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EVALUATING VALIDITY OF MODAPTS AS AN ASSESSMENT METHOD OF WORK SPEED IN RELATION TO THE OPEN LABOUR MARKET

by

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ABSTRACT

Background: Based on latest statistics only 0.9% of the Economically Active People in South Africa are persons with disabilities. Furthermore, many of the persons with disability in South Africa are employed in sheltered employment with little or no prospect of career advancement. The White Paper on the Rights of Persons with Disabilities (WPRPD) thus identifies the need for removing discriminatory barriers that hinder equal participation of people with disabilities. Occupational therapists (OTs) are uniquely qualified to evaluate and treat occupational dysfunction that hinders participation in gainful employment and to advocate for the rights of persons with disability in the workplace. OTs depend on standardised procedures to evaluate work capacity and to determine ability to work and rehabilitation needs. It is of importance that valid and reliable test results be obtained to inform these decisions. At present, it appears that expensive and imported assessment methods are used. MODAPTS could prove to be a more cost-effective alternative to standardise work assessments, yet hardly any studies report its validity as an assessment method in OT. This study aimed to evaluate face, content and criterion validity of MODAPTS as an assessment method of work speed.

Methods: A quantitative cross-sectional research design was used. Two electronic surveys were utilised to determine face and content validity of MODAPTS. The Lynn method was used to analyse data related to face and content validity. Criterion validity was evaluated by comparing MODAPTS to the gold standard of work samples, namely Valpar Component Work Samples (VCWS) that utilises the Methods-Time-Measurement (MTM) technique. The specific VWCS used to compare with MTM and MODAPTS times was informed by a realist synthesis that focused on the content of work assessments. VCWS 9, VCWS 4 and VCWS 6 was used. A deterministic model was used to evaluate the comparability of MODAPTS to MTM.

Results: Face validity for MODAPTS as an assessment method of work speed was confirmed through an agreement of 94.73% (>80% demonstrates adequate agreement). Content validity for the codes used to analyse basic movement and handling of smaller and larger articles as well as other body actions was confirmed with an agreement of 100% respectively. Content validity for mental and clerical operations codes was not confirmed with an agreement of 67% respectively. Criterion validity for tasks involving basic movements, handling smaller articles and other body actions was confirmed. Criterion validity for tasks involving mental and clerical operations was not confirmed. The results of the content and criterion validity are consistent.

Conclusion: MODAPTS demonstrated adequate face validity. Content and criterion validity of tasks involving basic movements, handling of articles and other body actions was confirmed. However, content and criterion validity for tasks involving mental and clerical operations was not confirmed. The results of this study indicate that MODAPTS can be used to assess work speed in physical and manual tasks.

Keywords: MODAPTS, validity, assessment, work speed, open labour market, work rehabilitation, functional capacity evaluation, work capacity, occupational therapy, instrumentation.

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LIST OF ABBREVIATIONS

Abbreviation	Meaning
AOTA	American Occupational Therapy Association
CINAHL	Cumulative Index to Nursing and Allied Health Literature
DOT	Dictionary of Occupational Titles
EUMASS	European Union for Medicine in Assurance and Social Security
FCE	Functional capacity evaluation
HPCSA	Health Professions Council of South Africa
ICF	International Classification of Functioning, Disability, and Health
ILO	International Labour Organization
MODAPTS	Modular Arrangement of Predetermined Time Standards
MTM	Methods-Time-Measurement
OT	occupational therapist
OTASA	Occupational Therapy Association of South Africa
OTPF	Occupational Therapy Practice Framework
PTS	Predetermined Time Standard
T/PAL	Therapist Portable Assessment Laboratory
SA	South Africa
SASSA	South African Social Security Agency
TBI	Traumatic brain injury
VCWS	Valpar Component Work Samples
WFOT	World Federation of Occupational Therapy
WPRPD	White Paper on the Rights of Persons with Disabilities

