Counted and scored for rotation task
5.	Unnamed test of Bonnier	*n/a*	No specific instructions available. Scoring described in the article. No interpretation of scores provided.	Formal Mechanistic tasks	3	Not specified	Only non-dominant hand. Actively restrain non-affected/ dominant hand	Ordinal scale	✓ 5-point rating scale for rotation and shift tasks	×	×	×	×

6.	Test of In-Hand Manipulation – Revised	TIHM-R	Instructions and presentation described in articles. No scoring sheet or interpretation of results provided. Equipment requirements are a prefabricated 9-HPT™	Formal Mechanistic tasks	3	5-7 minutes	Only dominant hand. Actively discourage non-dominant hand	Ordinal scale	✓ 3-point scale (0 = no IHM skills used, 1 = IHM used less than 50% of the time, 2 = IHM used more than 50% of the time)	✓ Counted and scored the times the peg was stabilized on an external surface	×	✓ Scored in seconds	✓ Counted and scored
7.	Assessment of Children's Hand Skills	ACHS	Description of test items and scoring published in the appendix. No standardised materials, methods, or test settings required. Formal manual in the process of development (predicted cost USD 70).	Informal Functional tasks	22	20-30 minutes	Not specified	Ordinal scale	✓ 6-point scale	×	×	×	×
8.	University of the Free State – In-hand Manipulation Checklist	UFS IHM-C	Instructions and presentation described in articles. No scoring sheet or interpretation of results provided. Photo of equipment requirements included.	Formal Mechanistic tasks	8	10-15 minutes	Only dominant hand	Nominal scale	✓ Two categories: 1) Successful completion with or without compensation 2) No compensatory methods used	✓ Scored specified as stabilise against body & surface; Rotate body; Use both hands; Fixation of arm; Change hands; Rotate the wrist	×	×	± Additional observation, not scored
9.	Timed-Test of In-Hand Manipulation	T-TIHM	Instructions and presentation described in articles. No scoring sheet or interpretation of results provided. Equipment requirements are a prefabricated 9-HPT™	Formal Mechanistic tasks	3	5-7 minutes	Only dominant hand	Ordinal scale	×	± Additional observation if an external surface was used but not scored	×	✓ Scored best attempt out of two in seconds	± Additional observation, not scored
10.	Test of In-hand Manipulation Skills	TIMS	Instructions, equipment and presentation published in the appendix. Manual can be purchased (USD 80).	Formal Mechanistic tasks	47	15-20 minutes	Only right-hand	Ordinal scale	✓ 4-point rating scale (0 = No manipulation within the hand noticeable, hand is used only to grasp; 3 = object manipulated smoothly and quickly within the hand, using the distal finger pads predominantly)	± Additional observation could be noted, but not scored	×	×	✓ Counted and scored but not included in the final score
Scoring aspect is either: ✓ scored, × not included in scoring, ± noted as an observation only													

Two of the assessment instruments, *TIMS* (Raja, Katyal & Gupta 2016) and *ACHS* (Chien et al., 2012), published a thorough description of the instrument as an appendix to their articles, while the *IMT-Q* is not reproducible from the articles' descriptions (Exner, 1990; 1993; Miles Breslin & Exner, 1999; Smith-Zuzovsky & Exner, 2004). The remainder of the instruments included descriptions of the instructions, tasks and equipment (Bonnier et al., 2006; Humphry et al., 1995; Pehoski et al., 1997b; Visser et al. 2016; Raja et al., 2016), with the *UFS IHM-C* article, the only one to include a photo of the equipment (Visser et al., 2016). The *TIHM*, *TIHM-R* and *T-TIHM* are all pegboard-based assessment instruments that used the 9-Hole Pegboard Test (9-HPT™) equipment (Case-Smith, 2002; Pont et al., 2008; Van Hartingsveldt et al., 2015) which is commercially available. The exact scoring sheet and interpretation of the results, along with the instructions are available in the respective published articles, but are incomplete to classify as a standardised manual (Bonnier et al., 2006; Humphry et al., 1995; Pehoski et al., 1997; Raja et al., 2016; Visser et al., 2016).

A formal administration approach was proposed by the guidelines of nine instruments, with the exception of *ACHS* that followed an informal and naturalistic approach (Chien et al., 2009). Functional tasks were also used by the *ACHS* (Chien et al., 2009) and for a part of the *Observational Protocol of In-hand Manipulation*, which included tasks such as fastening a button, eating with a spoon or brushing teeth (Chien et al., 2009; Humphry et al., 1995). Mechanistic tasks used by the remaining instruments referred to either structured test items like the pegboard with a specific goal verbalised (Case-Smith, 2002; De Vries et al., 2015; Pehoski, et al., 1997; Pont et al., 2008; Visser et al., 2016), or 'games' that were structured to ensure the movement was elicited and repeated for optimal scoring (Bonnier, Eliasson & Krumlinde-Sundholm 2006; Visser et al. 2016; Exner 1993; Humphry, Jewell & Rosenberger 1995; Raja, Katyal & Gupta 2016). The time to administer an assessment instrument ranged from five minutes (De Vries et al., 2015; Pont et al., 2008) to 30 minutes (Chien et al., 2012). Most instruments only assessed the dominant hand (Case-Smith, 1996; Chien et al., 2009; De Vries et al., 2015; Humphry et al., 1995; Pehoski et al., 1997; Pont et al., 2008; Smith-Zuzovsky & Exner, 2004; Visser et al., 2016). In contrast to the *unnamed test of Bonnier* that only presented the activities to the non-dominant hand, *TIMS*, developed in India, presented the assessment items exclusively to the right hand as right-handedness is preferred for cultural reasons (Raja et al., 2016, p. 237). Four of the assessment instruments indicated that they actively discouraged the use of the other hand during the testing, either by restraining the hand (Bonnier et al., 2006), asking the child to place their hand onto a wooden dowel (Pehoski et al., 1997) or by asking the child to place the other hand in their laps (Case-Smith 1991; Pont, et al., 2009). The four fundamental levels of measurement scales used in assessment instruments are nominal, ordinal, interval and ration (Kielhofner 2006; Laver Fawcett, 2013). Nine of the assessment instruments used ordinal scales, which are the numerical values that represent the performance of the child on a continuum and either refer to a rating scale or a timed score (Laver Fawcett, 2013). The *UFS IHM-C* used a nominal scale, as two categories were used during the scoring

(Visser et al., 2016). The quality of the movement was often scored on a rating scale ranging from a 3-point (Pehoski et al., 1997; Pont et al., 2008) to a 6-point scale (Chien et al., 2009). Additional movements were referred to by some authors as substitution patterns (Miles Breslin & Exner, 1999), compensatory methods (Visser et al., 2016) or alternative manipulation strategies (Humphry et al., 1995). These movements by the child referred to those other than the identified in-hand manipulation pattern that would be most efficient for that specific activity (Humphry, Jewell & Rosenberger 1995) which could indicate immaturity of the developed skill (Pehoski, et al., 1997; Pont et al., 2009; Visser et al., 2016). Scoring of any additional movement(s) was prevalent in six of the assessment instruments (Miles Breslin & Exner 1999; Case-Smith 1996; Humphry, Jewell & Rosenberger 1995; Pont et al. 2008; Visser et al. 2016; Raja, Katyal & Gupta 2016) with variations in the amount of scoring guidance provided, ranging from specific criteria to generalised observations. The frequency with which the correct in-hand manipulation movement pattern was used by the child was only scored by the *Observational Protocol of In-hand Manipulation* (Humphry et al., 1995). Recording the time to complete an item was scored in seconds by five of the assessment instruments (Case-Smith, 1996; De Vries et al., 2015; Exner, 1997; Pehoski et al., 1997; Pont et al., 2008). Scoring the exact number of times an object was dropped per item, was scored by half of the assessment instruments (Case-Smith, 1996; Exner, 1997; Pehoski et al., 1997; Pont et al., 2008; Raja et al., 2016) while three others included it as an additional observation (De Vries et al., 2015; Smith-Zuzovsky & Exner, 2004; Visser et al., 2016).

Psychometric properties

The *Psychometric Properties* that have been reported on in the eligible articles are summarized in Table 5. The instrument development process, as proposed by Benson and Clark (1982), consisted of item selection, content validity, retest reliability, equivalence reliability, and internal consistency, followed by criterion and construct validity. In addition, inter-rater and intra-rater reliability, as well as the assessment instruments' responsiveness to change were included as these were important aspects for predictive and evaluative instruments (Rudman & Hannah, 1998). **(INSERT TABLE 5)**

Table 5: Psychometric properties of the in-hand manipulation assessment instruments

No.	Name of the instrument	Abbreviation	PSYCHOMETRIC PROPERTIES									
			Item Selection	**Content validity**	**Retest reliability**	**Internal Consistency**	**Criterion Validity**	**Construct Validity**	**Inter-rater reliability**	**Intra-rater reliability**	**Responsiveness to change**	**Norm / Criterion Referenced**
1.	In-hand Manipulation Test – Quality section	IMT-Q	✓(Exner, 1990)	✓(Exner, 1993)	✓(Smith-Zuzovsky & Exner 2004; Miles Breslin & Exner 1999) ICC = ranged from 0.84 to 0.95 for different age groups	×	×	✓(Miles Breslin & Exner 1999) r = 0.427 age r = 0.433 hand preference r = 0.258 total IMT and gender r = –0.433, p <0.01 hand preference and total IMT	✓(Miles Breslin & Exner, 1999) ICC = 0.90	×	×	×
2.	Test of In-Hand Manipulation	TIHM	✓(Case-Smith, 1996)	×	×	×	×	×	×	×	×	×
3.	Observation Protocol of In-hand manipulation	*n/a*	✓(Jewell & Humphry, 1993)	×	✓ (Humphry et al., 1995) r = ranged from 0.71 to 0.94 for different test items	×	×	×	✓(Jewell & Humphry, 1993) r = ranged from 0.91 to 0.99	×	×	×
4.	Unnamed test of Pehoski	*n/a*	✓(Pehoski et al., 1997)	×	×	×	×	×	✓(Pehoski et al., 1997) Cohen's Kappa ranged from 0.79 to 0.82 for different items	×	×	×
5.	Unnamed test of Bonnier	*n/a*	✓(Bonnier et al., 2006)	×	×	×	×	×	×	×	×	×
6.	Test of In-Hand Manipulation – Revised	TIHM-R	✓(Pont et al., 2008)	×	✓(Pont et al. 2008; Brown & Link 2016) "Inadequate" at 75.86% agreement when two data sets overlapped	×	×	✓(Pont et al., 2008) Rasch modelling used – "adequate" although with limited sensitivity to the performance of finger-to-palm	✓(Brown & Link, 2016; Pont et al., 2008) "Excellent" 46 of the 100 data sets were given exactly the same overall ability	×	×	×

								and palm-to-finger translation	measured by two or more raters			
7.	Assessment of Children's Hand Skills	ACHS	✓(Chien et al., 2009)	✓(Chien et al., 2010)	✓(Chien et al., 2010) r = 0.78, p <0.01	×	×	✓(Chien et al., 2012) Rasch goodness-of-fit analysis, r = ranged from 0.59 - 0.89	✓(Chien et al., 2010) r = 0.63, later on improved to ICC 0.81 (Chien et al., 2014)	✓(Chien et al., 2014) ICC = ranged from 0.61 - 0.93 for different evaluations	×	×(Chien et al., 2012) Intended to be criterion-referenced
8.	University of the Free State – In-hand Manipulation Checklist	UFS IHM-C	✓(Visser et al., 2014; 2016)	×	×	×	×	×	✓(Visser et al., 2016)	×	×	×
9.	Timed-Test of In-Hand Manipulation	T-TIHM	✓(De Vries et al., 2015)	×	✓(De Vries et al., 2015) ICC = 0.71	×	×	✓(De Vries et al., 2015) r = -0.40 convergent validity with WRITIC established	×	×	×	×
10.	Test of In-hand Manipulation Skills	TIMS	✓(Raja et al., 2016)	✓(Raja et al., 2016)	✓(Raja et al., 2016) ICC = ranged from 0.82 to 0.95 for different items	×	×	✓(Raja et al., 2016) ICC = ranged from 0.7 to 0.9	✓(Raja et al., 2016) ICC = 0.87	×	✓(Raja et al., 2016)	×

✓ Component has been researched × Component has not been researched

WRITIC - Writing Readiness Inventory Tool in Context

Guidelines to interpret:		**Intraclass Correlation Coefficient (ICC)** Poor = <0.5; Moderate = 0.5 - 0.75; Good = 0.75 - 0.9; Excellent = >0.90 (Koo & Li, 2016, p.155) **Pearson's Correlation Coefficient (r)** Weak = ±0.1-0.3; Average = ±0.3-0.5; Strong = 0.5-1.0
1	Content validity	The degree to which the items in an instrument represent the domain being measured. (Powell et al., 2009)
2	Test-retest reliability	The stability of an instrument over time. Repeated scores in a short time period should be similar. (Powell et al., 2009)
3	Internal consistency	The degree to which items measure different aspects of the same attribute and nothing else. (Powell et al., 2009)
4	Criterion validity	The extent to which the results of an instrument relate to a measure of a similar construct, has demonstrated reliability and validity. (Rudman & Hannah 1998)
5	Construct validity	The degree to which test items measure a theoretical construct and is able to perform as theorized. (Laver Fawcett 2013)
6	Inter-rater reliability	The extent to which an instrument produces consistent scores when used by different raters. (Rudman & Hannah 1998)
7	Intra-rater reliability	The extent to which an instrument produces consistent scores when used by the same rater. (Rudman & Hannah 1998)
8	Responsiveness to change	The exactness of a measure and extent to discriminate differing amounts of a variable and its ability to measure change. (Laver Fawcett 2013)

The item selection process, the first part of constructing an instrument, was performed using different methods. These methods included either reviewing the literature and non-standardised activities (Bonnier, Eliasson & Krumlinde-Sundholm 2006; Visser et al. 2014), selecting the tasks based on Exner's *Classification of in-hand manipulation* (Bonnier, Eliasson & Krumlinde-Sundholm 2006), considering items that were familiar and easily available to the target group (Raja, Katyal & Gupta 2016), or consulting with parents and teachers to determine what functional tasks of a child were important to them (Humphry, Jewell & Rosenberger 1995). Content validity, although the recommended second step in instrument development, was only performed by *IMT-Q* (Exner, 1993), *ACHS* (Chien et al., 2012), and *TIMS* (Raja et al., 2016). Retest reliability was researched by six of the assessment instruments, with all reporting acceptable levels of reliability, except for the *TIMH-R* that reported a lower than the desired 95% agreement level after two weeks (Pont et al., 2008). Notably, the fourth and fifth steps, namely internal consistency and criterion validity, had not been researched by any of the authors (Brown & Link 2016; Feder et al., 2007). Construct validity had been researched for half of the assessment instruments, with acceptable levels of validity, apart from the translation activities of the *TIMH-R* that reported limited sensitivity to distinguish between the finger-to-palm and palm-to-finger movements (Pont et al., 2008). Inter-rater reliability was researched for the majority of assessment instruments with acceptable levels, with the exception of the *TIHM, T-TIHM,* and *unnamed test of Bonnier* that did not test inter-rater reliability. Intra-rater reliability was only researched and found to be adequate for the *ACHS* (Chien et al., 2014). Only the authors of the *TIMS* researched responsiveness to change after providing 15 children with various hand dysfunctions with 15 days of 25-minute intervention sessions (Raja et al., 2016).

Discussion

The ten in-hand manipulation instruments identified from 31 eligible articles, published in seven different countries, over 28 years, confirm that in-hand manipulation is pertinent to pediatric therapists in both developed and developing countries.

Components of in-hand manipulation

None of the instruments incorporated all the components of in-hand manipulation in a manner that were easily differentiated during the presentation and scoring of the tasks. The instruments;

ACHS (Chien et al., 2009) and *TIMS* (Raja et al., 2016), include tasks or activities that potentially elicit the components, but lack the scoring opportunity to distinguish between the simple and complex components of shift and rotation, while the *IMT-Q* (Smith-Zuzovsky & Exner, 2004) and *UFS IHM-Checklist* (Visser et al., 2016), excluded either the components of simple or complex shift. This inconsistency of discriminating between the more discreet components of shift stems from Exner's *Classification for In-hand manipulation* (1990) that only refers to shift as one component. However, Pont et al.'s *Modified Classification of In-hand manipulation* (2009) has further conceptualised all the components by providing comprehensive definitions with examples and therefore recommended that future instruments should base their item selection process on this model (Pont et al., 2009). A cause for concern is that the published articles reviewed after 2009, did not integrate (De Vries et al., 2015) or adjust their instruments' items to clearly reflect both simple and complex shift (Chien et al., 2012; Visser et al., 2016; Raja et al., 2016). A possible reason for this may be that the tasks included by these instruments are too complex to observe and score simple and complex shift or rotation separately. For example, the assessment of simple shift can either be based on the desired action (i.e., fingers are flexed and extended in unison) or the child's performance of an activity (i.e. the fingers push a key into a hole) or during a functional task (i.e., the child opens up a lock), but specific instructions are needed to guide the assessor in distinguishing between what must be scored as "each aspect demands an evaluation of both quality and speed of execution" (Pont et al., 2009).

Clinical utility

In this study, the multi-dimensional term of clinical utility referred to the instrument's applicability and practicality to acknowledge the clinical factors that influence a clinician's choice of instrument (Smart, 2006). It is reassuring that the age group of four- to six-year-olds were included by the majority of the instruments, as this age group corresponds with the rapid development spur of in-hand manipulation (Pehoski, 2006; Visser et al., 2014; 2016) and relates to the development of a child's pre-writing and writing skills (Van Hartingsveldt, De Groot, Aarts & Nijhuis-van der Sanden, 2011). In contrast, the limited inclusion of younger and older children in the instruments was concerning. Early detection of in-hand manipulation delays is important because children already start to develop in-hand manipulation skills from the age of one year (Exner, 1990; Henderson & Pehoski, 2006). Children aged twelve years and older are required to display mature in-hand manipulation skills, however not at the same

speed as that of an adult (Exner, 2010) and should also be assessed for poor in-hand manipulation. The design of the tasks from the current instruments relies on the child to wait for the instructions and understand how to use the objects to reach the goal. Understandably, this can make the assessment of a young child challenging as developmentally, children from the age of one year to 18 months, engage predominantly in 'pretend' games by imitating another person and use objects relevant to the situation (i.e., spoon or drinking cup), while only developing the ability of linking steps together and performing multiple related actions together while starting to use simple tools (i.e., shape blocks, hammering), up to the age of two years. Up to the age of three, children start to participate in more tasks that require object manipulation and start to combine actions into entire play scenarios (i.e., feeding and dressing a doll to put into bed), although they start to become shy towards strangers, especially adults. If an instrument is not specifically developed to incorporate these developmental stages of a child, the assessment of a child's in-hand manipulation is understandably difficult. For an older child again, the simplicity of the tasks required for good engagement of a four- to six-year-old might not pique their interest. Therefore, it would be important to adjust the presentation and goal of the task to be appropriate for an adolescent, which is possible when comparing to other formal handwriting assessments that include the age range of nine to seventeen years, such as the *Detailed Assessment of Speed of Handwriting (DASH)* (Simons & Probst 2014).

Few instruments were developed with the intention to be adjustable for the different age groups, such as changing the test item to be more or less challenging, the size or number of objects to handle or the time allowed for performing the task. The majority of instruments presented mechanistic tasks in a formal manner to a small age range. Should these instruments be extended to younger or older children, either a floor- or ceiling effect may occur, when the child scores the minimum or maximum of the test respectively, and as a result the instrument does not display the full deficit or extent of a child's ability (Laver Fawcett, 2013). In comparison, the *ACHS* (Chien et al., 2009) is flexible and allows the assessor to choose up to three from 22 functional activities to assess the hand function of the child. However, the chosen activities, albeit age-appropriate, may not demonstrate all six constructs of in-hand manipulation and as a result, may provide insufficient information on the child's in-hand manipulation skills.

The limited availability of the instruments and training may influence the extent to which the instruments are used (Smart, 2006). Training clinicians in how to administer and observe the

subtle in-hand manipulation movements, is vital as the ordinal scale used by most instruments are prone to subject bias (Laver Fawcett, 2013, p.146). Training through the use of video recordings have been proposed by some authors (Anon, 2016; Exner, 1993), but not yet implemented. Training a clinician to ensure competency to correctly assess, interpret and treat the problem areas identified by the assessment, is a requirement of standardised pediatric assessments such as the Sensory Integration and Praxis Test (South African Institute for Sensory Integration, 2019; Star Institute for Sensory Processing, 2019). The benefits of training a clinician to make detailed observations have been shown to also improve the inter-rater reliability of an instrument (Van Jaarsveld, Mailloux & Herzberg, 2012). None of the instruments are yet commercially available and still rely on the clinician to self-fabricate the equipment and scoring forms from the articles' descriptions. The danger, therefore, exists that clinicians either incorrectly apply the directions from the article, misinterpret the results, or do not assess in-hand manipulation at all as this task can appear too daunting. Should the clinician solely rely on clinical observations, or on more accessible 'grey' literature proposed on the internet, they run the risk of grounding clinical decisions on subjective and scientifically unsound information. In both cases, it can at best result in poor service delivery, or at worst, harmfully mislabel a child, providing unnecessary and expensive services or failing to identify and treat the existing problem (Laver Fawcett, 2013; Smith-Zuzovsky & Exner, 2004; Stewart, 2010).

Psychometric properties

From the overview provided, it is evident that the reliability and validity aspects of the instruments still require further research. The purpose of the different instruments was not clearly specified in the articles as being descriptive, evaluative or predictive (or a combination). This resulted in the researcher classifying the instruments based on the definitions from the *Instrument Evaluation Framework* (Rudman & Hannah, 1998). At the onset of the development process, it is important that the purpose of the instrument is clearly stated as this will ultimately guide which reliability and validity aspects should be evaluated during the instrument development process. Further research is warranted as none of the most important psychometric properties corresponds to the purpose of the instrument (Rudman & Hannah, 1998). Should any changes be made to an instrument by the clinician or future researchers, caution must be applied as Laver Fawcett (2013) warns that "once the standard procedure for

test administration and scoring has been changed, even in a small way, the reliability and validity of that part of the test or test item can no longer be guaranteed."

Overall, the results showed a lack of follow-through in refining the proposed instruments into more comprehensive and standardised instruments with established psychometric properties. The process of instrument development remains a "time-consuming, complex and iterative process of constructing, evaluating, revising and re-evaluating an instrument (Laver Fawcett, 2013)", with uncertainty remaining should instruments be further developed.

Limitations

This review only included published articles up to 2018, and although the researcher did an extensive search on the available databases to ensure a broad representation of the literature, grey literature and the review of the physical end-product of the instruments itself were not compared, which can be seen as a limitation. The instruments were not compared to each other as different instrument development processes and models were used. Lastly, the quality of psychometric evidence was not compared, as would be the case with a systematic review, and consequently, this scoping review "cannot determine whether particular studies provide robust or generalizable findings" (Arksey & O'Malley, 2005).

Recommendations

The landscape of the available in-hand manipulation assessment instruments described in published literature has been mapped out, while identifying gaps to be addressed by future research. From this evidence, the researcher proposes the following recommendations:

Firstly, it is recommended that an instrument be consistent with the *Modified Classification System of In-hand manipulation,* perform activity analyses of the tasks to ensure that all the components are included and ensure that clear observation and scoring guidelines accompany the items to enable the clinician to discern between the simple and complex components of both shift and rotation. Furthermore, a classification of the instruments (end-products) according to the level of complexity outlined by the Taxonomic Code of Occupational Performance (Polatajko et al., 2004) is needed to understand more fully why certain components are not included in an assessment.

Secondly, considering the different clinical utility aspects of in-hand manipulation, the following recommendations are made: an instrument must consider the developmental requirements of different age groups and be adjustable by changing either the presentation and complexity of a task or using different items based on the size, changing the numbers of items a child must manipulate, or adjusting the speed requirements. Training in the use of the instrument should be provided, either at undergraduate or postgraduate levels. Post-graduate training can be performed through the use of workshops, webinars or interactive video recordings that illustrate how to observe and score the different movements of each task according to the age groups. Further refinement of the instrument manuals is imperative, that include standardised administration and scoring instructions along with either criterion or norm-referenced guidelines for interpretation. The standardised manual must either be published in its entirety in an accredited journal, so that a clinician can accurately construct the instrument, or it should be made commercially available, with a prefabricated toolkit, from accessible publishers at a reasonable cost. Logic implies that should an instrument be too expensive, it may result in the illegal copying of the testing material, while the self-fabrication of an instrument in combination with no training may lead to incorrect use.

Lastly, future collaboration and coordinated research efforts are advised to attain a gold standard pediatric assessment instrument for in-hand manipulation. It is imperative that researchers follow a structured instrument development process, clearly define the intended purpose of the instrument and align this to the choice of psychometric properties required to be evaluated.

Conclusion

This scoping review provided an overview and structured summary of the ten available in-hand manipulation assessment instruments described in the published literature. The different constructs of in-hand manipulation included by the assessment instruments were described. Clinical utility, according to aspects of applicability and practicality, has been summarized that can support the health practitioner to make an informed decision about the selection of an assessment instrument. Psychometric properties that have been researched for each assessment instrument has been reported on. Results indicated that there is currently no instrument with proof of comprehensive instrument development, with good clinical utility and with established psychometric properties. The ideal to attain a gold standard in-hand manipulation assessment

instrument is possible, provided that future research studies are aimed at refining the existing assessment instruments which are most suitable for the health professional's respective clinical setting. With a comprehensive and contextually relevant in-hand manipulation instrument, clinicians will be able to identify children that present with problems in this complex area of fine motor skills and will be able to provide the appropriate treatment.

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Chapter 3 **Article 2: Assessment of in-hand manipulation by occupational therapists in paediatric practices in South Africa**

Note to the reader

It is the intention of the author to submit this article to the *South African Journal of Occupational Therapy (SAJOT)* for the following reasons: Firstly, it aligns with the journal's aim to disseminate research articles that contribute to the scientific knowledge of the occupational therapy profession and in particular its service delivery in Africa. Secondly, the audience of the journal corresponds with the participants of the study, South African occupational therapists, and can, therefore inform clinical practices. Thirdly, this study will resonate with the previous articles pertaining to a South African based in-hand manipulation instrument that was published in this journal by Visser et al. in 2014 and 2016 and aim to assist in the further development of a contextually relevant instrument for South Africa.

This journal regularly publishes scientific articles and the structuring guidelines for this publication are included in *Addendum G*. The structure of the content of this article strictly follows the journal guidelines. The most important structural guidelines are in short, an abstract that should be limited to 200 words and article content limited to 12-16 pages. A combined total of eight tables and figures are allowed. Tables should be numbered with Roman numerals with headings at the top of the table, while figures should carry Arabic numerals and be labelled at the bottom of the figure. Numbering the pages are required. The Vancouver citation style is required. The text requirements are Arial font, size 11, with 1.5 line spacing.

The current article's length is 16½ pages, with a word count of 6909, excluding the tables and reference list. The abstract length is 200 words, and there are six tables. This complies with the journal requirements.

This study followed an empirical approach and will address the following study objectives, namely *to describe what current methods were used by paediatric occupational therapists to assess in-hand manipulation of children and to describe what the preferences of paediatric occupational therapists were regarding a suitable in-hand manipulation assessment instrument for children.* Also, *the test-retest reliability of the questionnaire was determined.*

Abstract

Introduction*: A*ssessment of in-hand manipulation is fundamental to guide treatment for children with fine motor delays. Limited literature is available on how South African occupational therapists assess in-hand manipulation. This study aimed to describe what current in-hand manipulation assessment methods are used and what the preferences of occupational therapists in paediatric practices are regarding a suitable instrument.

Method*:* Quantitative cross-sectional study design with a non-probable, purposive sampling method was used. Participants completed an *EvaSys survey system* online questionnaire.

Results*:* Two-hundred-and-ninety-two (n=292) occupational therapists registered with HPCSA participated. Limited familiarity (n=50; 17.1%) of the formal assessment instruments described in literature was reported on. The informal assessment methods most used were subjective observation of tasks (n=287; 98.3%), specifically scholastic (n=261; 89.4%) and play tasks (n=255; 87.3%) for children between the ages of five to six (n=273; 93.5%). Preferences supported a descriptive instrument accompanied by a user manual that is administered under 15 minutes, in multiple languages, and with attention to the quality of movements and compensatory techniques used by the child.

Conclusion*:* Results showed that the current and preferred assessment methods used by occupational therapists might provide guidance for the future development of a contextual, relevant in-hand manipulation instrument for paediatric practice.

Keywords

In-hand Manipulation, Assessment Methods, Paediatric Practice

Introduction

Assessment is the foundation on which occupational therapy interventions are planned, improvement is measured, and the effectiveness of therapeutic interventions are determined[1]. In the context of paediatric practices, in-hand manipulation is inherently linked to the proficiency with which a child performs scholastic, self-care and play tasks [2–5]. Children with in-hand manipulation delays are often characterised as ‘clumsy’, with slow and messy fine motor skills [6,7], or present with handwriting difficulties [4,8,9]. The services of an occupational therapist working in paediatric practice are then consulted to determine the cause for poor

hand function and its appropriate treatment. This should include the assessment, and when identified, treatment, of poorly developed in-hand manipulation skills.

During the assessment of the child's functional difficulties, obtaining adequate and accurate information on in-hand manipulation through the use of a suitable assessment instrument is vital as this guides the intervention plan and ensures quality service delivery [10]. Literature indicates instruments that can be used for assessing in-hand manipulation in practice [5,11–15]. A review of these instruments, according to the *Instrument Evaluation Framework* of Rudman and Hannah [16] performed by the researcher, indicated that none of these instruments met all the criteria for a suitable assessment instrument. Arguably, this is the reason why therapists appear to assess in-hand manipulation informally by using checklists or clinical observations. However, no research was found to substantiate these assumptions.

A survey in 2011, on how South African occupational therapists assessed poor handwriting in foundation phase learners, confirmed that in-hand manipulation is an intrinsic performance component of handwriting, which 84% of the therapists 'always' assessed. Whether formal or informal assessment methods were used, was not elaborated on [17]. In 2017, a survey was conducted to determine the assessment instruments used by South African paediatric occupational therapists, which again made no reference to any hand function instrument, including in-hand manipulation, that can guide the therapist's clinical reasoning process [18]. To date, no description is available of how occupational therapists in South Africa are assessing in-hand manipulation, as well as no information describing the grassroots preferences of clinical therapists for a suitable in-hand manipulation assessment instrument. This demonstrates a gap for descriptive research to report on the current clinical methods used by clinicians to assess the six components of in-hand manipulation. Moreover, an understanding of the clinicians' preferences is required regarding a suitable in-hand manipulation assessment before further development of an instrument should commence.

The purpose of this article is therefore to firstly describe the current methods used by South African occupational therapists in paediatric practices when assessing in-hand manipulation and secondly to determine their preferences for a suitable instrument.

Literature review

In-hand manipulation is the complex skill of adjusting an object using different movements of the fingers for more effective placement. It enables a child to handle and place items, such as shoelaces or puzzle-pieces, with more precision [2,19] and allows a child to assume an efficient pencil grasp needed for refined and controlled movements during drawing and writing [8,20]. The six components of in-hand manipulation as described by the *Modified Classification System*, are finger-to-palm and palm-to-finger translation, simple- and complex shift and simple- and complex rotation. In addition, a component can also be performed 'with stabilisation', that refers to when an additional object(s) is held in the ulnar side of the palm[3]. Development starts after a child's first year until the age of twelve, when the components are performed similarly to an adult, albeit not at the same speed and quality [10,21].

Assessment methods that occupational therapists use can be grouped as either formal or informal. To ensure that a test is appropriate for a clinical setting, the clinician should critically evaluate the purpose of the assessment and appropriateness for the intended population. Ideally, a formal method should include a norm- or criterion-referenced evaluation that through a development process has established standardised procedures for administration and scoring and has established psychometric rigidity [16,22,23]. The instruments found in literature that have started the process of development, albeit not standardised, include the *UFS In-Hand Manipulation Checklist (UFS IHM-C)* [13,24]*,* the *In-hand Manipulation Test - Quality section (IMT-Q)* [6,25], *Test of In-hand Manipulation (TIHM)* [4,26] that was refined into the *TIHM-Revised (TIHM-R)* [12], the *Observational Protocol of In-Hand Manipulation* [5,27], the *unnamed test of Pehoski* [15,21] and the *Test of In-hand Manipulation Skills (TIMS)* [14], the *unnamed test of Bonnier* [28] and *the Timed-Test of In-Hand Manipulation (TIHM-T)* [29]. An occupational therapist can also use a complimentary hand function assessment that includes features of in-hand manipulation to guide their clinical observations. Examples include the *Assessment of Children's Hand Skills (ACHS)* [30,31], a naturalistic observational hand function assessment and the *Functional Dexterity Test (FDT) for children* [32,33] a peg-board based dexterity instrument. Cognisance should be taken that these two instruments report only on dexterity or hand function as a whole and not on the specific in-hand manipulation components [3,34].

Informal in-hand manipulation assessment methods can provide a therapist with information about the child's performance, yet the results are not quantitative and cannot be compared to a norm or a criterion. This method relies mostly on the assessor's judgment and skilled

observations and thus tend to be subjective [22]. Examples of informal methods that can be used include screening or observational “tick lists”, collateral information obtained from parents or teachers and observations made of the child’s participation in certain activities during school-, play- or self-care tasks. There is often no evidence of instrument development and psychometric research to support the reliability or validity of the informal method used. Suggested screening activities that contain a section on in-hand manipulation skills with expected age groups are available (Table 10-1) in the *Occupational Therapy for Children* textbook [35] and can guide a clinician to determine whether therapy services or an in-depth evaluation are required. The collateral information that can be obtained from a teacher or parent, either in the form of an interview or questionnaire, can help determine the intensity and duration of the problematic areas related to poor in-hand manipulations [36]. Lastly, the skilled observations of the therapist remain invaluable in clinical settings where resources are limited. The documentation of in-hand manipulation observations, either by using clinical notes or video recordings[14], can also be combined with a self-designed checklist that can aid the assessor to quickly refer to the different in-hand manipulation components for more precise observations.

When assessing in-hand manipulation, the clinician should be mindful of the practical and contextual aspects that can influence the accuracy of the assessment results. The practical aspects include the method of documentation, as well as the resources of time and equipment available to the clinician. Documentation is an important aspect of the occupational therapy process and should adhere to the Health Professions Council of South Africa’s (HPCSA) guidelines of patient records [37]. Different methods of record-keeping are permissible, provided it is done with precision to enable the accurate interpretation of the reassessment results. Time constraints should also be considered, as this was a factor that influenced South African occupational therapists not to use certain hand therapy assessment instruments [17]. Similarly, a clinician’s choice of activities can be influenced by the availability of the resources in a clinical setting, such as the instrument or equipment (i.e. toys and child-size furniture [25]). The contextual aspects include the age of the child and how the child interacts with the activity demands of the assessment task, as maintaining an interest in an appropriate task motivates the child to optimally engage [21,27]. The manner in which the instructions are presented can also influence the performance of a child, as Exner confirmed that when verbal- and visual cues are provided, children performed better in the assessment [38]. It is therefore important to also ascertain how the occupational therapists of South Africa are navigating the practical and contextual aspects of the in-hand manipulation assessment.

Lastly, the preferences of a clinician towards a suitable instrument can be influenced by the following components; the purpose of an instrument, the age ranges and language of the intended population, the practical aspects of administration time, documentation format and the scorable aspects of the in-hand manipulation constructs that should be recorded. The purpose of an assessment can either be descriptive, predictive, evaluative or a combination of these. It guides the therapist in understanding what information to gather and how to interpret the results from the assessment, whether; to determine the baseline of the child at that moment in time (descriptive), to determine the future ability or outcome of the child (predictive) or to assess the change that occurred in the child over time (evaluative) [16,22]. South Africa is multilingual, with eleven national languages, of which isiZulu, followed by English and isiXhosa is the most spoken language outside the household. The most commonly spoken language at home is again isiZulu, isiXhosa and then Afrikaans [39]. This results in a multilinguistic aspect in paediatric practice, with a possible difference between the languages of the therapist and child. The instruments described in literature scored the aspects of in-hand manipulation differently, with reference to; quality of the movement[14], speed of the movement [29], the frequency with which the correct movement is repeated[5], and the number of times an item is dropped [21].

This literature review confirmed that there are different methods available to a clinician when assessing in-hand manipulation, while also emphasising the contextual factors and practical aspects to consider during an assessment. Furthermore, aspects of an instrument that can influence a clinician's preferences have been briefly described. As no research was found about the current methods used by South African occupational therapists and their preferences for a suitable instrument, the aims of this study were to:

- Describe the formal and informal assessment methods most used and the contextual and practical aspects pertaining to an assessment
- Describe the preferences for a suitable instrument as indicated by the clinician.

Method

Study design

A quantitative, cross-sectional study was conducted in order to answer the research aims.

Sampling and population

A non-probable, purposive sampling method was used to ensure that the sample population was representative of the population of paediatric occupational therapists in South Africa. At the time of the study, 5111 occupational therapists were registered with the HPCSA, although the exact number of the population was unknown, as the HPCSA database has no record of the practice settings in which the occupational therapists work [40]. When the ratio of OTASA members working in paediatric practices (73.5%) was applied to the HPCSA membership base, it was assumed that 3 849 occupation therapists formed the sample size.

The inclusion criteria specified that occupational therapists who worked in paediatric practices at that time, or within the past two years, was registered with the HPCSA, and practised in South Africa for more than six months, were included. The online questionnaire was distributed using different methods that included sending an e-mail through the correspondence platform of the Occupational Therapy Association of South Africa (OTASA), posting on the social media platforms, that included Facebook, WhatsApp, Instagram, Linked-in and using 'word-of-mouth'. The researcher applied for access to the HPCSA occupational therapists e-mail dataset in order to distribute the questionnaire personally per e-mail.

Instrumentation

Data was collected using an online questionnaire, via the *EvaSys survey system*. The questionnaire was compiled from indicators found in literature and consisted of three sections. The first was to obtain demographic information of the participants and their practice profile. The second section focused on different assessment methods that included known in-hand manipulation tests and aspects thereof. The third was directed at the preferences for a suitable instrument based on the aspects listed in the *Instrument Evaluation Framework*[16]*.* In addition to each closed-ended questions, a non-compulsory 'other' option with space for text was provided to allow participants to elaborate on their answers to supplement the results.

Pilot testing

Five occupational therapists provided feedback on the layout, structure, clarity, suitability and the face validity of the questionnaire where upon changes were incorporated. They completed the questionnaire again to determine the ease of completion on different electronic devices.

Procedure

Data were collected in two rounds. The first round aimed to recruit as many occupational therapists working in paediatric practices in South Africa through different distribution methods. The link was available for 6 weeks, from June to August 2018. The second round was conducted to determine the test-retest reliability of the questionnaire. To limit the memory effect [42] the second round only commenced after ten days elapsed. Participants that completed the first round who indicated their willingness to participate in the second round received the link per e-mail. The link remained open for 10 days. To promote a higher response rate and to limit nonresponsive errors, participants received reminder prompts and were given the option to participate in a continuing professional development (CPD) accredited activity after completing a questionnaire round.

Data analysis

Data analysis was done by a qualified biostatistician from the University of the Free State. Descriptive statistics, namely frequencies and percentages for categorical data, medians and percentiles for numerical data were calculated. Temporal stability of the questionnaire, "how constant scores remain from one occasion to another" [41] was determined by the test-retest reliability. The reliability analysis for the two datasets was compared by means of a 2 x 2 table for each question. If a conflicting percentage score of more than 20% was present for an answer the question was considered to be unreliable and excluded from further analysis [42]. Reliable questions that contained unreliable sub-questions, as indicated with an asterisk, were included to ensure that the trends observed are interpreted within the context of the options that were available to the participants. This also provided a unique view of what aspects participants were uncertain about.

Ethics

Ethical approval for this study was obtained from the Health Sciences Research Ethics Committee of the University of the Free State (reference UFS-HSD2018/0358/2905). The participants were informed about the study and gave consent at the start of the questionnaire. If the participant did not meet the inclusion criteria, further access to the questionnaire was denied. Participant's information was kept strictly confidential by the researcher throughout the course of the study and securely stored on a password-protected laptop.

Results

From the 301 responses, 292 participants met the inclusion criteria and completed the first round. The response rate in relation to the 5111 occupational therapists registered with HPCSA at the time of the study, was 5.7%. However, when adjusted to the proposed sample size of 3 849 occupational therapists working in paediatric practices, an acceptable overall response rate of 7.6% was observed. This compares well to similar surveys performed on the same population[18] and similar online survey method [43]. Of the 292, a further 167 participants (54.2%) completed the second round that determined the test-retest reliability of the questionnaire.

Demographic profile

Participants' demographic information is shown in *Table I.* The practice profile comprises of the practice setting and type of clients seen by the participants. **(INSERT TABLE I)**

Table I: Demographic profile of participants (n=292)

Variables		**Median (min-max)**	**n (%)**
Age of participants		31 (23-66)	292 (100)
Experience	Years working as an occupational therapist	9 (1-45)	292 (100)
	Years working in paediatric practise	7 (1-46)	292 (100)
Gender	Female		284 (97.3)
	Male		8 (2.7)
Highest Occupational Therapy Qualification	Diploma		2 (0.7)
	Bachelor's degree		252 (86.3)
	Master's degree		31 (10.6)
	Doctoral degree		2 (0.7)
Employment status	Full-time		217 (74.3)
	Part-time		63 (21.6)
	Unemployed/Leave of absence		12 (4.1)
Practice setting	Private Practice		145 (49.7)
	Pre-School/Early Childhood Development Centre		135 (46.2)
	Primary School		135 (46.2)
	Hospital		87 (29.8)
	Special Needs School		74 (25.3)
	Community Clinic		26 (8.9)
	Non-Profit Organisation		25 (8.7)
	Secondary School		20 (6.9)
	Tertiary Institution		12 (4.1)
	Rehabilitation Centre		9 (3.1)
Paediatric Client Profile	Toddlers (1-3-years)		179 (61.3)
	Pre-schoolers (4-6-years)		264 (90.4)
	Primary school (7-12-years)		233 (79.8)

The expertise held by the participants was confirmed by their qualifications, wide age ranges and years of experience. Among the participants that held a master's degree, five completed their master's in Early Childhood Intervention. The contradiction observed regarding the maximum age ranges was due to a response error by the eldest participant yet included to remain true to the data received. Most participants worked on a full-time basis (n=217; 74.3%) and predominantly in the private practice setting (n=145; 49.7%) with a client profile that consisted primarily from pre-schoolers (n=264; 90.4%).

Current in-hand manipulation assessment methods

The results of the assessment methods used were grouped into two categories, namely the familiarity and reported use of formal assessment instruments (*Table II)*, and the results of the informal assessment methods used *(Table III)*. Thereafter, the practical *(Table IV)* and contextual aspects *(Table V)* of an assessment are discussed.

Formal assessment methods

Participants indicated whether they were familiar with the listed instruments. If they indicated yes, more questions followed to determine the specific instrument(s) they were familiar with and/or used. *Table II* illustrates the degree of familiarity and reported use of the seven in-hand manipulation assessment instruments, the two complementary hand function assessments, as well as the guideline for screening activities sourced from literature. **(INSERT TABLE II)**

Table II: Formal assessment methods (n=292)

	Familiarity		**Reported use**	
	n (%)	**Test-retest Reliability %**	**n (%)**	**Test-retest Reliability %**
IN-HAND MANIPULATION INSTRUMENT				
UFS In-hand manipulation-Checklist (UFS IHM-C)	15 (5.1)	**11.4**	6 (2.1)	**7.8**
Test of In-hand Manipulation (TIHM)	13 (4.5)	**10.2**	3 (1.0)	**7.8**
In-hand Manipulation Test (IMT-Q)	9 (3.1)	**7.8**	4 (1.4)	**7.8**
Test of In-hand Manipulation - Revised (TIHM-R)	8 (2.7)	**8.4**	1 (0.3)	**7.2**
Observation Protocol on In-Hand Manipulation	7 (2.4)	**8.4**	4 (1.4)	**8.9**
Test of In-hand Manipulation Skills (TIMS)	5 (1.7)	**7.8**	1 (0.3)	**7.2**
Unnamed Test by Pehoski	3 (1.0)	**7.8**	0 (0.0)	**7.8**
COMPLEMENTARY HAND FUNCTION ASSESSMENTS				
Functional Dexterity Test for children (FDT)	17 (5.8)	**8.4**	6 (2.1)	**8.4**
Assessment of Children's Hand Skills (ACHS)	5 (1.7)	**7.8**	2 (0.7)	**3.6**
SCREENING GUIDELINES FROM LITERATURE				
Screening Activities for Hand Skills (*Occupational Therapy for Children 6th Edition, Table 10-1)*	28 (9.6)	**8.9**	20 (6.8)	**9.6**

Most of the participants (n=242; 82.9%) indicated that they were not familiar with any of the listed formal assessment methods. From the remaining 50 (17.1%) that indicated their familiarity, the *Screening Activities of Hand Skills* guideline described by Exner in the Occupational Therapy for Children 6th Edition textbook were most known (n=28; 9.6%), followed by an additional fine motor assessment, the *FDT* for children (n=17; 5.8%) and then the in-hand manipulation assessment, *UFS IHM-C,* developed in South Africa by Visser et al. [13,24] (n=15, 5.1%). However, for all the instruments, there were fewer responses of their reported use in comparison to the familiarity indicated.