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1. CHAPTER 1: INTRODUCTION

1.1. Introduction

Work assessments are specifically used to determine vocational rehabilitation goals, work capacity and readiness and/or ability to return to work.[1] Work assessments include the evaluation of physical abilities, cognition, psychosocial abilities and work speed as well as accuracy, and usually make use of activities with established time standards.[2] The results of work assessments are also used in legal proceedings to determine a person's entitlement to compensation or disability benefit. An assessment method that evaluates work speed and accuracy, in which training is provided at some South African universities, is the Valpar Component Work Samples (VCWS). The VCWS have been developed with the Methods-Time-Measurement (MTM) Predetermined Time Standard (PTS); have established validity and reliability and have been proven relevant in the South African context.[3] Many occupational therapists (OTs) prefer using the commercially available system as it is supported by peer-reviewed research to evaluate work speed and accuracy. It is however imported and therefore expensive. Another disadvantage is that some components of the VCWS are large and heavy, and thus not easily portable. This is a significant limitation as it makes it difficult to transport components for assessments done at the workplace of clients. Anecdotal information, from discussions and experience, suggests there is a need for affordable and portable tools to be utilised in both the public and private health care sectors.

In the early 1980s, Judith Farrel introduced Modular Arrangement of Predetermined Time Standards (MODAPTS) as a cost and time effective assessment method.[2] Buys states that according to Shipham, it laid the scientific basis of work assessments.[4] However, hardly any reported studies over the past 38 years focus on the use of MODAPTS as an assessment method in the South African context. While training in the method is provided at some South African universities, private OTs and some public hospitals continue to prefer the expensive VCWS. This could be attributed to South African OTs having limited confidence in the validity and reliability of MODAPTS as an assessment method.[5]

Proven validity and reliability of an assessment method is essential for results to guide best practice and to have legal standing. With the significant benefits that MODAPTS could provide in the South African context, it is thus essential that further investigation into its validity and reliability be conducted.

1.2. Background to the study

The Occupational Therapy Practice Framework (OTPFIII) by the American Occupational Therapy Association (AOTA) describes the domain of occupational therapy in broad terms as: "supporting health and participation in life through engagement in occupation".[6] While acknowledging the diverse nature of the profession, the framework further states that the core goal of occupational therapy is to enable clients to engage in occupations that they want or need to engage in.[7] Occupations refer to daily activities and many types of occupations are considered by OTs when working with clients. These occupations are categorised as: activities of daily living, instrumental activities of daily living, rest and sleep, education, work, play, leisure and social participation.[7] This research pertains to the area of work. The OTPF describes the area of work as focused, productive activities with or without financial reward.[7] These activities involve job interest exploration, job seeking and securing work, work performance and retirement.[7]

A person's occupational well-being and participation is determined by the interaction of the client factors, occupation and context.[7] Client factors refer to the specific capacity of a person, and illness and/or disability thus contributes to occupational dysfunction.[7] This occupational dysfunction often also limits participation in work-related activities. The South African Social Security Agency (SASSA) reported on 30 April 2015 that 1 111 063 beneficiaries receive a disability grant in South Africa. According to the 14th Commission for Employment Equity annual report, only 0.9% of the Economically Active People in South Africa are persons with disabilities.[8] It is thus clear that persons with disabilities are not equally represented in the open labour market. Many of the persons with disability in South Africa are employed in sheltered employment with little or no prospect of career advancement.[8] They also earn a smaller income than those without disability.[8] The White Paper on the Rights of Persons with Disabilities (WPRPD) thus identifies the need to remove discriminatory barriers that hinder equal participation of people with disabilities.[8]

The vision of the National Development Plan as described in the WPRPD is to eliminate poverty and reduce inequality by 2030.[8] Thus, a strategy to reduce inequality, eliminate poverty and promote the employment of persons with disabilities should be implemented.[8] This is also in line with international goals as the International Labour Organization (ILO) also promotes Decent Work for Persons with Disabilities.[9] One of the main barriers to the 2030 vision is the lack of rehabilitation services available beyond the acute phases of disability. Lack of rehabilitation limits the actions of economic empowerment and employment opportunities for persons with disability.[8]

There is evidence that the following factors contribute to the lack of rehabilitation: poverty, limited knowledge of and access to specialised rehabilitative services, poor referral services within the health sector and between the health sector, social development services, the social security system and the employment and skills-development programs.[8] Cost-effective and valid evaluation methods need to be put in place in order to help overcome the aforementioned challenges.