Informal assessment methods

An overview of the informal assessment methods used, namely collateral information, checklists and skilled observations by the participants are provided in *Table III.* A cascading mechanism was built into the questionnaire so that once one of the main questions were selected, subsequent questions followed from which the participant could choose.

(INSERT TABLE III)

Table III: Informal assessment methods (n=292)

Informal assessment methods	**n (%)**	**Test-retest Reliability %**
COLLATERAL INFORMATION	147 (50.3)	22.2*
Parent interview/questionnaire	137 (46.9)	25.1*
Self-designed	132 (45.2)	23.9*
Standardised	3 (1.0)	25.1*
Teacher interview/questionnaire	98 (33.6)	28.7*
Self-designed	94 (32.2)	**17.9**
Standardised	4 (1.4)	**19.2**
CHECKLIST	74 (25.3)	**19.8**
Fine motor skills checklist	71 (24.3)	20.9*
Self-designed	61 (20.9)	23.9*
Standardised	8 (2.7)	20.9*
In-hand manipulation checklist	27 (9.2)	23.4*
Self-designed	20 (6.8)	**9.6**
Standardised	3 (1.0)	**10.2**
SKILLED OBSERVATION	287 (98.3)	**1.8**
Scholastic tasks	261 (89.4)	**11.9**
Drawing or colouring	254 (87.0)	**13.8**
Writing or copying	248 (84.6)	**15.6**
Cutting	247 (84.6)	**12.6**
School Tool use (ruler, eraser, glue)	160 (54.8)	30.5*
Pasting	149 (51.0)	31.7*
Paging/reading a book	59 (20.2)	22.2*
Play task	255 (87.3)	**10.8**
Threading activity	235 (80.5)	**17.4**
Construction activity (e.g. Lego's, puzzle-building)	222 (76.0)	24.6*
Pegboard activity	220 (75.3)	21.6*
Sorting activity	192 (65.8)	32.9*
Play-dough activity	185 (63.4)	29.9*
Painting activity	92 (31.5)	28.1*
Handling money	87 (29.8)	26.3*
Card game	81 (27.7)	28.7*
Self-care task	160 (54.8)	**18.6**
Putting on socks and shoes	151 (51.7)	22.8*
Dressing upper body (e.g. buttoning a shirt)	141(48.3)	23.9*
Eating with utensils	96 (32.9)	29.3*
Washing hands	95 (32.5)	26.9*
Finger-eating	90 (30.8)	28.1*
Drinking from bottle	74 (25.3)	29.9*
Spooning activity	58 (19.9)	25.7*
Brushing teeth	45 (15.4)	27.5*
Tying hair (for girls)	33 (11.3)	26.3*

** Unreliable questions (reliability percentage score of >20%)*

Collateral information obtained from teachers consistently showed that 94 participants (32.2%) used a self-designed questionnaire, with fewer reported using a standardised questionnaire. Checklists were used by 74 participants (25.3%), with evident uncertainty relating to the use of fine motor checklists despite the high response rate. Of the three main informal methods, skilled observations during tasks (n=287; 98.3%), were the reported method used most. In that method, scholastic tasks (n=261; 89.4%), closely followed by play tasks (n=255; 87.3%) and self-care tasks (n=160; 54.8%) were the commonly observed tasks. From these tasks, the specific activities used that tested reliable, included cutting (n=247; 84.6%), drawing/colouring (n=254; 87%), writing/copying (n=248; 84.9%), and threading activities (n=235; 80.5%). However, there was uncertainty regarding which self-care activities were specifically used to observe in-hand manipulation skills, as none of the sub-questions tested reliably.

Practical aspects of an assessment

The practical aspects as performed by the participants during an assessment is described in *Table IV.* The time taken to administer and score the assessment followed by the documentation method used and whether a reassessment was performed, as well as the availability of resources in the clinical setting to assess a child's in-hand manipulation, are tabulated below. **(INSERT TABLE IV)**

Table IV: Practical aspects of current assessment used (n=292)

Practical aspects of assessment		**n (%)**	**Test-retest Reliability %**
Documentation method	Clinical notes	268 (91.8)	**11.9**
	Self-generated form or checklist	114 (39.0)	24.6*
	Video recording	33 (11.3)	**6.6**
Reassess	Yes	237 (81.2)	**13.2**
	No	55 (18.8)	
Administration time	0-5 minutes	73 (25.0)	**18.6**
	5-15 minutes	144 (49.3)	35.3*
	15-30 minutes	69 (23.6)	25.1*
	30-45 minutes	12 (4.1)	**4.2**
	45-60 minutes	3 (1.0)	**1.8**
Scoring time	0-15 minutes	262 (89.7)	**10.8**
	15-30 minutes	30 (10.3)	**10.8**
Resources available	Yes	256 (87.7)	**2.4**
	No	36 (12.3)	

** Unreliable questions (reliability percentage score of >20%)*

The most used document method was clinical notes, as reported by 268 (91.8%), while 33 (11.3%) used video recordings. Most of the participants (n=237; 81.2%) reported reassessing in-hand manipulation of the child. The time taken to assess in-hand manipulation tested unreliable, for both the 5-15 minute and 15-30-minute options, possibly as 15 minutes was included in both options. For the administration time, 25% (n=73) indicated they only used 0-5 minutes. Similarly, for the scoring time the shortest time period, 0-15 minutes were indicated by 262 (89.7%) of the participants. When the participants were asked to indicate if they have access to available resources to assess in-hand manipulation in children, 256 (87.7%) answered yes. The open-ended question that followed this question prompted the participants to elaborate on their answer. The answers were analysed and showed that the majority used familiar objects such as pegboards (n=61; 20.9%), beads (n=39; 13.4%), money or coins (n=37; 12.7%), clay or similar mouldable material (n=37; 12.7%) and pegs (n=35; 12.0%).

Contextual aspects of an assessment

Results of the contextual aspects that a clinician should consider during an assessment of in-hand manipulation are provided in *Table IV* according to the different age groups of children assessed, if the activity demands were changed in relation to the child's age, the manner in which the instructions were presented, and lastly the position of the child during which in-hand manipulation was assessed. **(INSERT TABLE V)**

Table V: Contextual aspects of current assessment used (n=292)

Contextual aspects of assessment		**n (%)**	**Test-retest Reliability %**
Age groups	1-2-years	91 (31.2)	**17.9**
	3-4-years	204 (69.9)	23.9*
	5-6-years	273 (93.5)	**8.4**
	7-8-years	234 (80.1)	**10.2**
	9-11-years	161 (55.1)	21.6*
	11-12-years	121 (41.4)	**19.8**
Change activity demands in relation to the child's age	Yes	278 (95.2)	**10.2**
	No	14 (4.8)	
Presentation of instructions	Specific verbal instructions, describing the goal of the task	143 (49.0)	35.9*
	No instructions provided, only observations made during participation in tasks	138 (47.3)	27.5*
	Specific visual cue provided by to demonstrate the movement required	130 (44.5)	28.7*
	A practise opportunity is provided to eliminate unfamiliarity of the task	88 (30.1)	26.3*
	While the child performs the task, a verbal reminder to only use the hand that is being assessed	84 (28.8)	30.5*
	After presenting the task, a verbal instruction to only use the specific hand that is being assessed	69 (23.6)	**17.9**
	Actively discourage the use of the hand not being assessed by asking the child to hold onto a fixed object	24 (8.2)	**13.2**
Position of the child during assessment	Seated at a child-sized table where the child's feet can touch the ground	232 (79.5)	**13.2**
	On the floor, seated cross-legged	21 (7.2)	
	Seated at an adult-sized table, feet not touching the ground	6 (2.1)	
	In a standing position	3 (1.0)	
	On the floor, lying on their stomach	1 (0.3)	
** Unreliable questions (reliability percentage score of >20%)*			

Majority of the participants (n=273; 93.5%) indicated that they assessed in-hand manipulation for five-to-six-year-old children. The youngest and oldest age groups were the least assessed by the participants. Participants were noticeably uncertain regarding children in the three-to-four-year-old and nine-to-ten-year-old groups. When asked if the tasks' demand or selection of equipment was changed in relation to the child's age, 278 (95.2%) of the participants responded yes. The responses on how the instructions were provided were mostly unreliable with a low response rate on the two reliable methods that were used in practice. Most of the participants (n=232; 79.5%) indicated that they assessed a child's in-hand manipulation while

seated at a child-sized table where the child's feet can touch the ground, with some indicated a more informal approach where the child is sitting cross-legged on the floor (n=21; 7.2%).

Preferences for a suitable in-hand manipulation instrument

The reliable preferences indicated by the participants regarding a suitable instrument are shown in *Table VI.* These included the purpose of the assessment and what should be included in a user manual, the preferred aspects of in-hand manipulation included in the scoring, as well as the scoring method, the time to administer and score, and the language of presentation of the assessment instrument. **(INSERT TABLE VI)**

Table VI: Preferences for a suitable in-hand manipulation assessment instrument

Preferences for a suitable assessment tool		**n (%)**	**Test-retest Reliability %**
Purpose of assessment	Identify the child's strengths and limitations in order to inform the clinical treatment plan	255 (87.3)	**13.2**
	Describe the child's current functional status	243 (83.2)	**16.8**
	Evaluate the change in functioning over time and monitor the progress made by the child	216 (74.0)	**16.8**
	Evaluate the effectiveness of the intervention	188 (64.4)	26.9*
	Predict the child's future ability	80 (27.4)	**0.0**
User manual inclusions	Scoring and interpretation instructions	284 (97.3)	**1.8**
	Administration instructions	282 (96.6)	**5.9**
	Equipment instructions	228 (78.1)	**17.9**
Scorable in-hand manipulation aspects	Quality of movement	250 (85.6)	**17.4**
	Compensatory techniques used	244 (83.6)	**19.8**
	Speed of movement	240 (82.2)	26.3*
	Number of items dropped	177 (60.6)	38.9*
	Frequency of in-hand manipulation skill used	163 (55.8)	37.7*
Method of scoring	Score according to criteria per item	238 (81.5)	**16.8**
	Plot on a developmental trend chart	141 (48.3)	32.9*
	Video clips to guide scoring	51 (17.5)	**16.8**
Administration time	0-5 min	51 (17.5)	**11.9**
	5-15 min	172 (58.9)	31.1*
	15-30 min	72 (24.7)	26.3*
	30-45 min	9 (3.1)	**3.6**
	45-60min	2 (0.7)	**0.0**
Scoring time	0-15 min	272 (93.2)	**5.9**
	15-30 min	20 (6.8)	**6.6**
Presentation language	English	287 (98.3)	**1.8**
	Afrikaans	153 (52.4)	**16.2**
	Zulu	63 (21.6)	**9.6**
	Sesotho	56 (19.2)	**9.6**
	Xhosa	45 (15.4)	**7.2**

** Unreliable questions (reliability percentage score of >20%)*

For the purpose of a suitable instrument, both the descriptive components were indicated by most, followed by the evaluative component to monitor a child's progress through the change that occurs over time. Uncertainty was noted regarding the other evaluative function of determining the effectiveness of an intervention. The preferred aspects to be included in a user manual received a high response rate, with most indicating the need for administration instructions (n=282; 96.6%), followed by scoring and interpretation instructions (n=284; 97.3%) and fewer indicating the need for equipment instructions (n=228; 78.1%). Only two scorable aspects scored reliable, with a clear preference for scoring the quality of the in-hand manipulation movement and scoring the compensatory techniques used by the child. Majority of the participants preferred to score according to a specific criterion for an item while the use of video clips to guide the scoring was supported by 51 participants (17.5%). Plotting on a developmental trend chart tested unreliable, despite nearly half of the participants indicating this as a preferred scoring method. A stable preferred administration and scoring time for the shortest time slot were seen with only a few indicating the longer time slots. Uncertainty was again noted for the two administration times (5-15 minutes and 15-30 minutes) despite the high response rate. Majority of the participants preferred that an instrument be presentable in English (n=287; 98.3%), with the other languages preferred to a lesser degree. Additional suggestions included the use of a technological platform (e.g. tablet to enable visual demonstrations for persons or audio track) to present the instructions to children with intellectual impairments or that are hard of hearing, along with the proposal to provide specific instructions in all the languages in written or audio format.

Discussion

The first objective of this study was to determine the current assessment methods used by therapists. Clinical expertise to the different developmental phases of in-hand manipulation is confirmed by the paediatric profile as the ages ranging between three and six that were predominantly treated by the participants corresponds with the period of rapid development for in-hand manipulation [3].

The limited familiarity with published in-hand manipulation instruments may be due to the viewpoints of participants, while also revealing to what extent participants engaged in the scientific literature of the profession. The perception that in-hand manipulation was too insignificant an aspect of fine motor skills to warrant further investigation, might be the reason why the in-hand manipulation instruments available for an in-depth assessment were not further investigated. In the most familiar method, participants consulted primary literature

sources, like the guideline for *Screening Hand Skills* described in the Occupational Therapy for Children textbook. Furthermore, their familiarity with the *UFS IHM-C*, which was published in the South African Journal of Occupational Therapy (SAJOT) [13,24] attested that the participants accessed research published locally.

The lower response rate of 'used methods' observed in relation to familiarity can be suggestive of two interrelated factors. Firstly, most of the instruments are still in the process of development, lack comprehensive and commercially available manuals, and do not provide a form of training. This limits the application of the instrument to the clinical setting as well as the awareness created by marketing strategies, such as the catalogues distributed online or at workshops that could also explain the pronounced unfamiliarity with these instruments. Secondly, these results may confirm the findings of Pitout [44] that "although occupational therapists value research, they do not engage in applying research in practice". The use of a standardised in-hand manipulation instrument, when applicable, is preferable as it ensures that the clinicians' clinical decisions are based on rational and defensible results [22].

Informal assessment methods remain clinically useful and invaluable to a clinician. This study confirmed that observations within occupation-based activities are the primary assessment method used by participants (n=287, 98.3%). Quality of the observations was not determined by the questionnaire. Moreover, should observations be unstructured and unsupported by literature, the inferences drawn would be subjective and less reliable. In comparison, skilled and systematic observations based on the comprehensive *Modified Classification System of In-hand manipulation* [3] and documented in detail, set the foundation from which to draw useful interpretations. The use of checklists (n=74; 25.3%) and collateral information from the teachers in the format of interviews or self-designed questionnaires (n=94; 32.2%) are valuable to the assessment process. A possible explanation for the sparse use of these methods is the correlation pointed out by a South African study [17] that the tendency to use information obtained from the teacher, which is additional information on the child's context, is influenced by the therapists' age and years of experience, which for this study varied widely.

Scholastic tasks are highly regarded (n=261, 89.4%) and correspond with the findings that most collateral information was obtained from teachers (n=98; 33.6%), as well as with the two age groups that were assessed most; children between the ages of five and seven. As these age groups are mostly concerned with refining pre-writing skills in Grade R and learning writing skills in Grade 1 [17,45], it flows naturally that the activities of cutting, drawing/colouring and writing/copying were those most observed from the scholastic tasks. When considering that 60% of a school-going child's day is concerned with the fine motor task of writing [17], it is

understandable that practitioners focus on these tasks, specifically when poor in-hand manipulation is suspected. The activity of cutting provides a good opportunity to observe the simple shift movement of the supporting hand as the fingers adjust the paper for cutting [2,4]. While the in-hand manipulation required to adjust writing utensils includes complex- and simple rotation when correctly orientating the pencil, and complex shift when positioning the fingers on the shaft of the pencil or crayon [3,14]. However, to comprehensively establish the degree of in-hand manipulation delay, difficulties in other aspects of a child's functionality should also be considered, such as play and self-care tasks.

Participation in play tasks, per definition, requires a child to use toys, equipment, and supplies appropriately [1]. Of the various activities listed, threading was indicated by the majority of participants (n= 235; 80.5%) and is an ideal task for observing simple shift of the one hand, while performing translation movements of the beads held in the other hand. Yet, this activity is only included by the *ACHS* [30,31] and not in any of the other specific in-hand manipulation instruments. The availability of resources in clinical settings is confirmed by this study, with specific reference to play items, such as pegboards, beads, coins and clay. These can be used to observe in-hand manipulation as the items are included by the *IMT-Q* [6]*, TIMS* [14]*,* and the *UFS IHM-C* [13]*.* Furthermore, the use of pegboards and pegs were included by various in-hand manipulation instruments [11–14,21,29,46], with differences in the exact sizes, numbers of pegs and methods of presenting the task to the child. As pegboards are accessible and familiar items in practice settings including this item in an assessment is reasonable and relevant. Nevertheless, it is not advised to only use a pegboard, as in-hand manipulation should be displayed with a variety of items, and skills with one type of object are not always associated with an ability to use the skill with another size or shape of object [10,14]. However, the uncertainty observed with regards to the play tasks used, highlights the need to train clinicians in how to correctly present and observe in-hand manipulation during familiar play tasks, as well as self-care tasks.

Self-care tasks, per definition, are activities of daily living that are directed towards taking care of one's own body [1]. Various self-care activities were observed by approximately half of the participants (n=160; 54.8%). Again, uncertainty was evident relating to the specific activities used as the subsequent questions tested unreliable. Self-care tasks are not commonly included in developmentally-based in-hand manipulation instruments, apart from the *Observation Protocol of In-hand manipulation* [5] that included a task of buttoning and unbuttoning a shirt. In contrast, the occupation-based assessment *ACHS* [30,31] included several activities of daily living through which a child can spontaneously demonstrate the use of in-hand manipulation although it is not guaranteed that all the isolated components of in-

hand manipulation are assessed during these occupation-based activities. The difference between these two assessment approaches is that occupation-based instruments allow for the identification of critical occupational performance components caused by hand skill difficulties in the relevant environment [30,47], and is criterion-referenced when standardised. In comparison, all the current in-hand manipulation instruments follow a developmental assessment approach where the main focus is identifying the specific underlying components to determine a developmental delay in a formal and more structured environment and when the standardisation process is completed, tend to be norm-referenced [48].

Using clinical notes, as reported by most participants to accurately document assessment findings, is important to improve interpreting the reassessment findings and can provide valuable evidence when reviewed to generate practice-based evidence [49]. Using video recordings to document the in-hand manipulation movements performed by a child has been advised by the *IMT-Q* [6]*, UFS IHM-C* [13] and *TIMS* [14]*,* and was reported by a few participants (n=33; 11.3%). This method can ensure that the refined and subtle movements of in-hand manipulation are accurately observed and can be a valuable aid to monitor progress and compare to the results of the reassessment. Moving from written notes to electronic notes can incorporate the safe inclusion of video recordings, while also simplifying the retrieval of patient records for future research [49].

Changing the activity demands in relation to the child's age, as indicated by nearly all the participants (n=278; 95.2%), is encouraging as a child's best performance can be observed when they are interested and invested in succeeding at a task. During informal observations, the task can be changed intuitively while ensuring that the desired movement is still elicited, for example, changing the picture that a child is asked to colour in or a game that requires the throw of a dice. Still, the observation of a child, without a reference to an age norm or criterion requirements, remains descriptive and problematic when planning interventions. For a standardised assessment to accurately measure a child's abilities, different tasks or adjusting the requirements of a task is required to be age-appropriate yet uniform. Examples exist, such as the tasks of the Miller Assessment of Pre-schoolers (MAP) [50] that make allowances for different items per age group.

Majority of the participants were uncertain how they presented the instructions of the task, as demonstrated by five out of the seven unreliable answers provided, and was reiterated by the preference indicated by 282 (96.6%) for a user manual to include administration instructions. The two presentation methods which were consistently used by the participants do however encourage the child only to use the dominant hand while restricting the use of the other, which

are similar to the assessment instructions of the *unnamed test of Pehoski* [21,51]*, TIHM* [46] *a*nd *TIHM-R* [12]. It is encouraging to see that the majority of the therapists ensure that the child is positioned at a table where their feet can touch the ground (n=232; 79.5%), as this position best enables the child to display their in-hand manipulation skills in comparison to sitting at an adult-sized table [25]. However, as there is no research that opposes the child to sit cross-legged on the floor, as indicated by 21 (7.2%) participants, the impact of this assessment position should be further researched as it might allow the therapist to observe the child in a more naturalistic setting.

The second objective of this study was to determine the participant's preferences for a suitable in-hand manipulation instrument. The findings clearly indicated that the purpose of a suitable instrument should incorporate all the elements of a descriptive instrument, with elements of evaluative instruments. The uncertainty and lower response rate observed when asked if the instrument could be used to evaluate the effectiveness of an intervention, is a concern as it can either be representative of the limited willingness for research involvement of South African occupational therapists [44] or more likely due to the absence of intervention protocols for in-hand manipulation that can only be developed once a comprehensive instrument with sound psychometric properties have been developed [3]. For the user manual inclusions, emphases were placed on the need for scoring and interpretation instructions (n=284; 97.3%), more so than the equipment instructions (n=228; 78.1%). As in-hand manipulation is a complex skill, including training with video clips with a detailed scoring form, would be most suitable, which is a recommendation made by the *IMT-Q* [6] and *ACHS* [52], however, at the time of this study, it has not yet been realised. The two scorable aspects of in-hand manipulation that were preferred included the quality of the movement and the compensatory techniques used. The *TIMS* clearly distinguishes between the quality of the movements on a 4-point rating scale [14]. The *UFS IHM-C* again includes a comprehensive list of possible compensatory techniques that the child might use per task [13,24].

From the other practical aspects relating to an assessment, it was evident that participants preferred a quick instrument. Those instruments that require more time to administer, such as the *IMT-Q* [6,11]and *TIMS* [14] that require 20-30 minutes, may, therefore, be less suitable in a South African context. A definite preference was indicated that the instrument be developed in English (n=287, 98.3%). However, just as valuable were the strong support and suggestions to include other South African languages, either in the written form for a translator or as pre-recorded instructions which can even include sign-language. The value that can be added by including different languages and by overcoming barriers of disabilities is unfortunately overshadowed by the complex and costly process of translating an instrument. This process

contains various methodological pitfalls when attempting to translate conversational phrases, slang and idioms. Translation of an English version word-for-word into another language does not sufficiently account for the possible language and cultural differences [53]. The unanimity amongst the participants stood in contrast to the first set of questions relating to the current methods used. This marked awareness amongst the participants of what would suit the practice setting, highlights the need for further research to strongly consider these preferences as design principles when developing an instrument for the South African paediatric practice context.

Strengths and limitations

This study used a non-probable, purposive sampling method with the intention of representing the clinical practices and latent knowledge held by South African occupational therapists experienced in working in paediatric practices. The results of the study were strengthened by the wider sampling population that was deliberately approached and the adequate response rate which provides valuable information that can be used towards further instrument development for in-hand manipulation. However, the results cannot be generalised to other assessment practices relating to other aspects, apart from in-hand manipulation.

The results obtained from the questionnaire were strengthened by the test-retest reliability that was performed. Hence the results discussed in this article are a true representation of the participant's current practices and preferences. In contrast, the unreliable questions that were excluded from this study's results revealed possible areas of uncertainty among the participants regarding the method of assessing in-hand manipulation and their preferences for a suitable assessment instrument. A need to clarify and further investigate these questions such as the different components of in-hand manipulation that participants specifically assess, the hand(s) to which they assess, method of assessment (functional or formal) and the age range that they prefer for an assessment. In such a case, a revision of the questions will then be needed to ensure that the constructs are still accurately measured.

The questionnaire was detailed and timeous to complete despite consisting predominantly of closed-ended questions. To minimise a low-response rate the questionnaire was presented online so that participants with time constraints were able to conveniently access and complete the questionnaire, with the added encouragement of accessing a CPD-accredited activity upon completion.

The questionnaire used the formal in-hand manipulation instruments known to the researcher at the time of this study. In the interim, the researcher came across two instruments that were not included in the questionnaire, namely the *unnamed test of Bonnier* [28] published in 2006, and the *T-TIHM* [29] published in 2015, which can be seen as another limitation.

Recommendations

Clinicians are encouraged to apply the in-hand manipulation instruments described in published literature. The current practice of assessing children in a seated position should be continued until further clarification on the impact which sitting cross-legged has on the performance of a child is done. Lastly, clinicians are recommended to use electronic clinical notes to enable the generation of evidence from practice based on accurate documentation. These notes can include secure storage of video clip recordings of the child's hand while performing in-hand manipulation in an age-appropriate task, and should incorporate the use of different items, not only pegboards.

Educators are recommended to provide future training in refining the observational skills of in-hand manipulation by occupational therapists during occupation-based activities are recommended specifically during self-care and play tasks. This training can either occur at the undergraduate or postgraduate levels through workshops or interactive online courses.

Further research in the development of an in-hand manipulation instrument that is contextually appropriate for South Africa and has established psychometric properties [16] is recommended as observations alone cannot be used to presume intervention planning of this component of complex fine motor skills. Recommendations for such an instrument include that its purpose is predominantly descriptive which must be clearly stated and used to guide the instrument development process [16,22,23]. Furthermore, the tasks of the instrument should incorporate varying aspects of complexity to accommodate different age groups. This can be done by increasing the number of items required of a child to hold in their hand or adding a time component. This should be done to avoid the occurrence of a floor- or ceiling effect, which is when the instrument does not display the full deficit or extent of a child's ability as the child scores the minimum or maximum of the test respectively [22]. The instrument should be made commercially available to promote its familiarity and use upon completion of the development process. Training to improve competency in administering the test is also recommended, along with the inclusion of video clips as part of the training material.

Clarifying whether clinicians prefer criterion-referenced, compared to norm-referenced instruments should be conducted by further research as a criterion scoring method was preferred by most, yet does not provide conclusive evidence for this inference to be drawn. Obtaining a broader understanding of how the other hand function components are assessed by occupational therapists in South Africa is recommended. This will provide a better perspective of the South African practice context and generate practice-based knowledge from this practice area.

Conclusion

This study set out to describe the current and preferred methods used by South African occupational therapists in paediatric practices when assessing in-hand manipulation. The limited familiarity with and sparse use of formal assessment instruments are concerning. Subjective observations of occupation-based tasks were the most used informal assessment methods. Checklists and collateral information obtained from teachers were used to a lesser degree. Practically, participants mentioned using clinical notes to document their assessment, with a few using video recordings that are supported by the literature. To include familiar items in resources that are available to clinicians, is reciprocated by most of the in-hand manipulation instruments described in the literature. Encouragingly, participants assessed a child seated at an appropriate child-sized table and changed the demands of a task in relation to the child's age, which should be incorporated in further instrument development. The implications of the preferences supported the development of a predominantly descriptive instrument, with attention to scoring the quality of in-hand manipulation movements and compensatory techniques used by the child. This instrument should include a comprehensive user manual that is administered under 15 minutes, in multiple languages.

The detailed overview provided by this study uniquely contributed to a better understanding of the clinical practices of in-hand manipulation assessment at the grassroots level. The findings of this study clearly recommended the providing of more training and guidance on how to assess in-hand manipulation. The further development of an instrument that is contextually relevant and standardised is recommended, to reflect the current and preferred assessment methods used by the occupational therapists in paediatric practice in South Africa.

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Chapter 4 **Supplementary files**

Note to the Reader:

The decision to include a supplementary file section was made in consultation with the study supervisors, based on the following reasons: Firstly, reporting on all the information gathered from the main study within one empirical article was not feasible and would not honour the guidelines of the journals to which the articles will be submitted. Secondly, to ensure that the dissertation complies with the guidelines of the Master's degree module in presenting two (2) interrelated publishable manuscripts [33], the decision to include this section was deemed appropriate. Thirdly, to present all the information gathered from the data analysis process, as planned according to the original protocol, was necessary to ensure transparency and to be forthcoming with the results obtained. It is the intention of the author to use the supplementary findings for a possible third article.

The supplementary files present the results obtained from the data analysis and will address the last study objective of this dissertation, namely, *to make associations between the assessment methods used and preferences and the practice sector that the occupational therapists were working in*.

From the questionnaire, the 292 participants that participated were grouped according to five practice sectors in which they worked. These were grouped as 'Academic' (n=15); 'Community' (n=15); 'Private' (n=153); 'Public' (n=90); and both the 'Public and Private' sector (n=19). The questions that tested reliable were compared according to these five groups. The groups were compared by means of 95% confidence intervals using the Chi-square test, as well as the Fisher's exact test when the sample size was too small. A statistically significant association was present when the p-value was less than or equal to 0.05 (≤0.05). The reliable questions determined by the test-retest reliability analysis with a percentage score of less than 20% (<20%) that presented with a statistically significant association are reported on below in Tables 4-1 and 4-2.

Table 4-1: Associations between practice sector groups and the methods used to assess in-hand manipulation (n=292)

Question number	Question	n (%)	Test-retest Reliability%	p-value	Practice Sectors n (%)				
					Academic 15 (5.1)	Community 15 (5.1)	Private 153 (52.4)	Public 90 (30.8)	Public-Private 19 (6.5)
5.5	**Age groups for which in-hand manipulation skills are assessed**								
5.5.3	5-6 years	273 (93.5)	8.4	0.00	14 (93.3)	15 (100.0)	151 (98.7)	75 (83.3)	18 (94.7)
5.5.4	7-8 years	234 (80.1)	10.2	<.00	14 (93.3)	8 (53.3)	140 (91.5)	56 (62.2)	16 (84.2)
5.6	**Assessment method(s) used**								
5.6.1	Observation of tasks or activities	287 (98.3)	1.8	0.02	14 (93.3)	13 (86.6)	152 (99.3)	89 (98.9)	19 (100.0)
5.38	**Familiarity with in-hand manipulation assessment instruments**								
5.38.4	Test of In-hand Manipulation - Revised (TIHM-R)	8 (2.7)	8.4	0.02	1 (6.7)	0 (0.0)	1 (0.6)	4 (4.4)	2 (10.5)
5.38.8	University of the Free State In-hand Manipulation Checklist (UFS IHM-C)	15 (5.1)	11.4	0.01	3 (20.0)	1 (6.7)	9 (5.9)	1 (1.1)	1 (5.3)
5.47	**Assessment position of the child**								
5.47.1	Seated at a child-sized table where the child's feet can touch the ground	232 (79.5)	13.2	<0.00	10 (66.6)	9 (60.0)	127 (83.0)	73 (81.1)	13 (68.4)
5.47.2	Seated at an adult-sized table, feet not touching the ground	6 (2.1)			0 (0.0)	2 (13.3)	1 (0.6)	3 (3.3)	0 (0.0)
5.47.3	On the floor, seated cross-legged	21 (7.2)			2 (13.3)	1 (6.7)	13 (8.5)	5 (5.6)	0 (0.0)
5.47.4	On the floor, lying on their stomachs	1 (0.3)			0 (0.0)	1 (6.7)	0 (0.0)	0 (0.0)	0 (0.0)
5.47.5	In a standing position	3 (1.0)			0 (0.0)	0 (0.0)	1 (0.6)	1 (1.1)	1 (5.3)
5.49	**Change activity demands in relation to the child's age**								
5.49.1	Yes (grouped with "yes, at times")	278 (95.2)	10.2	0.03	15 (100.0)	12 (80.0)	143 (93.5)	90 (100.0)	19 (100.0)
5.49.2	No	14 (4.8)			0 (0.0)	3 (20.0)	9 (5.9)	1 (1.1)	0 (0.0)
5.59	**Documentation method(s) used**								
5.59.3	Video recording	33 (11.3)	6.6	0.00	0 (0.0)	14 (93.3)	128 (83.7)	87 (96.7)	15 (79.0)

Assessing children of different age groups indicated the following: For the age group of 5-6 years, the Public practice sector reported a significantly lower assessment rate of 83.3% (n=75) compared to the other practice sector groups that reported an assessment rate of between 93-100%. For the 7-8 year age group, there was a statistically significant association among the Community occupational therapists who reported a lower assessment rate of 53.3% (n=8), along with the Public group that also only assessed 62.2% (n=56) compared to the other groups that all reported between 84-93%. Using observations of tasks and activities as an assessment method was reported less by the Community practice (n= 13; 86.6%) when compared to the other occupational therapists who had a higher response, ranging from 93-100%.

Familiarity with the Test of In-Hand Manipulation (TIHM), a formal in-hand manipulation instrument, was indicated by eight participants (2.7%), with a significant association noted for the participants working in the Public sector as having the highest response rate (n= 4; 4.4%). A significant rate of response for the familiarity with the UFS IHM-C was reported by nine (5.9%) of the participants from the Private practice compared to the other sector groups.

The assessment position of the child at an appropriately sized table showed a marked difference between the Community practice (n=9; 60.0%) with the lowest response rate, and the Private practice (n=127; 83.0%). This pattern was mirrored by the following question in which the Community practice respondents had a significantly higher response compared to the other sectors when indicating the use of an adult-sized table (n=2; 13.3%). Of the practice sectors, assessing the child while seated cross-legged on the floor, was reported highest among those of the Academic practice (n=2; 13.3%).

Changing the activity demands and equipment in relation to the child's age was reported significantly less by the Community practice (n=12; 80%) compared to the Private sector (n= 143; 93.5%) and the Academic, Public and Public-Private groups that all reported a 100% response. Using video recordings as a form of documentation was reported significantly lower (n=0; 0.0%) by the Academic group compared to the other groups that ranged from 83.7-100%.

Table 4-2: Associations between practice sector groups for the preferences of a suitable instrument (n=292)

Question Number	Question	n (%)	Test-retest Reliability %	p-value	Practice Sectors n (%)				
					Academic 15 (5.1)	Community 15 (5.1)	Private 153 (52.4)	Public 90 (30.8)	Public-Private 19 (6.5)
6.13	**Method of scoring**								
6.13.2	Video clips to guide scoring	51 (17.5)	16.8	0.05	3 (20.0)	1 (6.7)	36 (23.5)	9 (10)	2 (10.5)
6.19	**Administration time**								
6.19.1	0-5 min	51 (17.5)	11.9	<0.00	0 (0.0)	2 (13.3)	30 (19.6)	11 (12.2)	8 (42.1)
6.19.4	30-45 min	9 (3.1)	3.6	0.01	1 (6.7)	1 (6.7)	3 (2.0)	4 (4.4)	0 (0.0)
6.20	**Scoring time**								
6.20.1	0-15 min	272 (93.2)	5.9	0.00	14 (93.3)	12 (80.0)	145 (94.7)	82 (91.1)	19 (100.0)
6.20.2	15-30 min	20 (6.8)	6.6	0.00	1 (6.7)	3 (13.3)	10 (6.5)	8 (8.9)	0 (0.0)
6.25	**Presentation language**								
6.25.3	IsiZulu	63 (21.6)	9.6	<0.00	4 (26.7)	6 (40.0)	26 (17.0)	22 (24.4)	5 (26.3)
6.25.4	IsiXhosa	45 (15.4)	7.2	<0.00	1 (6.7)	6 (40.0)	15 (9.8)	17 (18.9)	6 (31.6)
6.25.5	Sesotho	56 (19.2)	9.6	<0.00	3 (20.0)	5 (33.3)	16 (10.5)	30 (33.3)	2 (10.5)
6.26	**User Manual inclusions**								
6.26.1	Administration instructions	282 (96.6)	5.9	0.03	15 (100.0)	15 (100.0)	148 (96.7)	85 (94.4)	19 (100.0)
6.26.2	Scoring and interpretation instructions	284 (97.3)	1.8	0.02	14 (93.3)	15 (100.0)	149 (97.4)	88 (97.8)	18 (94.7)
6.26.3	Equipment instructions	228 (78.1)	17.9	0.00	13 (86.6)	12 (80.0)	120 (78.4)	68 (75.5)	15 (78.9)
6.29	**Purpose of assessment**								
6.29.1	Describe the child's current functional status	243 (83.2)	16.8	0.00	14 (93.3)	11 (73.3)	125 (81.7)	76 (84.4)	17 (89.5)
6.29.2	Identify the child's strengths and limitations to clinically inform the treatment planning	255 (87.3)	13.2	0.00	15 (100.0)	13 (86.6)	135 (88.2)	77 (85.6)	15 (78.9)
6.29.4	Evaluate the change in functioning over time and monitor the progress made	216 (74.0)	16.8	0.00	13 (86.6)	10 (66.6)	108 (70.6)	71 (78.9)	14 (73.7)
6.29.5	Evaluate the effectiveness of intervention	188 (64.4)	26.9*	0.03	14 (93.3)	6 (40.0)	95 (62.1)	59 (65.6)	14 (73.7)

** Unreliable questions (reliability percentage score of >20%)*

Including video clips to guide the scoring methods were reported more by the Private practice (n=36; 23.5%), seconded by the Academic practice (n=3; 20.0%) indicating a significant difference compared to the other practice sectors. The shortest administration time, namely 0-5 minutes was preferred significantly more by the Public-Private sector participants (n= 8; 42.1%), in contrast to no respondents from the Academic practice (n=0; 0.0%), while the remaining practice sectors ranged between 13.3-19.6%. For the scoring time, the same trend was repeated, with unanimous (n=19; 100%) agreement among the Public-Private practice for the shortest scoring time, namely 0-15 minutes. Of all the sectors, the Community practice reported significantly lower for the 0-15 minute scoring time option (n=12; 80%).

For both isiZulu and isiXhosa, the Community practice showed significantly high support for the instrument to be presented in these languages (n=6; 40%). The language choice of Sesotho was supported equally by both the Community practice (n=5; 33.3%) and the Public practice (n=30; 33.3%). The inclusion for administration instructions in a user manual was unanimously supported by the Academic practice (n=15; 100%), the Community practice (n=15; 100%) and the Public-Private practice (n=19; 100%), in contrast to the Public practice (n=85; 94.4%) which responded significantly lower. The inclusion of instructions on scoring and interpretation was supported 100% by the Community practice (n=15), while the other practices ranged between 93.3-97.8%. Including equipment instructions in the user manual was reported on significantly more by the Academic practice (n=13; 86.6%) when considering that this was least reported on by the Public practice (n=68; 75.5%).

Both components of a descriptive purpose for a clinically suitable assessment were rated significantly higher by the Academic sector, namely, to describe the child's current function (93.3%) and to inform treatment planning (100%). In contrast, the Community sector indicated the lowest (73.3%) response rate when describing the current function of a child. The Public-Private sector again deemed the purpose to inform treatment planning, the least in comparison to the other groups (79.0%). Following a predictive purpose, namely, to monitor the change or progress made by a child was again reported significantly higher by the Academic sector participants (86.7%), while the Community sector deemed it the least important (66.7%). Evaluating the change of functioning over time, that includes the process of monitoring the progress made by a child, was reported most by Public-Private sector participants (42.1%) compared to the Private sector (24.2%) that had the lowest response rate.

Strength and limitations

The strengths and limitations of the second article apply to the results of the supplementary files, as the same study method was used.

The study used a non-probable, purposive sampling method to represent the clinical practices and latent knowledge held by South African occupational therapists experienced in working in paediatric practices. The novel contribution of obtaining an in-depth understanding of how the different practice sectors current assess in-hand manipulation and their specific preferences provided insight into the specific behavioural trends that aided in the generation of practice-based knowledge for this practice area.

Furthermore, the results of the study were strengthened by the wider sampling population that was deliberately approached and the adequate response rate which provides valuable information that can be used towards further instrument development for in-hand manipulation. Distinguishing between the five sector groups provide a unique opportunity to reflect on the inherent differences of each practice sector. The inferences which can be drawn in relation to the availability of resources (time, and equipment), the diverse population groups that receive treatment and the differences in culture and language barriers between client and therapist is valuable to the understanding of the practice area.

This study is unique in categorizing the population into five distinct groups, compared to only two (public or private) as seen in similar South African studies performed by van der Merwe, Smith and Vlok in 2011 [21] and Janse van Rensburg et al in 2017 [22].

However, a limitation is that the results cannot be generalised to other assessment practices relating to other aspects, apart from in-hand manipulation. The associations made between the different practice sectors relating to the preferences of an assessment instrument are limited to therapists in paediatric practices in South Africa.

Recommendations

The results represented in this section should be appropriately disseminated in the form of a third scientific article.

Consideration and application of the specific preferences, as highlighted by the different practice sectors is recommended for the future development of an in-hand manipulation instrument.

Chapter 5 **Conclusion, recommendations and closure**

Within the paediatric context, in-hand manipulation is considered closely related to a child's proficiency in performing scholastic, self-care and play tasks. These refined movements underpinning activities such as writing, building puzzles and buttoning are a component of fine motor skills. A child with poor hand function is often referred to an occupational therapist after displaying difficulty in one or more of the tasks that make up their daily occupations. It then follows that the child is assessed, among others, for delays in in-hand manipulation. Using an accurate assessment method is critical in guiding the occupational therapy process as it forms the foundation on which intervention is planned, improvement is measured, and the effectiveness of therapeutic interventions is determined. However, limited research was available on how clinicians assess in-hand manipulation on a clinical level, what instruments are available, and what the preferences of occupational therapists are regarding a suitable in-hand manipulation instrument.

The main aim of this dissertation was to describe how paediatric occupational therapist in South Africa assess in-hand manipulation of children. The first object of the study was to describe the paediatric in-hand manipulation assessment instruments available in published literature. This was reached in the first theoretical article that followed a non-empirical approach, namely a scoping review. By following the Arskey and O'Malley *six-stage scoping review framework,* the study provided a broad overview and structured summary of the ten available in-hand manipulation assessment instruments found in published literature. A critical evaluation of the instruments according to three key concepts found no instrument with proof of comprehensive instrument development, with good clinical utility and with established psychometric properties. The study succeeded to map the literary landscape that is valuable in informing clinical practices. Furthermore, recommendations for future research were made based on the gaps identified in the evidence.

The second and third aims of the study were to discuss the current methods used by paediatric occupational therapists to assess in-hand manipulation and what their preference were regarding a suitable in-hand manipulation instrument for children. These two aims, as well as the last aim, namely, to determine the test-retest reliability of the questionnaire was accomplished in the second scientific article. This article followed an empirical approach, namely a quantitative, cross-sectional study design. A non-probable, purposive sampling method was used to approach all the occupational therapists who worked in paediatric

practices in South Africa. The data was collected using an online questionnaire that 292 participants completed, an acceptable response rate of 7.6% for an online survey method. After that, 167 participants completed a second round of the questionnaire to determine its test-retest reliability. This strengthened the credibility of the results. The study provided a better understanding of the current practices of occupational therapists at a grassroots level, revealing a limited familiarity and use of the formal assessment instruments described in the literature. Observations of a task, specifically scholastic tasks, were the most used informal assessment method reported, with collateral information and checklists used to a lesser degree. The children most often assessed were between the ages of five to six and positioned correctly during an assessment. The participants collectively agreed to change the activity demands with the child's age, while uncertainty was observed about the presentation of instructions and administration time. The preferences supported a descriptive instrument accompanied by a user manual that is administered under 15 minutes, in multiple languages, and with attention to the quality of movements and compensatory techniques used by the child. By achieving the aim of the study, the results of the current methods used by occupational therapists and their preferences for a suitable instrument provided guidelines for the future development of a contextual, relevant in-hand manipulation instrument for paediatric practices in South Africa.

The fourth aim of the study, to make associations between the assessment methods used and preferences and the practice sectors of the occupational therapists were reported in a supplementary file. Reporting on all the information gathered from the main study within one empirical article was not feasible and would not have honoured the guidelines of the journals to which the articles are intended to be submitted. The results of the questions that tested reliable and where a statistically significant association was present, was reported to ensure transparency of the results obtained from the main study. The author intends to use the supplementary findings for a possible third article.