Vocational rehabilitation, an intervention that OTs provide, is directed at the occupation of work. It encompasses the assessment and treatment of all activities related to work.[10] The ILO describes the purpose of vocational rehabilitation as: "to enable a disabled person to secure, retain, and advance in suitable employment and thereby to further such a person's integration or reintegration into society".[9] The World Federation of Occupational Therapy (WFOT) Position Statement on vocational rehabilitation in OT states that OTs have the necessary skills and knowledge to enable individuals' participation in work-related activities.[10] The Position Statement further describes that OTs have a significant role in the vocational rehabilitation process. These services include assessment of the client and workplace, intervention programs to enable individuals to enter, re-enter, return to and/or remain at work aimed at overcoming barriers that hinder participation in work, case management and/or counselling, and health promotion programs aimed at creating a healthy work environment.[10] Due to the domain and scope of occupational therapy including the area of work, OTs have a professional and ethical responsibility to consider work participation of all clients, and to advocate for occupational justice for all individuals.[6, 10]

OTs play a significant role in vocational rehabilitation when they compare the assessment of function to the demands of work and provide intervention in order to enable productive participation in work.[10] This is done through addressing one or more of the following aspects: the individual's abilities and limitations, contexts and environments influencing engagement, and the individual's physical and mental health.[10] According to the WFOT Position Statement on occupational therapy in work-related practice, OTs are uniquely able to determine a job-person fit through the evaluation of the person, the job and the environment.[11] In order for a worker to be considered productive, certain quality and quantity standards have to be met, leading to the importance of work speed and work accuracy. With the vision of equal gainful employment of persons with disability that includes equal remuneration and career progression possibilities, one has to consider in which environment these persons might be able to compete best. Securing suitable employment that will not place unrealistic demands on the individual is essential as it has been found that placing unrealistic demands on employees with regard to work quality and speed causes high levels of anxiety, and defensive

psychological strategies such as individualism and false behaviour.[12] Valid and reliable work assessment results will contribute towards people with disabilities being employed in suitable positions, in which they meet the set productivity standards. This in turn will facilitate equal remuneration for equal work delivered by persons with and without disability.

The need for undertaking and disseminating research in the field of vocational rehabilitation services (assessment and intervention), in the endeavour to promote equality and equal opportunities for gainful employment for people with disabilities, has been identified at various levels.[10, 11] As stated before, a person's ability to deliver productive work that meets time and accuracy standards is important to facilitate equal employment and career progression. It is thus important that an accurate and reliable work assessment, that involves work speed, be conducted in order to facilitate best intervention. Furthermore, the need to evaluate the importance, assessment, and treatment of work speed as part of work performance, exists with significantly limited published research on work speed available, especially within the South African context.

1.3. Problem statement

In order for the results of a work assessment to be accurate, to inform best practice, and have legal standing, the assessment method has to have evidence of inter- and intra-rater reliability and it needs to be valid.[2, 13] The choice of an assessment method used as part of work assessments, must thus be based on dependability (referring to reliability) and utility (referring to validity) as demonstrated by the assessment method when appropriately used.[14]

With the low employment rate of persons with disability, the need for vocational rehabilitation services in South Africa is evident. Vocational rehabilitation services should include thorough and standardised work assessments in order to inform best practice. Since a large percentage of the population is economically inactive, services have to be accessed in the public sector, or at an affordable rate in the private sector. However, it seems as if therapists are reluctant to conduct work assessments in the public sector for a number of reasons, including limited access to standardised assessments as well as limited confidence in conducting these assessments.[15] Due to inadequate resources available at grassroot level, there is an influx of referrals to tertiary hospitals, placing increased load on OTs working at these hospitals and delaying the provision of vocational rehabilitation services. It is thus evident that the need for an affordable, standardised assessment method that is relevant to the South African population exists.