The unreliable questions were not included in Article 2 or the Supplementary Files are listed in *Addendum D* for reference. The questionnaire contained closed-ended questions from which the participant could select an answer(s) with a non-compulsory 'other' option provided with spaces for text, to allow the participants to add information not included by the final questionnaire. The answers to the open-ended questions were analysed and reported on in *Addendum E.*

Recommendations

From the findings of the two articles and supplementary files in this dissertation, recommendations according to the different roles of an occupational therapist are as follows:

Recommendations for clinicians

Firstly, clinicians should become familiarised with the available in-hand manipulation instruments described in the literature. The detailed overview of the different instruments, both sensitises and guides a clinician to make informed decisions about incorporating an appropriate in-hand manipulation instrument as part of their assessment process. Utilising an instrument to specifically assess in-hand manipulation is recommended as opposed to using a generalised fine motor skill assessment or unstructured observations. This dissertation does not support the presumption that the latter options can provide adequate information for intervention planning on the six specific and refined components of in-hand manipulation.

Secondly, clinicians are encouraged to continue assessing children in a seated position during an evaluation until further research clarifies the impact which sitting cross-legged has on the performance of a child. Additionally, clinicians are advised to incorporate a variety of items, not only pegboards, as the skill displayed with one type of object does not necessarily correlate with the ability to use the skill with another size or shape of object.

Thirdly, clinicians are also recommended to use electronic clinical notes that can include securely stored video clip recordings of the child's hand while performing in-hand manipulation in an age-appropriate task. The continuation of accurate documentation in this format will simplify the process of generating evidence based on the practice setting.

Recommendations for researchers

The further development and refinement of an in-hand manipulation instrument are recommended. The following aspects should be included to ensure that the instrument displays all the aspects of an instrument development process and is standardised with established psychometric properties.

Activity analysis of the items intended for an instrument should be undertaken to ensure that all the components of in-hand manipulation are included in an instrument. Aligning the items with clear observations and scoring guidelines that are consistent with the Modified Classification System of In-hand manipulation is recommended. Furthermore, it is recommended to classify the end-products of the existing instruments according to the level of complexity outlined by the Taxonomic Code of Occupational Performance. This should be done to improve understanding of why certain components were excluded by some of the current assessment instruments and how to overcome this barrier.

For an instrument to be appropriate for South Africa, it is recommended that the preferences of the occupational therapists are incorporated when considering the clinical utility aspects of the instrument. It is recommended that a variety of appropriate tasks for a wider age range of children are included in an instrument, to reflect the developmental requirements of the child that is assessed, while simultaneously avoiding the occurrence of a floor- or ceiling effect. Recommendations to realise this include changing the presentation of the task, adjusting the components to make it more complex, using different sizes or numbers of items a child must manipulate or adjusting the speed requirements of the task.

Refinement of the user manual of an instrument is recommended and should include standardised administration and scoring instructions, along with either criterion or norm-referenced guidelines for interpretation. It is recommended that the standardised user manual be published in its entirety in an accredited journal with the exact equipment guidelines so that a clinician can accurately construct the instrument. Alternatively, the user manual can be made commercially available with a prefabricated toolkit from accessible publishers at a reasonable cost. Training that improves competency in administering the test is recommended, along with the inclusion of video clips as part of the training material.

Future collaboration and coordinated research efforts are recommended to attain a gold standard paediatric assessment instrument for in-hand manipulation. The specific purpose of the instrument must be clearly stated and followed by the developer who should know what psychometric properties the instrument must comply with. For South Africa, the purpose of an instrument is preferred to be predominantly descriptive, with elements of an evaluative instrument. Further investigation in the manner of scoring should be undertaken, as the preference for either a criterion-referenced or norm-referenced instrument was still inconclusive.

It is recommended that a follow-up study be undertaken to determine the current and preferred methods used by occupational therapists in South Africa when assessing the broader category of hand function. This will be beneficial in terms of providing a better perspective in the South African context and to generate practice-based knowledge from this area of occupational therapy.

Recommendations for educators

It is recommended that occupational therapists receive training on how to use the instruments described in the literature, as well as how to observe in-hand manipulation during occupation-based activities, specifically self-care and play tasks. This training can either be provided at undergraduate or postgraduate levels. Postgraduate training can be performed with workshops, webinars or interactive online courses that illustrate how to observe and score the different movements of each task according to the age groups.

Closure

The two articles of this dissertation confirmed that the accurate assessment of in-hand manipulation is necessary to enable concise intervention and quality service to an occupational therapist's paediatric clientele. The results of this dissertation highlighted both the progress that has been made in developing an in-hand manipulation instrument while also providing a better understanding of the assessment practices of South African clinicians.

Results of the scoping review study provided an overview of the progress made in developing in-hand manipulation instruments from which clinicians can make an informed decision. It also became clear that there is still room for improvement and future research before a gold standard can be developed. The empirical study provided a descriptive insight into the current in-hand manipulation assessment methods used by South African occupational therapists and their preferences of a suitable instrument at the grassroots level. This contributed a unique perspective on what would constitute a relevant instrument for the paediatric practice context and the gaps for future research.

Although limitations were identified in this study, value has been added to the profession of occupational therapy and specifically for the occupational therapist working with children with fine motor difficulties and in-hand manipulation delays. Clinicians are sensitised towards the importance of assessing in-hand manipulation and can make an informed decision on what instruments from the literature to apply to their clinical settings, while direction and recommendations for future research have been highlighted that direct the future development of a contextually relevant in-hand manipulation instrument for South Africa.

Chapter 6 **Addendums**

A: Ethical clearance document

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UNIVERSITEIT VAN DIE VRYSTAAT
YUNIVESITHI YA FREISTATA

UFS·UV
HEALTH SCIENCES
GESONDHEIDSWETENSKAPPE

Health Sciences Research Ethics Committee

28-May-2018

Dear **Ms Elizabeth Malan**

Ethics Clearance: **Assessment of in-hand manipulation by occupational therapists in paediatric practice in South Africa.**

Principal Investigator: **Ms Elizabeth Malan**

Department: **Occupational Therapy (Bloemfontein Campus)**

APPLICATION APPROVED

Please ensure that you read the whole document

With reference to your application for ethical clearance with the Faculty of Health Sciences, I am pleased to inform you on behalf of the Health Sciences Research Ethics Committee that you have been granted ethical clearance for your project.

Your ethical clearance number, to be used in all correspondence is:**UFS-HSD2018/0358/2905**

The ethical clearance number is valid for research conducted for one year from issuance. Should you require more time to complete this research, please apply for an extension.

We request that any changes that may take place during the course of your research project be submitted to the HSREC for approval to ensure we are kept up to date with your progress and any ethical implications that may arise. This includes any serious adverse events and/or termination of the study.

A progress report should be submitted within one year of approval, and annually for long term studies. A final report should be submitted at the completion of the study.

The HSREC functions in compliance with, but not limited to, the following documents and guidelines: The SA National Health Act. No. 61 of 2003; Ethics in Health Research: Principles, Structures and Processes (2015); SA GCP(2006); Declaration of Helsinki; The Belmont Report; The US Office of Human Research Protections 45 CFR 461 (for non-exempt research with human participants conducted or supported by the US Department of Health and Human Services- (HHS), 21 CFR 50, 21 CFR 56; CIOMS; ICH-GCP-E6 Sections 1-4; The International Conference on Harmonization and Technical Requirements for Registration of Pharmaceuticals for Human Use (ICH Tripartite), Guidelines of the SA Medicines Control Council as well as Laws and Regulations with regard to the Control of Medicines, Constitution of the HSREC of the Faculty of Health Sciences.

For any questions or concerns, please feel free to contact HSREC Administration: 051-4017794/5 or email EthicsFHS@ufs.ac.za.

Thank you for submitting this proposal for ethical clearance and we wish you every success with your research.

Yours Sincerely

Dr. SM Le Grange
Chair : Health Sciences Research Ethics Committee

Health Sciences Research Ethics Committee
Office of the Dean: Health Sciences
T: +27 (0)51 401 7795/7794 | E: ethicsfhs@ufs.ac.za
IRB 00006240; REC 230408-011; IORG0005187; FWA00012784
Block D, Dean's Division, Room D104 | P.O. Box/Posbus 339 (Internal Post Box G40) | Bloemfontein 9300 | South Africa

B: E-mail distributed to participants

Title: Assessment of in-hand manipulation by occupational therapists in paediatric practice in South Africa

LAST WEEK TO PARTICIPATE!

Dear Occupational Therapist,

Thank you for your valuable time and interest in this research study that **aims to describe how paediatric occupational therapists in South Africa assess in-hand manipulation of children.**

Kindly complete the questionnaire by clicking on the following link http://surveys.ufs.ac.za/evasys/online.php?p=IHMQ1 if you:

- are registered with the Health Professions Council of South Africa (HPCSA),
- have practised in South Africa for more than 6 months,
- are currently working, or have worked in the paediatric practice, in the last 2 years, i.e. you have, or are currently, providing occupational therapy services to children between the ages of 1 year and 12 years.

The objectives of this study are to describe the current methods used to assess in-hand manipulation of children, to describe the preferences for a suitable in-hand manipulation assessment instrument for children as recommended by paediatric occupational therapists in South Africa, and to establish the test-retest reliability of the questionnaire.

This questionnaire is mobile-friendly and designed to take approximately 15-20 minutes to complete. The questionnaire closes on the **3rd of August 2018**. Upon completion of this questionnaire, you will be directed to a CPD-accredited activity in which you can earn 3 CPD points

at no additional cost. Should you agree to participate in the second round of the questionnaire, you will be provided with an opportunity to complete another CPD-accredited activity, in which you can earn 3 CPD points.

Please answer the questions honestly and to the best of your abilities. The results of the study may be published. Note that by completing this questionnaire you voluntarily agree to participate in this research study. You are free to decline or stop completing the questionnaire at any time. The only cost that you will incur will be the data cost to complete the questionnaire. Your personal information will be kept strictly confidential at all times by the researcher and will only be used for this study.

If you agree to participate in this study, please click on the following link: http://surveys.ufs.ac.za/evasys/online.php?p=IHMQ1

Please share the link to this questionnaire with friends, colleagues or other acquaintances that will be able to contribute to this study.

Ethical clearance no: UFS-HSD2018/0358/2905

If you have any questions regarding this process, please do not hesitate to contact us.

Regards,

Annelize Malan - *064 686 0997* - Researcher
Monique Strauss - *083 656 1541* - Supervisor

[Disclaimer: The image in the advertisement was used with the permission of Mielasiela, the manufacturer of the toys that can be purchased online at www.etsy.com/listing/125902529/wooden-toys-garden-play-set-educational.]

C: Questionnaire as featured on *EvaSys Survey System*

DRAFT

EvaSys	The assessment of in-hand manipulation by occupational therapists in paediatric practices in	Electric Paper

Mark as shown: ☐ ☒ ☐ ☐ ☐ Please use a ball-point pen or a thin felt tip. This form will be processed automatically.
Correction: ☐ ■ ☐ ☒ ☐ Please follow the examples shown on the left hand side to help optimize the reading results.

1. Information

Thank you for your interest and valuable time to participate in this research study.

This study aims to describe how paediatric occupational therapist in South Africa assesses in-hand manipulation of children. (Ethical clearance no UFS-HSD2018/0358/2905)

The objectives of this study are to describe the current methods used to assess in-hand manipulation of children, to describe the preferences for a suitable in-hand manipulation assessment instrument for children as recommended by paediatric occupational therapists in South Africa and to establish the test-retest reliability of the questionnaire.

Kindly complete the questionnaire if you:
- Are registered with the Health Professions Council of South Africa.
- Have practiced in South Africa for more than 6 months.
- Are currently working, or have worked in the last 2 years, in the paediatric practice, i.e. you have or are currently providing occupational therapy services to children between the ages of 1 year and 12 years.

Upon completion of this questionnaire, you will be directed to a CPD accredited activity in which you can earn 3 CEU's no additional cost. Should you agree to participate in the second round of the questionnaire, you will be provided with an opportunity to complete another CPD-accredited activity, in which you can earn 3 CEU's. This questionnaire is designed to take approximately 20-30 minutes to complete. The questionnaire will be available for 20 working days.

This questionnaire consist of 4 sections:
1. Demographic information about you as a participant and describe your paediatric client profile.
2. Information relating to the methods that you currently use to assess in-hand manipulation.
3. Information on your preferences for a suitable assessment tool in your paediatric practice in South Africa.
4. Provides information to participate in the second round that determines the test-retest reliability of the questionnaire. Followed by the website link to the CPD-accredited activity that you can complete for 3 CEU's at no additional cost.

Please answer the questions honestly and to the best of your abilities. The results of the study may be published. Note that by completing this questionnaire you voluntarily agree to participate in this research study. Even if you agree to take part initially, you are free to decline to participate or to stop completing the questionnaire at any time. The only cost that you will incur will be the data cost to complete the questionnaire. Your personal information will be kept strictly confidential at all times by the researcher and only used for the purpose of this study.

1.1 By clicking yes, you confirm that you have read and understood the above explanation about the study. You also agree to participate in this study and only complete the questionnaire once per round. You also agree that you understand that your participation in this study is voluntary.

☐ Yes ☐ No

DRAFT

2. Inclusion criteria

2.1 Are you currently registered with the Health Professions Council of South Africa?
☐ Yes ☐ No

2.2 Have you practised in South Africa for more than 6 months?
☐ Yes ☐ No

2.3 Within the last 2 years, have you worked with children between the ages of 1 to 12?
☐ Yes ☐ No

3. Section 1: Demographic Information - Occupational Therapist Profile

3.1 In what year were you born?

3.2 Please select your gender

☐ Female ☐ Male

3.3 What is your highest level of education?

☐ Diploma in occupational therapy
☐ Bachelor's degree in occupational therapy
☐ Master's degree in occupational therapy
☐ Doctorate degree in occupational therapy
☐ Master of doctorate degree in another field (please specify at "other")
☐ Other

3.4 Other....

3.5 Have you completed any courses specifically on fine motor development, assessment and or treatment for children?

☐ No ☐ Yes

3.6 If yes, please specify....

3.7 How many years have you been working within the scope of occupational therapy? This includes working as a clinician, consultant, researcher, or lecturer in a tertiary institution.

☐ 6 months
☐ 1 year
☐ 2 years
☐ 3 years
☐ 4 years
☐ 5 years
☐ 6 years
☐ 7 years
☐ 8 years
☐ 9 years
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☐ 54 years
☐ 55 years
☐ 56 years
☐ 57 years
☐ 58 years
☐ 59 years
☐ 60 years
☐ More than 60 years

3. Section 1: Demographic Information - Occupational Therapist Profile [Continue]

3.8 How many years of practice do you have in the field of paediatrics?

☐ 6 months	☐ 1 year	☐ 2 years
☐ 3 years	☐ 4 years	☐ 5 years
☐ 6 years	☐ 7 years	☐ 8 years
☐ 9 years	☐ 10 years	☐ 11 years
☐ 12 years	☐ 13 years	☐ 14 years
☐ 15 years	☐ 16 years	☐ 17 years
☐ 18 years	☐ 19 years	☐ 20 years
☐ 21 years	☐ 22 years	☐ 23 years
☐ 24 years	☐ 25 years	☐ 26 years
☐ 27 years	☐ 28 years	☐ 29 years
☐ 30 years	☐ 31 years	☐ 32 years
☐ 33 years	☐ 34 years	☐ 35 years
☐ 36 years	☐ 37 years	☐ 38 years
☐ 39 years	☐ 40 years	☐ 41 years
☐ 42 years	☐ 43 years	☐ 44 years
☐ 45 years	☐ 46 years	☐ 47 years
☐ 48 years	☐ 49 years	☐ 50 years
☐ 51 years	☐ 52 years	☐ 53 years
☐ 54 years	☐ 55 years	☐ 56 years
☐ 57 years	☐ 58 years	☐ 59 years
☐ 60 years	☐ More than 60 years	

3.9 What is your current employment status?

☐ Full-time	☐ Part-time	☐ Leave of absence (Maternity, sabbatical, study)
☐ Unemployed		

3.10 What is your current, or has been your most recent, practice sector? [Please tick all that apply]

☐ Private sector	☐ Public sector	☐ Academic sector
☐ Community Service	☐ Independent Practitioner	☐ Other... (Please specify)

3.11 Other...

3.12 In which practice setting do you currently, or have recently, work? [Please tick all that apply]

☐ Pre-school/Early Childhood Developmental Centre	☐ Primary School	☐ Secondary School
☐ Tertiary Institution	☐ Special Needs School (LSEN)	☐ Hospital
☐ Community Clinic	☐ Non-profit Organisation (NGO)	☐ Private Practice
☐ Rehabilitation Centre	☐ Other... (Please specify)	

3.13 Other...

3. Section 1: Demographic Information - Occupational Therapist Profile [Continue]

3.14 What is your professional field of practice? [Please tick all that apply]

☐ Geriatrics ☐ Paediatrics ☐ Neurological Rehabilitation
☐ Vocational Rehabilitation ☐ Hand Therapy ☐ Medico-Legal
☐ Mental Health ☐ Community ☐ Education / Teaching
☐ Other ... (Please specify)

3.15 Other...

4. Section 1: Demographic Information - Paediatric Client Profile

4.1 What are the age groups of your paediatric clients?

☐ Toddlers (1 year - 3 years) ☐ Pre-schoolers (4 years - 6 years) ☐ Primary school (7 years-12 years)
☐ Other... (please specify)

4.2 Other...

What distribution of your total paediatric client caseload has documented the improvement of fine motor skills as a treatment goal:

	None	Less than half	Half	More than half	All
4.3 Toddlers (1 - 3 years)	☐	☐	☐	☐	☐
4.4 Pre-schoolers (4 - 6 years)	☐	☐	☐	☐	☐
4.5 Primary Schoolers (7 - 12 years)	☐	☐	☐	☐	☐

4.6 Do you have resources that you can use to assess in-hand manipulation of children? Resources can refer to but are not limited to toys, games and assessment instruments.

☐ No ☐ Yes

4.7 Please elaborate on your answer....

5. Section 2: Current methods used to assess in-hand manipulation skills in children

In-hand Manipulation: It is classified as a component of fine motor skill that can be defined as the process of adjusting an object by movements of the fingers for more effective placement or use. In order for the task to be accomplished the object does not usually come in contact with a surface. *(Exner 2010:275; Exner 2006:255)*

5.1 Do you assess fine motor skills of the child?

☐ No ☐ Yes

5.2 If no, please provide more information on why you do not assess fine motor skills of the child?

5.3 If yes, please select the fine motor skill components of a child that you assess. [Please tick all that apply]

☐ Reach ☐ Grasp (e.g. pencil grip) ☐ Carry
☐ Voluntary release (e.g. precise placement) ☐ In-hand manipulation ☐ Bilateral hand use (e.g. scissor handling)
☐ Tool use (e.g. handwriting) ☐ All of the above ☐ Other... (Please specify)

5.4 Other....

5.5 Indicate for which age groups do you assess in-hand manipulation skills during your evaluation of fine motor skills? [Please tick all that apply]

☐ 1-2 years ☐ 3-4 years ☐ 5-6 years
☐ 7-8 years ☐ 9-10 years ☐ 11-12 years

5.6 Which method(s) do you use for in-hand manipulation during your evaluation of children ages 1-12 years' fine motor skills? [Please tick all that apply]

☐ Observation of tasks or activities ☐ Collateral information ☐ Checklist
☐ Screening activities ☐ Standardised Assessment Instrument(s) ☐ Other... (Please specify)

5.7 Observation of tasks or activities:

☐ Scholastic task ☐ Self-care task ☐ Play task

5.8 Scholastic task

☐ Cutting ☐ Pasting ☐ Drawing or colouring
☐ Writing or copying ☐ School tool use (ruler, eraser, glue) ☐ Reading a book
☐ Other... (Please specify)

5.9 Other...

5.10 Self-care task

☐ Finger-eating ☐ Eating with utensils ☐ Drinking from bottle
☐ Dressing upper body (e.g buttoning a shirt) ☐ Putting on socks and shoes ☐ Washing hands
☐ Brushing teeth ☐ Tying hair (for girls) ☐ Other... (please specify)

5.11 Other...

5. Section 2: Current methods used to assess in-hand manipulation skills in children [Continue]

5.12 Play task

- ☐ Sorting activity
- ☐ Threading activity
- ☐ Play-dough activity
- ☐ Pegboard activity
- ☐ Painting activity
- ☐ Spooning activity
- ☐ Handling money
- ☐ Card game
- ☐ Construction activity (e.g. Legos, puzzle-building)
- ☐ Other... (Please specify)

5.13 Other...

5.14 Collateral information

- ☐ Parent Interview/questionnaire
- ☐ Teacher interview/ questionnaire

5.15 Parent interview/questionnaire

- ☐ Self-designed
- ☐ Standardised
- ☐ Other... (Please specify)

5.16 Please specify the name of the standardised interview/questionnaire...

5.17 Other...

5.18 Teacher interview/questionnaire

- ☐ Self-designed
- ☐ Standardised
- ☐ Other... (Please specify)

5.19 Please specify the name of the standardised interview/questionnaire...

5.20 Other...

5.21 Checklist

- ☐ Fine motor skills checklist
- ☐ In-hand manipulation skills checklist

5.22 Fine motor skills checklist

- ☐ Self-designed
- ☐ Standardised
- ☐ Other... (Please specify)

5.23 Please specify the name of the standardised assessment...

5.24 Other...

5.25 Please describe the activities/task that you use:

5.26 In-hand manipulation skills checklist

- ☐ Self-designed
- ☐ Standardised
- ☐ Other... (Please specify)

5. Section 2: Current methods used to assess in-hand manipulation skills in children [Continue]

5.27 Please specify the name of the standardised assessment...

5.28 Other...

5.29 Please describe the activities/task that you use:

5.30 Screening activities

☐ Fine motor skills ☐ In-hand manipulation skills

5.31 Fine motor skills: Please describe the activities/task that you use

5.32 In-hand manipulation skills: Please describe the activities/task that you use

5.33 Name the Standardised Assessment Instrument(s):

5.34 Please describe the activities/task that you use

5.35 Other... (Please specify)

5. Section 2: Current methods used to assess in-hand manipulation skills in children [Continue]

5.36 Indicate which components of in-hand manipulation skills of a child you assess: [Tick all that apply]

- ☐ **Finger-to-palm translation:** An object is moved from the fingertips and pad of the thumb into the palm of the hand in order to stabilise and store an object in the palm of the hand
- ☐ **Palm- to-finger translation:** An object is moved from its stabilised position in the palm to the tips of the fingers and is commonly used to retrieve an object from storage within the palm
- ☐ **Simple shift:** An object is moved in a linear movement by simultaneous flexion or extension of the thumb and fingers as a single unit
- ☐ **Simple rotation:** An object is rotated through one-fourth or one-half around its axis while the thumb moves independently of the fingers, and all the involved fingers act as a single unit
- ☐ **Complex shift:** An object is moved in a linear movement by individual finger movements, as result of the digits being repositioned on the object
- ☐ **Complex rotation:** An object is rotated about one or more of its axes, by 180-360 degrees, which requires independent and isolated finger movements
- ☐ **With stabilisation:** Another object is held on the ulnar side of the hand, usually by the 4th and 5th digit, while another object is being manipulated for better placement

5.37 Are you **familiar** with any of the following in-hand manipulation assessment tools?

1) Screening Activities for Hand Skills (Exner 2010:296 in Case-Smith and O'Brien Occupational Therapy for Children Sixth Edition)
2) In-hand Manipulation Test (IMT-Q) (Exner 1990; 1993; Miles-Breslin and Exner 1999) \
3) Test of In-hand Manipulation (TIHM) (Case-Smith 1995; 1996; 2000)
4) Test of In-hand Manipulation - Revised (TIHM-R) (Pont, Wallen, Bundy and Case-Smith 2008)
5) Observation Protocol on In-Hand Manipulation and Functional Skill Development (Jewell and Humphry 1993; Humphry, Jewell and Rosenberger 1995)
6) Unnamed Test by Pehoski et al. (Pehoski, Henderson and Tickle-Degnen 1997a; 1997b)
7) Children's Hand Skills Assessment Framework (Chien, Brown and McDonald 2009; 2010; 2011a; 2011b; 2012; 2014)
8) University of the Free State In-hand Manipulation Checklist (Visser et al. 2014; 2016)
9) Test of In-hand Manipulation Skills (TIMS) (Raja, Katyal and Gupta 2016)
10) Functional Dexterity Test for children (FDT) (Gogola et al. 2013; Duff et al. 2015)

☐ Yes ☐ No

5.38 If yes, please select the in-hand manipulation assessment tool(s) that you are familiar with:

- ☐ Screening Activities for Hand Skills
- ☐ In-hand Manipulation Test (IMT-Q)
- ☐ Test of In-hand Manipulation (TIHM)
- ☐ Test of In-hand Manipulation - Revised (TIHM-R)
- ☐ Observation Protocol on In-Hand Manipulation and Functional Skill Development
- ☐ Unnamed Test by Pehoski et al.
- ☐ Children's Hand Skills Assessment Framework
- ☐ University of the Free State In-hand Manipulation Checklist
- ☐ Test of In-hand Manipulation Skills (TIMS)
- ☐ Functional Dexterity Test for children (FDT)
- ☐ Other... (Please specify)

5.39 Other...

5. Section 2: Current methods used to assess in-hand manipulation skills in children [Continue]

5.40 Please indicate which of the in-hand manipulation assessment tool(s) do you use:

- ☐ Screening Activities for Hand Skills
- ☐ In-hand Manipulation Test (IMT-Q)
- ☐ Test of In-hand Manipulation (TIHM)
- ☐ Test of In-hand Manipulation - Revised (TIHM-R)
- ☐ Observation Protocol on In-Hand Manipulation and Functional Skill Development
- ☐ Unnamed Test by Pehoski et al.
- ☐ Children's Hand Skills Assessment Framework
- ☐ University of the Free State In-hand Manipulation Checklist
- ☐ Test of In-hand Manipulation Skills (TIMS)
- ☐ Functional Dexterity Test for children (FDT)
- ☐ None of the above
- ☐ Other... (Please specify)

5.41 Other...

Approximately how long does it usually take you to assess a child's in-hand manipulation skills?

5.42 Administration time

- ☐ 0-5 min
- ☐ 5-15 min
- ☐ 15-30 min
- ☐ 30-45 min
- ☐ 45-60min

5.43 Scoring time

- ☐ 0-15 min
- ☐ 15-30 min

5.44 Do you reassess in-hand manipulation skills of the child?

- ☐ Yes
- ☐ No

5.45 How often do you reassess in-hand manipulation skills of the child?

- ☐ Daily
- ☐ Weekly
- ☐ Bi-weekly
- ☐ Monthly
- ☐ Every 3 months
- ☐ Every 6 months
- ☐ Yearly
- ☐ Other... (Please specify)

5.46 Other...

5.47 Select the position of the child while you assess in-hand manipulation:

- ☐ Seated at a child-sized table where the child's feet can touch the ground
- ☐ Seated at an adult-sized table, feet not touching the ground
- ☐ On the floor, seated cross-legged
- ☐ On the floor, lying on their stomach
- ☐ In a standing position
- ☐ Other... (Please specify)

5.48 Other...

5.49 When selecting the material/equipment to assess in-hand manipulation of a child, do you change the demands of the task in relation to the child's age? (E.g. The picture asked to be coloured in by a 3-year-old and 8-year-old will be different)

- ☐ Yes
- ☐ No
- ☐ At times, depending on... (please specify)
- ☐ Other... (please specify)

5. Section 2: Current methods used to assess in-hand manipulation skills in children [Continue]

5.50 At times, depending on ... (please specify)

5.51 Other...

5.52 When selecting the material/equipment to assess in-hand manipulation of a child, do you change the size of the object in relation to the child's hand? (E.g. The size of a bead to be threaded by a 3-year-old and 8-year-old)

☐ Yes ☐ No ☐ At times, depending on... (please specify)

☐ Other... (please specify)

5.53 At times, depending on ... (please specify)

5.54 Other...

5.55 How do you assess in-hand manipulation skills of a child?

☐ Unilateral - Dominant hand only ☐ Unilateral - Dominant and non-dominant hand, apart ☐ Bilateral - Dominant and non-dominant hands, at the same time

☐ Unilateral and Bilateral – First apart to the dominant and non-dominant hand, and then both hands at the same time ☐ Other... (Please specify)

5.56 Other... (Please specify)

5. Section 2: Current methods used to assess in-hand manipulation skills in children [Continue]

5.57 How do you present the instructions during an in-hand manipulation assessment? [Please tick all that apply]

- ☐ No instructions provided, only observations made during participation in tasks
- ☐ Specific verbal instructions, describing the goal of the task
- ☐ Specific visual cue provided by to demonstrate the movement required
- ☐ A practise opportunity is provided to eliminate unfamiliarity of the task
- ☐ After presenting the task, a verbal instructions to only use the specific hand that is being assessed
- ☐ While the child performs the task, a verbal reminder to only use the hand that is being assessed
- ☐ Actively discourage the use of the hand not being assessed by asking the child to hold onto a fixed object
- ☐ Other... (Please specify)

5.58 Other... (Please specify)

5.59 What documentation method(s) do you use when you assess in-hand manipulation? [Please tick all that apply]

- ☐ Clinical notes
- ☐ Self-generated form or checklist
- ☐ Video recording
- ☐ Other... (Please specify)

5.60 Other... (Please specify)

5.61 In your opinion, rate the importance of in-hand manipulation skills in the functioning of your paediatric clients:

Not ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ Very important

5.62 Why do you assess in-hand manipulation of a child? [Please tick all that apply]

- ☐ To assess the child's current function
- ☐ To guide treatment planning
- ☐ To predict the child's future ability
- ☐ To evaluate progress
- ☐ To evaluate intervention effectiveness
- ☐ All above

6. Section 3: Preferences for a suitable in-hand manipulation assessment instrument in children

The aim of this section is to collect information about your preferences what a suitable in-hand manipulation assessment instrument for children should contain for frequent and easy use in your clinical setting.

Which assessment aspects would you prefer to report on when using an in-hand manipulation assessment instrument? [Please tick all that apply]

		Included	Excluded	Optional Observation(s)
6.1	**Quality of movement:** The fluidity and maturity of the in-hand manipulation method used to complete a task	☐	☐	☐
6.2	**Speed of movement:** Time taken to complete a task using in-hand manipulation skills	☐	☐	☐
6.3	**Frequency with which in-hand manipulation skill is used:** When the task is repetitive in nature, the number of times that the child successfully used in-hand manipulation skill	☐	☐	☐
6.4	**Compensatory techniques used:** Such as using the body or table to stabilise the object, using the other hand to move the object or fixating the arm	☐	☐	☐
6.5	**Number of items dropped:** When the task is repetitive in nature, the amount of times an item is dropped	☐	☐	☐

6.6 Which in-hand manipulation elements would you prefer to assess? [Please tick all that apply]

☐ Palm-to-finger translation ☐ Finger-to-palm translation ☐ Simple shift
☐ Simple rotation ☐ Complex shift ☐ In-hand manipulation with stabilisation
☐ All of the above

6.7 How would you prefer to administer the tasks to the child?

☐ Unilateral - Dominant hand only ☐ Unilateral - Dominant and non-dominant hand, apart ☐ Bilateral - Dominant and non-dominant hands, at the same time
☐ Unilateral and Bilateral – First apart to the dominant and non-dominant hand, and then both hands at the same time ☐ Other ... (Please specify)

6. Section 3: Preferences for a suitable in-hand manipulation assessment instrument in children [Continue]

6.8 Other... (Please specify)

6.9 How would you prefer to present the instructions of the tasks to the child? [Please tick all that apply]

- ☐ No instructions provided, only observations made during participation in tasks
- ☐ Specific verbal instructions, describing the goal of the task
- ☐ Specific visual cue provided by to demonstrate the movement required
- ☐ A practise opportunity is provided to eliminate unfamiliarity of the task
- ☐ After presenting the task, a verbal instructions to only use the specific hand that is being assessed
- ☐ While the child performs the task, a verbal reminder to only use the hand that is being assessed
- ☐ Actively discourage the use of the hand not being assessed by asking the child to hold onto a fixed object
- ☐ Other... (Please specify)

6.10 Other... (Please specify)

What administration method do you prefer? [Please tick all that apply]

	Checklist/Screening	Standardised Assessment	Naturalistic/Observations
6.11 **Functional:** Activities that are expected of their age relating to Activities of Daily Living, School, Play	☐	☐	☐
6.12 **Mechanistic:** Specific tasks that are timed and scored according to the quality and quantity	☐	☐	☐

6.13 What method of scoring would you prefer? [Please tick all that apply]

- ☐ Score according to criteria per item
- ☐ Video clips to guide scoring
- ☐ Plot on a developmental trend chart
- ☐ Other... (Please specify)

6.14 Other... (Please specify)

6. Section 3: Preferences for a suitable in-hand manipulation assessment instrument in children [Continue]

6.15 What method of interpretation of the results would you prefer? [Please select the best option]

- ☐ Criterion-referenced scoring (performance is examined against pre-defined criteria and produces raw scores that are intended to have a direct, interpretable meaning)
- ☐ Normative-referenced scoring (performance is examined against the scores of a peer group whose performance has been described using a normative sample)
- ☐ Developmental trend chart
- ☐ Interval level of measurement so that total score can be compared to a functional level score
- ☐ Electronic generated results
- ☐ Other ... (Please specify)

6.16 Other... (Please specify)

6.17 In what format would you prefer an in-hand manipulation assessment instrument for children to be made available to therapists?

- ☐ Prefabricated, available to order online at a cost
- ☐ Public domain with specifications of equipment/ materials required, available to make it at own cost
- ☐ Both
- ☐ Other ... (Please specify)

6.18 Other... (Please specify)

How long would you prefer to administer and score the results of an in-hand manipulation assessment?

6.19 Administration time

- ☐ 0-5 min
- ☐ 5-15 min
- ☐ 15-30 min
- ☐ 30-45 min
- ☐ 45-60min

6.20 Scoring time

- ☐ 0-15 min
- ☐ 15-30 min

6.21 Which form of training would you prefer?

- ☐ Open electronic access within the public domain
- ☐ Online course with video tutorials and scoring/ interpretation scoring opportunities
- ☐ Personal training
- ☐ Self-learning through means of manual
- ☐ Other... (Please specify)

6.22 Other... (Please specify)

Indicate your preference of the age range that an in-hand manipulation assessment instrument should be suitable for?

6. Section 3: Preferences for a suitable in-hand manipulation assessment instrument in children [Continue]

6.23 Youngest age

☐ 1year	☐ 1 year 6 months	☐ 2 years
☐ 2 years 6 months	☐ 3 years	☐ 3 years 6 months
☐ 4 years	☐ 4 years 6 months	☐ 5 years
☐ 5 years 6 months	☐ 6 years	☐ 6 years 6 months
☐ 7 years	☐ 7 years 6 months	☐ 8 years
☐ 8 years 6 months	☐ 9 years	☐ 9 years 6 months
☐ 10 years	☐ 10 years 6 months	☐ 11 years
☐ 11 years 6 months	☐ 12 years	

6.24 Oldest age

☐ 1year	☐ 1 year 6 months	☐ 2 years
☐ 2 years 6 months	☐ 3 years	☐ 3 years 6 months
☐ 4 years	☐ 4 years 6 months	☐ 5 years
☐ 5 years 6 months	☐ 6 years	☐ 6 years 6 months
☐ 7 years	☐ 7 years 6 months	☐ 8 years
☐ 8 years 6 months	☐ 9 years	☐ 9 years 6 months
☐ 10 years	☐ 10 years 6 months	☐ 11 years
☐ 11 years 6 months	☐ 12 years	

6.25 Indicate what language(s) you would prefer the in-hand manipulation assessment tool to be presented in? [Please tick all that apply, even if it implies using a translator]

☐ English	☐ Afrikaans	☐ Zulu
☐ Xhosa	☐ Sesotho	☐ Other... (Please specify)

6.26 Other... (Please specify)

6.27 According to your preference, should the in-hand manipulation assessment instrument include a user manual for [Please tick all that apply]

☐ Administration instructions	☐ Scoring and interpretation instructions	☐ Equipment instructions
☐ None of the above	☐ Other ... (Please specify)	

6.28 Other... (Please specify)

6.29 What purpose would you prefer an in-hand manipulation assessment instrument to serve: [Please tick all that apply]

☐ Describing the child's current functional status	☐ Identifying the child's strengths and limitations in order to clinically inform the treatment planning	☐ Predicting the child's future ability
☐ Evaluating the change in functioning over time and monitor the progress made by the child	☐ Evaluating the effectiveness of the intervention	☐ Other ... (Please specify)

6. Section 3: Preferences for a suitable in-hand manipulation assessment instrument in children [Continue]

6.30 Other... (Please specify)

6.31 Which of the following perspectives would you prefer to be included in an in-hand manipulation assessment instrument? [Please tick all that apply]

- ☐ Child's perspective of own functionality
- ☐ Child's perspective of own in-hand manipulation abilities
- ☐ Child's perspective of the desired therapy outcome
- ☐ Parent's perspective of child's functionality
- ☐ Parent's perspective of child's in-hand manipulation abilities
- ☐ Parent's perspective of the desired therapy outcome
- ☐ None of the above
- ☐ Other... (Please specify)

6.32 Other... (Please specify)

7. More about the second round of this research study:

Your contribution towards this research study thus far, is greatly valued, thank you!

To ensure that the data collected by the questionnaire is theoretically sound and accurately represent the occupational therapists of South Africa, test-retest reliability will be measured. Therefore, after 10 working days after the first round is closed, a second round will be performed. You as a participant can fill in the exact same questionnaire for a second time as accurately and thoroughly as possible. Afterwards, you will be directed to a second CPD-accredited activity where you can earn another 3 CEU's at no additional cost. **By agreeing to participate in the second round, you will have the opportunity to participate in two CPD-accredited activities and earn 6 CEU's in total.**

In order to match your first questionnaire dataset to your second dataset, please fill in your unique "identifier code" as directed. For your convenience, use the first letter of you name, followed by the 7th to 10th digits of your ID (YYMMDD [SSSS] CAZ), and lastly the first letter of your surname (e.g. A1265M).

7.1 **Identifier Code:** *(First letter of your name – 7th to 10th digit of your ID number– First letter of your surname)*

7.2 **Email address:** Please provide your e-mail address:

You will receive an e-mail 10 working days have passed after the first round is closed.

8. CPD accredited activity

You have now completed the questionnaire and can continue on to complete the CPD-accredited activity at no additional cost. After pressing the submit button you will be directed to a screen with the opportunity to participate in another survey. Use the password **IHM-CPD1** to access the CPD activity.

Please note that in order to qualify for 3 CEU's you need to obtain a 70% pass rate on the 15 multiple-choice questions that are based on an open-sourced, peer-reviewed journal article namely: *In-hand manipulation (IHM) in children 6 and 7 years of age: A follow-up study by Visser, M., Nel, M., Du Plessis, C., Jacobs, S., Muller, M., Smith, B., and T. Van Heerden. Published in the South African Journal of Occupational Therapy 46 (2) pp. 52-58.*

Thank you for participating in this research study, your time and contribution is highly valued.

References list of In-hand Manipulation Assessment Instrument referred to in Section 2, Question 7:

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D: Unreliable questions from questionnaire

The questions and their corresponding reliability score (%) are listed in the table below according to the question number corresponding to the questionnaire for quick reference. The main questions are in bold followed by the possible answers from which the participants could select. The test-retest reliability was determined after completing the same questionnaire for a second time following ten days from the closing of the first questionnaire round. The data analysis was performed on both sets and a question was deemed unreliable if the answers differed with more than 20%. This question was then regarded as unreliable and excluded from further analysis.

Table 6-1: Unreliable questions excluded from further data analysis

Question number	Question	Test-retest reliability %
4.1	**What distribution of your total paediatric client caseload has documented the improvement of fine motor skills as a treatment goal?**	
4.2	Toddlers (1-3 years)	49.1
4.3	Pre-schoolers (4-6 years)	41.9
4.4	Primary schoolers (7-12 years)	46.1
5.3	**Please select the fine motor skill components of a child that you assess:**	
Reach		30.5
Grasp (e.g. pencil grip)		32.9
Carry		21.6
Voluntary release (e.g. Precise placement)		31.7
In-hand manipulation		37.1
Bilateral hand use (e.g. scissor handling)		28.1
Tool use (e.g. handwriting)		31.1
All the above		28.7
5.6	**Which method(s) do you use for in-hand manipulation during your evaluation of children ages 1-12 year's fine motor skills?**	
5.6.4	Screening activities	21.6
5.30	**Indicate which screening activities:**	
Fine motor skills		28.1
In-hand manipulation skills		35.3
5.36	**Indicate which components of in-hand manipulation skills of a child you assess:**	
Finger-to-palm translation		22.2
Palm-to-finger translation		17.4
Simple shift		25.7
Simple rotation		36.5
Complex shift		28.1
Complex rotation		25.1
With stabilisation		27.5
5.45	**How often do you reassess in-hand manipulation skills of the child?**	**43.7**

5.52	**When selecting the material/equipment to assess in-hand manipulation of a child, do you change the size of the object in relation to the child's hand? (E.g. The size of a bead to be threaded by a 3-year-old and 8-year-old)**	**21.6**
5.55	**How do you assess the in-hand manipulation skills of a child? Unilateral - Dominant hand only; Unilateral - Dominant and non-dominant hand, apart; Bilateral - Dominant and non-dominant hands, at the same time; Unilateral and Bilateral - First apart to the dominant and non-dominant hand, and then both hands at the same time.**	**31.1**
5.62	**In your opinion, rate the importance of in-hand manipulation skills in the functioning of your paediatric clients on a scale of 1 to 10**	**53.3**
5.62	**Why do you assess in-hand manipulation of a child?**	
To assess the child's current function		32.3
To guide treatment planning		29.9
To predict the child's future ability		15.6
To evaluate progress		31.7
To evaluate the effectiveness of an intervention		27.5
6.6	**Which in-hand manipulation elements would you prefer to assess?**	
Palm-to-finger translation		28.1
Simple shift		17.9
Simple rotation		23.9
Complex shift		10.2
In-hand manipulation with stabilisation		26.9
All the above		23.9
6.9	**How would you prefer to present the instructions of the tasks to the child?**	
No instructions provided, only observations made during participation in tasks		23.4
Specific verbal instructions, describing the goal of the task		29.9
Specific visual cue provided by to demonstrate the movement required		32.3
A practise opportunity is provided to eliminate unfamiliarity of the task		30.5
After presenting the task, a verbal instruction to only use the specific hand that is being assessed		34.1
While the child performs the task, a verbal reminder to only use the hand that is being assessed		31.7
Actively discourage the use of the hand not being assessed by asking the child to hold onto a fixed object		10.8
6.10	**What administration method do you prefer?**	
6.11	Functional: Activities that are expected of their age relating to Activities of Daily Living, School, Play	39.5
6.12	Mechanistic: Specific tasks that are timed and scored according to the quality and quantity	24.6
6.15	**What method of interpretation of the results would you prefer?**	**42.5**
Criterion-referenced scoring		
Normative-reference scoring		
Developmental trend chart		
Interval level of measurement		
Electronic generated results		

6.17	**In what format would you prefer an in-hand manipulation assessment instrument for children to be made available to therapists?**	**31.7**
Prefabricated, available to order online at a cost		
Public domain with specifications of equipment/materials required, available to make at own cost		
Both		
6.21	**Which form of training would you prefer?**	**38.3**
Open electronic access within the public domain		
Online course with video tutorials and scoring/interpretation scoring opportunities		
Personal training		
Self-learning through means of manual		
Indicate the preference of the age range that an in-hand manipulation assessment instrument should be suitable for:		
6.23	**Youngest: ranging from 1 year to 11years 6months**	**52.7**
6.24	**Oldest: ranging from 1 year to 11years 6months**	**48.5**
6.31	**Which of the following perspectives would you prefer to be included in an in-hand manipulation instrument?**	
Child's perspective of own functionality		26.9
Child's perspective of own in-hand manipulation abilities		30.5
Child's perspective of the desired therapy outcome		26.3
Parent's perspective of child's functionality		25.1
Parent's perspective of child's in-hand manipulation abilities		33.5
Parent's perspective of the desired therapy outcome		26.3
None of the above		9.6

E: Data analysis of open-ended questions

The results of the optional open-ended questions have been analysed and grouped, and were applicable sub-headings were used. In the table below the data is presented according to the question number(s) corresponding to the questionnaire for quick reference, the question rephrased, followed by the number of total participants that answered the specific question, followed by the number of times a specific answer was provided. It is important to remember that often a participant's answer consisted of several variables that were extracted and listed. Some questions were combined where the overlap of the questions was evident, for example when the participants were asked to 'specify the specific name of an assessment instrument' and 'list other instruments used'.

Table 6-2: Data analysis of open-ended questions of the questionnaire (n=292)

Question Number	***Question***	***n (%)***
3.4	**Elaborate on the highest level of education**	**10 (3.4)**
Master's in Early Childhood Intervention		5 (1.7)
Honours degree in Psychology		2 (0.7)
Honours degree in Neurology and Vocational Rehabilitation Diploma		1 (0.3)
Master's in Business		1 (0.3)
Master in Hand Rehabilitation		1 (0.3)
3.5	**Specify the courses specific to fine motor development, assessment or treatment of children that you have attended**	**69 (23.6)**
Specific course *(A specific name was given)*	Bunty McDougall Course on Fine Motor Skills	9 (3.1)
	Busy Hands Workshop	2 (0.7)
	The Happy Hand writer	2 (0.7)
	Benbow Neurokinesthetic hand function course	1 (0.3)
	Writing without tears	1 (0.3)
	Treatment of the Paediatric Hand (splinting courses)	1 (0.3)
	Brain Gym	1 (0.3)
Assessment instrument course *(Training in using a specific instrument was named)*	Bayley Scales of Infant Development	2 (0.7)
	Movement Assessment Battery for Children (MABC)	2 (0.7)
	Bruininks-Oseretsky Test of Motor Proficiency, Second Edition (BOT-2)	1 (0.3)
	START Checklists (Sunshine Centre, South Africa)	1 (0.3)
	Griffiths Mental Development Scales (GMDS)	1 (0.3)
	Developmental Test of Visual Perception (DTVP-2)	1 (0.3)
	Miller Assessment for Pre-schoolers (MAP)	1 (0.3)
Course for specific client group	Left-handedness workshop	2 (0.7)
	Child with cerebral-palsy (Bobath) course	2 (0.7)
	Dyspraxia workshop	1 (0.3)
	Child with autism course	1 (0.3)
	Dysgraphia course	1 (0.3)
Course as part of degree	South African Sensory Integration Course (SASIC)	11 (3.8)
	Neurodevelopmental Therapy (NDT)	8 (2.7)
	Master's degree in Neuroscience	1 (0.3)

(Refer to degree that provided additional insights)	Master's degree in Research with paediatric focus	1 (0.3)
	Diploma in Hand Therapy	1 (0.3)
	Master's degree in Early Childhood Intervention	1 (0.3)
	Doctoral degree in Research with paediatric focus	1 (0.3)
4.7	**Elaborate on the resources that you can use to assess in-hand manipulation skills of children**	**247 (84.6)**
Specific items *(Refers to the resources that were explicitly listed)*	Pegboards	61 (20.9)
	Beads	39 (13.4)
	Coins/money	37 (12.7)
	Clay (include play dough, kinaesthetic sand, and Thera putty)	37 (12.7)
	Pegs	35 (12.0)
	Pencils	26 (8.9)
	Blocks	24 (8.2)
	Marbles	17 (5.8)
	Puzzles	16 (5.5)
	Sticks	15 (5.1)
	Tweezers	14 (4.8)
	Buttons	13 (4.5)
	Shape boards	12 (4.1)
	Crayons	11 (3.8)
	Paper	9 (3.1)
	Balls	8 (2.7)
	Scissors	8 (2.7)
	Nuts & Bolts	7 (2.4)
	Pens	7 (2.4)
	Connect 4 / 4-in-a-row	5 (1.7)
	Elastics	5 (1.7)
	Beans	4 (1.4)
	Lids & Bottles	4 (1.4)
	Books	3 (1.0)
	Pins	3 (1.0)
	Tricky Fingers	3 (1.0)
	Dice	2 (0.7)
	Droppers / Pipettes	2 (0.7)
	Spinning tops	2 (0.7)
	Activities with cars	1 (0.3)
	Cards	1 (0.3)
	Computers	1 (0.3)
	Counters	1 (0.3)
	Fine motor Olympics	1 (0.3)
	Hair clips	1 (0.3)
	Jumping Frog	1 (0.3)
	Linking chains	1 (0.3)
	Pipe cleaners	1 (0.3)
	Rattles	1 (0.3)
	Scoops	1 (0.3)
	Sensory - Foam, rice, lentils, sand.	1 (0.3)

	Spray bottle	1 (0.3)
	Stickies	1 (0.3)
	Teacup game	1 (0.3)
	Texture board	1 (0.3)
	Thera-band	1 (0.3)
General items *(Items that were referred to in broad terms)*	Toys	69 (23.6)
	Games	42 (14.4)
	Familiar / Activity of daily living objects	16 (5.5)
	Art & Craft	11 (3.8)
	Dressing Items	6 (2.1)
	Small / Tiny toys	6 (2.1)
	Eating utensils	4 (1.4)
Accessible activities *(Resources are available to perform certain actions)*	Threading	15 (5.1)
	Posting	14 (4.8)
	Writing	13 (4.5)
	Lacing / shoelaces	11 (3.8)
	Cutting	11 (3.8)
	Colouring	8 (2.7)
	Painting	4 (1.4)
	Drawing	3 (1.0)
	Hammering	2 (0.7)
	Pasting	2 (0.7)
	Action – Reaction games	1 (0.3)
	Brushing hair	1 (0.3)
Assessment instruments *(Evaluation tools available)*	Miller Assessment for Pre-schoolers (MAP)	7 (2.4)
	Bruininks-Oseretsky Test of Motor Proficiency, Second Edition (BOT-2)	7 (2.4)
	Mary Benbow - Observations of Hand skill of the 'K & 1' child checklist	5 (1.7)
	Movement ABC	5 (1.7)
	Miller Function & Participation Scales (M-FUN)	4 (1.4)
	9 Hole Peg Test	3 (1.0)
	Bunty McDougall – The Wall	3 (1.0)
	WITS developmental checklist	3 (1.0)
	BEERY™ VMI: Beery-Buktenica Developmental Test of Visual-Motor Integration	3 (1.0)
	Sensory Integration and Praxis Test (SIPT)	2 (0.7)
	Enhance your child's development - Sonja Witthaus	2 (0.7)
	Test of Motor Impairment – Denis Herbert Stott	2 (0.7)
	Bayley Scales of Infant Development	2 (0.7)
	Developmental Test of Visual Perception (DTVP-2)	1 (0.3)
	Dynamometer	1 (0.3)
	Modular Arrangement of Predetermined Time Standards (MODAPTS)	1 (0.3)
	Purdue pegboard test	1 (0.3)
	Shore handwriting test	1 (0.3)
	Sollerman Grip Function	1 (0.3)
	TIME by Exner	1 (0.3)
	Adapted Wall Model of Occupational Performance (WOP)	1 (0.3)
	Do not have a formal assessment instrument	54 (18.5)

Other remarks *(Additional remarks)*	Observations	26 (8.9)
	Self-designed checklist	11 (3.8)
5.9	**"Other" scholastic tasks used to assess in-hand manipulation**	**7 (2.4)**
Folding a paper		1 (0.3)
Getting dress and undressed		1 (0.3)
Opening a bag		1 (0.3)
Placing pegs in a pegboard		1 (0.3)
Playdough		1 (0.3)
Shoelace		1 (0.3)
Threading		1 (0.3)
Turning a page		2 (0.7)
5.11	**"Other" self-care tasks used to assess in-hand manipulation**	**12 (4.1)**
Building houses with sand		1 (0.3)
Buttons		1 (0.3)
Cleaning after oneself		1 (0.3)
Creaming hands		1 (0.3)
Managing lunch boxes, drink bottles and school bag		1 (0.3)
Opening varied containers		1 (0.3)
Toileting		1 (0.3)
Tying shoelaces		7 (2.4)
Undressing pants		1 (0.3)
Washing mouth		1 (0.3)
Zippers on coats		1 (0.3)
5.13	**"Other" play tasks used to assess in-hand manipulation**	**14 (4.8)**
Ball game		1 (0.3)
Containers with lids		2 (0.7)
Different writing utensils		1 (0.3)
Dolls		2 (0.7)
Lacing games		1 (0.3)
Magnets		1 (0.3)
Marble activity		1 (0.3)
Posting activity		2 (0.7)
Pretend-play		2 (0.7)
Random fidgets		1 (0.3)
Rattles		1 (0.3)
Sensory play		1 (0.3)
Shape sorter		2 (0.7)
Stickies		1 (0.3)
Tactile discrimination		2 (0.7)
Tweezers		1 (0.3)
5.16/5.17	**"Other" collateral information gathered from parents**	**9 (3.1)**
DAY-C		1 (0.3)
Informal discussion		3 (1.0)
Information questions based on observations		1 (0.3)
Interview		1 (0.3)
Previous courses		1 (0.3)

Sensory profile	2 (0.7)
Van der Bilt Parent Questionnaire	1 (0.3)
5.19/5.20 "Other" collateral information gathered from teachers	**7 (2.4)**
School companion	1 (0.3)
Teacher Sensory Profile	1 (0.3)
Van der Bilt Teacher Questionnaire	2 (0.7)
School companion	1 (0.3)
Teacher Sensory Profile	1 (0.3)
5.23/5.24 "Other" standardised fine motor checklist used	**16 (5.8)**
Adapted Wall Model of Occupational Performance (WOP)	4
BEERY™ VMI: Beery-Buktenica Developmental Test of Visual-Motor Integration	3 (1.0)
Bruininks-Oseretsky Test of Motor Proficiency, Second Edition (BOT-2)	1 (0.3)
Bunty McDougall – The Wall	1 (0.3)
Developmental checklist compiled by Louise Kitchin (Nov 2002);	1 (0.3)
Developmental Test of Visual Perception (DTVP-2)	1 (0.3)
Fine motor screening in the Diana Henry Fine Motor Olympics programme	1 (0.3)
Griffiths Mental Development Scales (GMDS)	1 (0.3)
Lists from the Fantastic Fingers program	1 (0.3)
Miller Assessment for Pre-schoolers (MAP)	1 (0.3)
Miller Function & Participation Scales (M-FUN)	1 (0.3)
Movement ABC	2 (0.7)
Normal developmental milestones checklist in the "Enhancing your child's development" book by Onja Witthaus	1 (0.3)
Own checklist compiled from Internet-based checklists that make most sense	1 (0.3)
Purdue pegboard	1 (0.3)
Sensory Integration and Praxis Test (SIPT)	1 (0.3)
START Checklists	1 (0.3)
5.27/5.28 "Other" in-hand manipulation checklists	**7 (2.4)**
Bunty McDougall – The Wall	1 (0.3)
Fine Motor Olympics	1 (0.3)
Mary Benbow - Observations of Hand skill of the 'K & 1' child	3 (1.0)
TIME test for In-hand manipulation (Exner)	1 (0.3)
Purdue pegboard	1 (0.3)
5.33 "Other" standardised assessments used in screening activities	**77 (26.4)**
9 Hole Pegboard Test	1 (0.3)
Adapted Wall Model of Occupational Performance (WOP)	2 (0.7)
Bayley Assessment of Pre-schoolers	2 (0.7)
BEERY™ VMI: Beery-Buktenica Developmental Test of Visual-Motor Integration	14 (4.8)
Bruininks-Oseretsky Test of Motor Proficiency, First Edition (BOT)	4 (1.4)
Bruininks-Oseretsky Test of Motor Proficiency, Second Edition (BOT-2)	4 (1.4)
Clinical Observations	5 (1.7)
Developmental Profiles of WITS and Tygerberg	1 (0.3)
Developmental Test of Visual Perception (DTVP-2)	9 (3.1)
Developmental Test of Visual Perception (DTVP-3)	1 (0.3)
Draw-a-man	1 (0.3)
Dynamometer	1 (0.3)
Early Childhood Development Criteria (ECDC)	1 (0.3)

Griffiths Mental Development Scales (GMDS)		1 (0.3)
Herbst School Readiness		1 (0.3)
Mary Benbow - Observations of Hand skill of the 'K & 1' child		1 (0.3)
Miller Assessment for Pre-schoolers (MAP)		10 (3.4)
Miller Function & Participation Scales (M-FUN)		4 (1.4)
Modular Arrangement of Predetermined Time Standards (MODAPTS)		1 (0.3)
Movement-ABC		4 (1.4)
Movement-ABC 2		2 (0.7)
Peabody Developmental Motor Scales (PDMS-2)		1 (0.3)
Purdue Pegboard		1 (0.3)
Sensory Integration and Praxis Test (SIPT)		4 (1.4)
Test of Motor Impairment – Denis Herbert Stott		2 (0.7)
Writing Readiness Inventory Tool in Context (WRITIC)		1 (0.3)
5.39	**“Other” familiar in-hand manipulation assessment tool(s)**	**6 (2.1)**
Bruininks-Oseretsky Test of Motor Proficiency, Second Edition (BOT-2)		2 (0.7)
In-hand manipulation assessment – Klymenko et al. 2018 - for adult clients		1 (0.3)
Mary Benbow - Observations of Hand skill of the 'K & 1' child		1 (0.3)
Minnesota Hand Dexterity		2 (0.7)
Purdue Pegboard		1 (0.3)
Wits University checklist		1 (0.3)
5.41	**“Other” used in-hand manipulation assessment tool(s)**	**5 (1.7)**
Shore assessment M-ABC		1 (0.3)
Purdue Pegboard		1 (0.3)
Self-designed from other developmental tests		2 (0.7)
Bruininks-Oseretsky Test of Motor Proficiency, Second Edition (BOT-2)		1 (0.3)
Griffiths Mental Development Scales (GMDS)		1 (0.3)
5.48	**“Other” position of the child during assessment**	**28 (9.6)**
Age-dependent		5 (1.7)
Child-directed position in free play		8 (2.7)
Function-dependent		2 (0.7)
Other positions		5 (1.7)
Scholastic tasks at table		2 (0.7)
Various positions (combinations of what was provided)		8 (2.7)
5.51	**“Other” considerations when selecting material/equipment and changing the activity demands in relation to the child’s age**	**23 (7.9)**
Functional level of child		13 (4.5)
Availability of the resources		3 (1.0)
Scholastic requirement		5 (1.7)
5.58	**“Other” method of instruction presentation**	**15 (5.1)**
Child's functional level		8 (2.7)
Hand-over hand guidance		1 (0.3)
Depending on task's demands		2 (0.7)
Depending on child's understanding of English		1 (0.3)
5.60	**“Other” documentation method(s) used**	**7 (2.4)**
Photography		4 (1.4)
Assessment form		2 (0.7)
Video to guide clinical notes		1 (0.3)

6.14	**“Other” preferable method of scoring**	**2 (0.7)**
Own notes		1 (0.3)
Age		1 (0.3)
6.26	**“Other” preferable languages for presentation**	**9 (3.1)**
Tswana		2 (0.7)
Setswana		1 (0.3)
Sepedi		1 (0.3)
German		1 (0.3)
All on Tablet		3 (1.0)
Visual demonstration		1 (0.3)
6.28	**“Other” preferences for user manual inclusion**	**1 (0.3)**
Translation to another language		1 (0.3)
6.30	**“Other” preferred purpose for an assessment**	**1 (0.3)**
Standardised scores will give a less biased assessment of improvement with therapy over time		1 (0.3)

F: Author guidelines for Physical & Occupational Therapy in Pediatrics (POTP)

Journal

Physical & Occupational Therapy In Pediatrics ›

This journal

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Contents

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Physical & Occupational Therapy in Pediatrics accepts the following types of article: original articles, perspective, systematic review, meta-analysis, scoping review.

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Invited Commentary

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Structure

Your paper should be compiled in the following order: title page; abstract; keywords; main text introduction, materials and methods, results, discussion; acknowledgments; declaration of interest statement; references; appendices (as appropriate); table(s) with caption(s) (on individual pages); figures; figure captions (as a list).

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Please include a word count for your paper.

Manuscripts should be no more than 15 typed pages (approximately 3,500 words) double-spaced (excluding abstract and references). Slightly longer lengths will be considered for qualitative and mixed methods designs. References are generally limited to 40 (except for systematic reviews). The combined total number of tables and figures should not exceed 6.

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Please use American spelling style consistently throughout your manuscript.

Any form of consistent quotation style is acceptable. Please note that long quotations should be indented without quotation marks.

Spacing: Double-spaced, including endnotes and references.
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POTP uses "people-first" language. Example: children with developmental delays.

Please be consistent in the use of abbreviations, terminology, and in citing references. Keep abbreviations to a minimum. Check the accuracy of all arithmetic calculations, statistics, numerical data, text citations, and references.

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The format for first- and second-level headings is illustrated immediately below. Third-level headings are written in italic (e.g., Dimensions of Mastery Questionnaire)

Introduction (Do not include the heading 'Introduction')

The introduction is a focused summary of the problem or issue, what is known, and the rationale for the study. The introduction is not a comprehensive literature review.

Methods

Design (optional)

Participants (Subjects)

· Indicate the recruitment procedures and number of participants
· Include data describing participants (do not include in the Results)
· Indicate institutional review board (ethics) approval or exemption

· Indicate who provided informed consent and assent (when appropriate)
· Present a power analysis to determine the desired sample size here or in the Design

Measures (Instrumentation)

· Description of measures and measurement approach
· Reliability of measures among persons who collected data or calibration of instrumentation is presented here

Procedure

· Description of the procedures used to carry out the study including intervention fidelity, adherence, tolerance, and modifications to the protocol / intervention

Data Analysis

· Indicate whether assumptions for distribution and variance of data were met
· Describe statistical analyses of all data presented in the Results and criteria for interpretation.

Results

· Present only descriptive data and inferential statistics related to research questions
· Summarize key information but do not repeat details presented in tables and figures

Discussion

· Interpret the results and indicate whether hypotheses were supported
· Compare results to findings cited in the Introduction and from other literature
· Address methodological factors that might have influenced the results
· Present study limitations and recommendations for further research
· Provide implications for practice

Conclusions

· Briefly summarize the contribution of the results (new knowledge) and implications for practice, research, or both.
· Do not overstate the contribution or implications

Perspective - There is no standard format.

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· Justification of need and aims
· A focused clinical question (systematic review, meta-analysis)
· Comprehensive literature search: databases and dates searched, keywords, and combinations of keywords, other search strategies
· Criteria for inclusion of a study in the review
· Criteria for methodological quality of studies included in the review (systematic review, meta-analysis)
· Description of how results were aggregated and analyzed (meta-analysis)
· Interpretation of aggregate findings
· Application of findings to practice

Case Report or Case Series

The format is immediately below:

Introduction (Do not include the heading 'Introduction'). Introduce the topic or issue, present the rationale including the potential contribute to practice knowledge. Cite relevant literature.

Case Description or Narrative – Include relevant information about participants, practice setting, and intervention.

Outcome or Findings – Present documentation, systematic observations, and/or participant responses to open-ended questions

Discussion – Reflect on findings and possible explanations of outcomes. Address implications for practice and recommendations for further inquiry. Clearly discuss how the report contributes to practice knowledge without overstating the findings and implications for practice.

References

Please use this reference guide when preparing your paper.

An EndNote output style is also available to assist you.

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Checklist: What to Include

1. **Author details.** Please ensure everyone meeting the International Committee of Medical Journal Editors (ICMJE) requirements for authorship is included as an author of your paper. All authors of a manuscript should include their full name and affiliation on the cover page of the manuscript. Where available, please also include ORCiDs and social media handles (Facebook, Twitter or LinkedIn). One author will need to be identified as the corresponding author, with their email address normally displayed in the article PDF (depending on the journal) and the online article. Authors' affiliations are the affiliations where the research was conducted. If any of the named co-authors moves affiliation during the peer-review process, the new affiliation can be given as a footnote. Please note that no changes to affiliation can be made after your paper is accepted. Read more on authorship.
2. Should contain a structured abstract of 200 words. For all types of manuscripts other than perspectives, the abstract should be structured under the following headings:

Aims, Methods, Results, and Conclusions. Do not include authors' names and affiliations on the Abstract page.

3. You can opt to include a **video abstract** with your article. Find out how these can help your work reach a wider audience, and what to think about when filming.
4. Between 5 and 6 **keywords**. Read making your article more discoverable, including information on choosing a title and search engine optimization.
5. **Funding details.** Please supply all details required by your funding and grant-awarding bodies as follows:
   For single agency grants
   This work was supported by the [Funding Agency] under Grant [number xxxx].
   For multiple agency grants
   This work was supported by the [Funding Agency #1] under Grant [number xxxx]; [Funding Agency #2] under Grant [number xxxx]; and [Funding Agency #3] under Grant [number xxxx].
6. **Disclosure statement.** This is to acknowledge any financial interest or benefit that has arisen from the direct applications of your research. Further guidance on what is a conflict of interest and how to disclose it.
7. **Biographical note.** Please supply a short biographical note for each author. This could be adapted from your departmental website or academic networking profile and should be relatively brief (e.g. no more than 200 words).
8. **Data availability statement.** If there is a data set associated with the paper, please provide information about where the data supporting the results or analyses presented in the paper can be found. Where applicable, this should include the hyperlink, DOI or other persistent identifier associated with the data set(s). Templates are also available to support authors.
9. **Data deposition.** If you choose to share or make the data underlying the study open, please deposit your data in a recognized data repository prior to or at the time of submission. You will be asked to provide the DOI, pre-reserved DOI, or other persistent identifier for the data set.
10. **Supplemental online material.** Supplemental material can be a video, dataset, fileset, sound file or anything which supports (and is pertinent to) your paper. We publish supplemental material online via Figshare. Find out more about supplemental material and how to submit it with your article.
11. **Figures.** Figures should be high quality (1200 dpi for line art, 600 dpi for grayscale and 300 dpi for colour, at the correct size). Figures should be supplied in one of our preferred file formats: EPS, PS, JPEG, TIFF, or Microsoft Word (DOC or DOCX) files are acceptable for figures that have been drawn in Word. For information relating to other file types, please consult our Submission of electronic artwork document.

12. **Tables.** Tables should present new information rather than duplicating what is in the text. Readers should be able to interpret the table without reference to the text. Please supply editable files.
13. **Equations.** If you are submitting your manuscript as a Word document, please ensure that equations are editable. More information about mathematical symbols and equations.
14. **Units.** Please use SI units (non-italicized).

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In order to be published in a Taylor & Francis journal, all clinical trials must have been registered in a public repository at the beginning of the research process (prior to patient enrolment). Trial registration numbers should be included in the abstract, with full details in the methods section. The registry should be publicly accessible (at no charge), open to all prospective registrants, and managed by a not-for-profit organization. For a list of registries that meet these requirements, please visit the WHO International Clinical Trials Registry Platform (ICTRP). The registration of all clinical trials facilitates the sharing of information among clinicians, researchers, and patients, enhances public confidence in research, and is in accordance with the ICMJE guidelines.

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Please ensure that all research reported in submitted papers has been conducted in an ethical and responsible manner, and is in full compliance with all relevant codes of experimentation and legislation. All papers which report in vivo experiments or clinical trials on humans or animals must include a written statement in the Methods section. This should explain that all work was conducted with the formal approval of the local human subject or animal care committees (institutional and national), and that clinical trials have been registered as legislation requires. Authors who do not have formal ethics review committees should include a statement that their study follows the principles of the Declaration of Helsinki.

Consent

All authors are required to follow the ICMJE requirements on privacy and informed consent from patients and study participants. Please confirm that any patient, service user, or participant (or that person's parent or legal guardian) in any research, experiment, or clinical trial described in your paper has given written consent to the inclusion of material pertaining to themselves, that they acknowledge that they cannot be identified via the paper; and that you have fully anonymized them. Where someone is deceased, please ensure you have written consent from the family or estate. Authors may use this Patient Consent Form, which should be completed, saved, and sent to the journal if requested.

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Updated 10-04-2019

G: Author Guidelines for South African Journal of Occupational Therapy (SAJOT)

GUIDELINES FOR PUBLISHING IN THE SOUTH AFRICAN JOURNAL OF OCCUPATIONAL THERAPY

The South African Journal of Occupational Therapy accepts scientific articles, scientific letters, literature reviews, book reviews, and biographies for publication.

The language of the Journal is English although abstracts may be published in Afrikaans or the Vernacular.

GENERAL

The following are included:

1. General Instructions and Guidelines
2. General Requirements
3. Guidelines for Authors of Scientific Articles
4. Guidelines for Authors of Scientific Letters
5. Guidelines for publishing a Literature Investigation / Review
6. Guidelines for writing an Opinion Piece
7. Guide to writing a commentary
8. Instructions for Reviewers of Books
9. Guidelines for writing a Biography
10. Guide To Submitting An Article On Line

The relevant guidelines to authors (which follow) must be consulted for the layout and the format of the article, tables, diagrams and referencing.

1. GENERAL GUIDELINES & INSTRUCTIONS – PROCEDURE AND PRESENTATION

Scripts must be submitted via the SAJOT web site (www.sajot.co.za); the author must retain a copy of the script. Please insert a note in the "footer" that gives the title of the article and the date at each submission. This is important for tracking purposes and will ensure that the correct version of the script is used for publication. This foot note will be removed at publication.

TITLE PAGE

Each manuscript must include a separate title page.

This page should bear the title of the article, the name(s) of the author(s), academic degrees, present posts held, complete addresses, telephone numbers and fax numbers and e-mail addresses.

Please include the ethics clearance number if applicable to the study the ethical clearance certificate must be available on request.

The article itself should not contain information on the authors so that their anonymity is maintained during the peer review process.

(See page 93)

REFERENCES

Each reference in the text must be indicated by a number.
This number should be inserted in superscript without brackets e.g.[12].
A reference list should be provided on a separate numbered page following the text.
References must be cited in the order that they appear in the text
References should adhere to the **Vancouver system**, for example:

Journal article

1. You CH, Lee KY, Chey RY, Menguy R. Predisposing locus for Alzheimer's disease on chromosome 21. *Lancet*, 1989; 1: 325-330
   [Author. Title. *Journal*, Year; Volume: Page numbers.]

Book

2. Colson JH, Armour WJ. *Sports injuries and their treatment*. 2nd rev.ed. London: S. Pauol, 1986.
   [Author. *Title*. Edition. City: Publishers, Year.]

Chapter in a Book

1. Weinstein L, Swartz MN. Pathologic properties of invading microorganisms. In: Sodeman WA Jr, Sodeman WA, editors. *Pathologic physiology: mechanisms of disease*. Philadelphia: Saunders, 1974:456-72.

World Wide Web (WWW) sites

1. Burka, LP. "A hypertext history of multi-user dimensions." *MUD History*. 1993.
   <http://www.ccs.neu.edu/home/lpb/mud-history.html> (5 Dec 1994)
   [Author. "Document Title." *Title Complete Works*. Date/last revision. <http address> (Date of visit)]

The following references should be consulted:
http://openjournals.net/files/Ref/VANCOUVER%Reference%20guide.pdf

or

Vancouver referencing style: *Quick guide on how to use* at www.library.up.za/health.Vancouver.htm

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GENERAL REQUIREMENTS

Manuscripts must be clearly typed in MSWord double-spaced with a legible font (Arial size 11 is preferable).

Authors should not assume that the readers know the context in which the article is set. The content needs to be organised in a coherent and logical manner and may require concise descriptions and definitions of terms to elucidate the content. A review of the relevant literature must be provided.

The section on research methods should include: the aim of the study, the research design used, the population and manner of selecting the population sample, the research tools, method of data collection, the methods used to analyse the data and the ethical clearance and consent obtained.

The results should be clear. **Tables** should have the heading at the top of the table and labeled with Roman letters e.g. Table II. **Figures** should be labeled at the bottom of the figure with Arabic numbers e.g. Figure 2.

Tables and figures should not be scanned but formatted and included on separate pages. JPG format is preferable.

Conclusions must be brief, drawing the article to a close and containing no new information.

REVIEWS

All manuscripts undergo an anonymous peer review process and are sent to at least two reviewers for comment on the scientific worth of the article and it's suitability for publication in SAJOT. (To ensure a blind review see section below).
The comments are returned to the authors by the editor with a directive for further action required
Articles may be accepted without change, changes may be requested or the article may be rejected.

EDITING

Please note that the article will be checked by the Editor and the English Language editor before going to print. The article will then be returned to the author for a final check.

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Confirmation that the following items have been attended to will be required as part of the submission process on the SAJOT website.

- The submission has not been previously published, nor has it been before another journal for consideration (or an explanation has been provided in Comments to the Editor).
- The submission file is in Microsoft Word, or a WordPerfect document file format.
- All references have been checked to see that they comply with the requirements (see author guidelines). Where available, URLs for the references have been provided.
- The text is 1.5 spaced; employs italics, rather than underlining (except with URL addresses); and all illustrations, figures, and tables are placed on separate pages with their place in the text clearly indicated.
- The text adheres to the stylistic and bibliographic requirements outlined in the Author Guidelines, which is to be found under the tab "About the Journal" or under the tab "Guide to submitting an article".
- The instructions for Ensuring a Blind Review have been followed (see below).
- A colleague has read the article for objective peer input and inconsistencies. Spelling and grammar have been checked and a spell-check with English South African as the default setting has been run.
- Multiple Choice Questions are attached in the supplementary file section of the article submission. In addition it is advisable to email these to the editor at sajot@mweb.co.za. The article will not be sent for review until these have been received.
- The details of all the authors have been included in the "Step III - Entering the submissions metadata" and includes the following:
  - Full names and **all** qualifications of all authors and where these were obtained e.g. BSc OT (Wits).
  - Place of employment / affiliations of all authors.
  - Contact details of all authors including email address, phone number and address.
- Ethical approval for the study has been sought and explained in the article and an approval number is given.
- The title of the article is on the article submission.
- The abstract has been included in the submission as well as in the "Submission metadata" section.
- The article has undergone a plagiarism check such "Cross Ref" or "Turn-it-in".
- Permission has been obtained from the co-authors to publish the article and to use their names.
- The relevant acknowledgements have been provided.
  As a special request, the author is asked to provide the names, place of work, and email contact details of two people who they know of who have have the skills and expertise to review the article. These should be provided in the supplementary file section of the submission and may be either local or international expert clinicians or researchers in the field of research. These persons may or may not be invited to review the article but will help in identifying suitable reviewers to add to the list of reviewers.

ENSURING A BLIND REVIEW

To ensure the integrity of the blind peer-review of the submission to this journal, every effort is made to prevent the identities of the authors and reviewers from being known to each other.

It is primarily the duty of the author to remove any possible identification from the text submitted as indicate below. The reviewer is obliged to keep his/her comments/opinions about the article confidential and relate these only to the editor; should the reviewer have

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prior knowledge of or involvement with (incidental or otherwise) with the author or the article in question, the editor should be informed of the situation and the situation reviewed if needed.

The editor is the only person who has access to all the information about authors and reviewers. Any issues concerning a review/edit/authorship/copyright etc. about a SAJOT submission must be brought to the attention of the editor directly – the editor is the only person authorised to deal with these issues and will do so in a strictly confidential manner.

The process below applies to the authors, editors, and reviewers (who upload documents as part of their review) checking to see if the following steps have been taken with regard to the text and the file properties:

1. The authors of the document have deleted their names from the text, and substituted "Author" and year used in the references and footnotes, instead of the authors' name, article title, etc. This includes ensuring that names used in the acknowledgements section have also been substituted with an X. Names will be inserted just prior to publication.
2. With Microsoft Office documents, author identification should also be removed from the properties for the file.

For **Microsoft 2003** and previous versions, and **Macintosh** versions of Word:

Under the File menu select: Save As > Tools (or Options with a Mac) > Security > Remove personal information from file properties on save > Save.

For **MacIntosh Word 2008** (and future versions)

- Under the File menu select "Properties."
- Under the Summary tab remove all of the identifying information from all of the fields.
- Save the File.

For **Microsoft 2007** (Windows):

- Click on the office button in the upper-left hand corner of the office application
- Select "Prepare" from the menu options.
- Select "Properties" for the "Prepare" menu options.
- Delete all of the information in the document property fields that appear under the main menu options.
- Save the document and close the document property field section.

For **Microsoft 2010** (Windows):

- Under the File menu select "Prepare for sharing."
- Click on the "Check for issues" icon.
- Click on "inspect document" icon.
- Uncheck all of the checkboxes except "Document Properties and Personal information".
- Run the document inspector, which will then do a search of the document properties and indicated if any document property fields contain any information.
- If the document inspector finds that some of the document properties contain information it will notify you and give you the option to "Remove all," which you will click to remove the document properties and personal information from the document.

For **PDF files**:

- With PDFs, the authors' names should also be removed from Document Properties found under File on Adobe Acrobat's main menu.

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CEU points are accredited as follows:

- CEUs for **authors** of an article:

  Principal author of an article (15 CUEs)
  Co-authors of ab article (5 CEUs)

- CEUs for **reviewers** of an article:

  3 CEUs per article reviewed (which may include a 2nd review)

- CEU's for **readers**:

  Readers obtain CEU's for answering multiple choice questions as per article
  3 CEUs per article
  The MCQs can be found on www.otasa.org.za

CEU's for authors and reviewers can be obtained by applying to the OTASA office.

Paid up members of OTASA will receive their points free of charge.

3. Guidelines for Authors of Scientific Articles

Articles submitted to the SAJOT must be original and must not have been published elsewhere. Articles should contain new information, add to existing knowledge, resolve controversy or provoke thought and discussion.

The content of the article must justify the length, which should be **not more than 12-16 pages**, with 1.5 spacing.

Please ensure that for all the authors contact details for the submission are in a **separate** document entitled 'Title Page' – see above.

Abstract and key Words

All manuscripts submitted to the SAJOT must be accompanied by an abstract not exceeding 200 words in length.

The abstract must contain a succinct structured summary of the study using the headings: Introduction, method, results/findings, conclusions.

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Introduction
This should provide a brief rationale for the study and an outline of the aims or questions

Literature Review
This should be a **critical** appraisal of the current relevant literature identifying the limitations in the work already conducted on the subject and a rationale for the study. A maximum of 35 references should be included.

Method
This should contain the following: Aims, study method and data collection procedures, population and sampling procedure, methods of analysis of data, information on validity, reliability, trustworthiness and credibility.

Details of the ethical clearance and informed consent must be provided.

Results
The results must be presented in a way that makes them accessible to the readers and are clearly linked to the aims and methods of the research.

Discussion and Implications of the research
The implications for occupational therapists and or other health professionals/groups/ contexts must be outlined and the contribution that the study makes to the current state of knowledge of the profession/s stated. Limitations must also be discussed.

Conclusion
There should be a clear summary of the main points of the paper, drawing the article to a close and containing no new information.

Illustrations
Articles may include up to eight tables, graphs or diagrams and should be numbered and clearly labelled with their place in the text indicated as a guide to the editor.

Figures should carry Arabic numerals (1, 2, 3 etc.) and labelling must be at the base of the figure. Tables should have Roman numerals (I, II, III etc.) and be placed at the top of the table.

Figures and tables must be submitted on separate pages following the reference list.

Please ensure that illustrations are clear and have printed well so that they can be easily scanned. All figures must be in JPG format. Please note that coloured figures and photos do not print well in the black and white format of the Journal.

Photographs
Photographs may be of any size. They must be very sharp, taken close up, with a lightish over-all tone and without dark backgrounds. If the photograph photocopies well, it will print well. Please check this before you send photographs.

4. GUIDELINES FOR AUTHORS OF SCIENTIFIC LETTERS
Letters submitted to the SAJOT must be original and must not have been published elsewhere. Letters should contain new information, add to existing knowledge, resolve controversy or provoke thought and discussion.

The requirements of a scientific letter are as follows:

- The letter must have the same scientific format as an article, but is much shorter i.e. 1500 – 1 700 words, to fill only one to two pages of the Journal but does not have an abstract.
- It may have only one table of results.
- There should be not more than 5 references.
- It must be original research.
- Peer evaluation will take place as with all other articles submitted to SAJOT.

5. GUIDELINES FOR PUBLISHING A LITERATURE INVESTIGATION / REVIEW
Literature investigations submitted to the SAJOT must be original and must not have been published elsewhere.

The requirements of a critical review of the literature review is as follows:

- The review should provide reasons for choosing to review the topic and give the method used to conduct the survey along with the sources consulted.
- The review must cover the topic thoroughly i.e. it must include all or most of the major studies that have been conducted on the topic of interest within a given time frame. The most recent literature must be included.
- The publications referred to must be the primary source and the review should not rely on secondary sources. Articles reviewed should also not rely on opinion articles but should emphasise research articles.
- It should not be merely a summary of past work but must critically appraise and compare the key studies as well as discuss weaknesses and strengths. Important gaps in the literature should be identified.
- The review must conclude with a brief synopsis of the current state of the topic and give recommendations for future work.
- The format of the review must follow that for all scientific articles i.e. it must contain the following:
  - An abstract
  - Introduction
  - Method. In this instance the approach taken to search the literature, the data bases searched, the search parameters and key must be provided.
  - Results: this should present the main evidence and a summary of its quality
  - Implications: An outline of the implications for occupational therapy, the methodological limitations of the review, identify gaps and make recommendations.

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- Conclusion - a clear summary of the main findings.
  - ❋ Implications: An outline of the implications for occupational therapy, the methodological limitations of the review, identify gaps and make recommendations.
  - ❋ Conclusion - a clear summary of the main findings.

6. GUIDE LINES FOR WRITING AN OPINION PIECE

Opinion pieces provide authors with the opportunity to express an opinion concerning any aspect of occupational therapy. They are designed to encourage topical debate and the exchange of ideas. Contributors may discuss specific aspects of occupational therapy practice or debate the impact of occupational therapy on the health of people. Opinion Pieces may also deal with health care and relevant social practice/issues in general such as consumer rights that may impact on the profession. They may also debate the impact of the current political and financial climate on the practice of the profession and its ability to meet all in need.

Irrespective of the topic discussed, opinions should be supported by evidence or theory. They should include:

- An abstract
- Headings which give structure to the paper
- References (a maximum of 15)

Opinion pieces are subject to the same critical review process that other submissions undergo.

Opinions are not necessarily those of the Occupational Therapy Association of South Africa nor The South African Journal of Occupational Therapy but never the less my provide information for debate.

7. GUIDE LINES FOR WRITING A COMMENTARY

These are similar to Opinion Pieces and are as follows:

A commentary is written on a current event or topic by a person with the background to make an informed comment and should report on an issue or topic of interest and relevance to OT practitioners, educators and researchers.

Irrespective of the information being commented upon, commentaries should include:

- An abstract
- Introduction
- Coherent body with headings which give structure to the paper
- Recommendations and conclusion
- References (a maximum of 15)

Commentaries are subject to the same critical review process that other submissions undergo

8. INSTRUCTIONS FOR REVIEWERS OF BOOKS

A book review should contain the following information:

- ➢ The full title of the book
- ➢ The full name of the author(s) and their qualifications and the position that they hold
- ➢ Details of the book
  1. Name of Publisher
  2. Whether it is a paperback or hard copy and the number of pages
  3. The publication Date
  4. The ISBN number
  5. The Price (in SA Rand if possible)
- ➢ A review of the content which should include:
  1. The aim of the book
  2. The way in which the information is structured
  3. A brief summary of the content of each chapter
  4. A comment on its relevance to health care generally and SA occupational therapy specifically
- ➢ The name, qualifications and work position of the reviewer

9. GUIDELINES FOR WRITING A BIOGRAPHY

A biography has been defined as "a written account or history of the life of an individual" and "the art of writing such accounts"[1]. The biography should have a focus on occupation and/or views on occupation.

Approach to the interview

- Try to get a conversation going rather than a 'question and answer session'. Very good information is available in Rubin and Rubin[2].
- Start by explaining what SAJOT is and why biographies are included in the journal. The interviewee might be told that occupational therapists are interested in the impact of chosen occupations on personal development – that we believe people are shaped by the occupations they do. Another point of interest would be the impact of the interviewee's occupations on other people (this is usually only relevant to their work-occupation), for example, teachers or politicians.
- Explain what the intended product at the end will look like (or show an example).
- Give your assurance that the draft biography will be returned to the interviewee for 'checking' accuracy and that suggested changes will be made (ensure that this is done).
- Start your conversation with issues that are more public before asking questions that are more private.
- A good first question might be: "Tell me your story as you would like it to be remembered."

..... continued on page 96

Issues to consider for inclusion

Brief discussion of family and early life

Provide some information on the background of the person you're interviewing. Use questions below as a very loose guideline, in other words, do not ask questions that do not seem appropriate given the background and current status of the person being interviewed.

- Parents: where they came from, their occupations and roles in the family.
- Brothers, sisters and childhood friends: children's responsibilities, games and leisure activities.
- Local geography: the community, village or town; communal areas, land rights and ownership; markets, meeting places and other significant places; neighbours, important people and interesting characters.
- Social and cultural life: religion and politics; education and instruction at home, school or work; important friendships, influences and ambitions.

Questions above were adapted from Slim & Thompson[3].

Working life

The interviewee might feel more comfortable to start the interview with a discussion of work life. This is usually also the part that is already known and therefore not necessarily the most interesting.

- Occupation(s) inside and outside the home: domestic, agricultural, vocational, professional, formal, informal, paid and unpaid.
- How the skills were learnt; the work environment; what the work involves and who with; formal or informal training or apprenticeship.
- Important influences at work: mentors, colleagues, friends.
- Wider changes affecting work: environmental, industrial, political etc.

Questions above were adapted from Slim & Thompson[3].

Other occupations

It would be very interesting to know a range of occupations the person is involved in; the meaning and purpose of these in their lives.

- Leisure activities: hobbies; music, religious or cultural festivals and entertainments.

Future perspectives

Ask questions that will allow an opportunity for the person to share future directions (pertaining personal, career or broader issues) he/she would hope for / aim at achieving / advise others to take.

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2. Rubin, H. J. and Rubin, I. S. *Qualitative Interviewing: The Art of Hearing Data,* SLACK, Thousand Oaks, 1995.
3. Slim, H. and Thompson, P. *Listening for Change: Oral Testimony and Development,* Panos, London, 1993.

10. GUIDE TO SUBMITTING AN ARTICLE ON LINE

The Guide to submitting an article on line is featured under the tab "Guide to submitting an article" in the header of the SAJOT web site and shows screen shots to help with the submission process.

Prepare the article as described above.

The title page of the submission should be emailed to The Editor at sajot@mweb.co.za. A user name and password will then be provided to enable the author to complete the on line article submission.

The following are the steps to follow:

Go to www.sajot.co.za. Log in using the "user name" and "password" that has been provided. Click on the tab "New Submission". The following are the steps as enumerated on the web site:

Step 1 – Starting the submission

Journal Section

Select the relevant category of the submission in this section from the drop down box.

Submission check list

Ensure that you the author have done all the things mentioned in the submission check list and confirm this by placing a check in the relevant box. See the section CHECKING THE ARTICLE BEFORE SUBMISSION under the heading General Requirements on page 92 for the list.

- **Copyright notice** – click to accept copyright provisions as seen on the web site.
- You may also send a note to the editor in the box provided.
- Click **save and continue** at the bottom of the page, this will enable you to move on to the next stage of the submission process.

Step 2 – Upload the submission

- Follow the steps for uploading your article.

NB it is important that you upload the file containing the complete article here. Do not include any information about the authors on the article.

To upload - Click on the browse button, locate the file containing the article on your computer, click on it so that the name of the file appears in the window, and then click the "**upload"** button. This is the only place where the main article can be uploaded.

Click **save and continue**

..... continued on page 97

Step 3 - Entering the submissions metadata

- **Authors** – Information about **all** the authors must be provided here.
  The bio statement box should be used to complete the details of the qualifications of the authors (i.e. degree and where obtained and their place of practice in full.) as well as the place of work and position held.
- **Title and abstract** – Please copy / type in the full title of your article into the box provided. Paste in a copy of the abstract into the block provided.
- **Indexing** – we are still working on this section so ignore
- **Supporting agencies** – complete if relevant eg funding organisation.

Click **save and continue**

Step 4 – Uploading supplementary information

You may upload tables and figures here if they have not been included within the main article. You do not have to complete this section but must click **save and continue** to go to the next step. Photographs should be also be loaded here. Please note that there are two steps here

Step 4 and Step 4a

In step 4 the file/files containing the tables can be uploaded. Click save and continue. This will bring up step 4a where you can add any information needed to identify the supplementary information. This is the place where the nomination of a reviewer may be included. The only compulsory window is the title window.

- **Click save and continue**. This will bring you back to step 4 here another file can be uploaded.

Step 5 – confirming the Submission

- Click **Finnish Submission**. Please remember to do this otherwise your submission will not be recorded. It is very important to note that once you have confirmed the submission you will be unable to make changes to your documents.

Any changes that you wish to make will need to be done via a completely new submission.

Resubmission of article after revisions/amendments suggested by the Editor:

Scroll to the section at the bottom of the Review page of your article to the section labelled Editor Decision. There you will see the box "Upload author version". Please post your revised copy here. Please also note that the article, tables and diagrams should be included in one document at this stage in the process.

Help with this submission process can be obtained by emailing the editor at sajot@mweb.co.za.

H: Proof of language editing

Marina Knight

28 January 2020

Translation, Proofreading, Administration

TO WHOM IT MAY CONCERN

I hereby declare that I've proofread the dissertation of Annelize Kruger to the best of my knowledge.

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