MODAPTS has been utilised by OTs in South Africa since its introduction in the 1980s as part of work assessments to specifically evaluate work speed. Although, since the introduction of VCWS in 1991, therapists tend to rather use these commercially available work assessment methods as it is based on peer-reviewed research.[3, 4] VCWS were developed in the United States of America and are applicable in the South African context as they are criterion referenced as opposed to norm referenced.[3] Based on professional experience and personal communications these work samples are considered to be the gold standard for evaluating work speed.

Positive results of this study may encourage OTs to utilise MODAPTS which could lead to evidence-based practice, increased access to work assessments and effective vocational rehabilitation in the South African context. It is anticipated that it could be utilised in both the private and public health care settings of South Africa.

1.4. Justification of the research

The WPRPD identifies the need for increased access of persons with disabilities to specialised rehabilitative services since less than 1% of the economically active population are persons with disability.[8] Standardised, objective assessments are thus essential in South Africa to firstly determine the presence, degree and functional limitations of a person's disability, and further to guide the vocational rehabilitation process that is aimed at increased gainful employment of persons with disability. This can be achieved by matching a person's abilities with the demands of a job.

Validity needs to be established before an assessment method will have legal standing.[13] If positive results are obtained through this research, it could lead to increased use of this cost and time effective method. The research could lead to the development of affordable South African testing methodologies based on MODAPTS to be used in both public and private sectors. Accessibility to standardised assessment methods, and increased confidence of therapists in the utilisation of these methods, could also increase vocational rehabilitation services rendered in the public sector at a primary and secondary level. The load on tertiary hospitals may then be reduced.

In turn, the private sector also stands to benefit from the possible development of affordable testing modalities. This could lead to increased availability of objective work assessments to form part of the disability claim process – decreasing the financial burden of such a claim. Furthermore, an objective measure of work speed could be incorporated in acute and subacute rehabilitation and increase the evidence-based practice of especially return-to-work

programs. It could also inform decisions on the inclusion of MODAPTS as part of OT curricula, clinical practice, and vocational rehabilitation services rendered.

1.5. Purpose of the research

The purpose of the research was to validate MODAPTS as an assessment method of work speed. The study focused upon the face, content and criterion validity of MODAPTS as an assessment method to measure work speed against the standard of the open labour market. Validity was to be evaluated thoroughly in order to determine the value of using MODAPTS, instead of developed alternative, standardised assessment modalities, in the South African context.

A realist synthesis that focused on current trends in work assessments, and specifically assessment methods, was conducted with the aim of providing insight into the aspects included in work assessments to inform both this validation study and further development of testing methodologies. Comparison with the gold standard assessment (MTM) was done in order to firstly establish the method's criterion validity, and to ascertain why OTs have a lack of confidence in MODAPTS.

1.6. Research question

Is MODAPTS a valid assessment method of work speed in relation to the standard of the open labour market?

1.7. Research aim

The aim of the study was to evaluate the validity of MODAPTS as an assessment method of work speed in relation to the standard of the open labour market.

1.8. Research objectives

The objectives of the study included the following:

i. To evaluate the face validity of MODAPTS by determining the perception of OTs on the use of MODAPTS as a work assessment method.
ii. To evaluate the content validity of MODAPTS by determining the relevance of the category codes in the current South African context.
iii. To evaluate the criterion validity of MODAPTS by determining the level of agreement between the time standards obtained using MTM and MODAPTS in the same work samples.

iv. To develop a reference range for MODAPTS against which the results of testing can be measured in relation to the standard of the open labour market.

1.9. Delimitations and assumptions

1.9.1. Delimitations

The proposed study evaluated face, content, and criterion validity only. It is noted that reliability is equally important when considering the standardisation of a testing method. However, one has to establish validity before establishing reliability since reliability refers to consistency, and it will not be useful to have an assessment method consistently evaluating a phenomenon, if it does so inaccurately.[16] Due to the scope of the study, predictive value and reliability was not evaluated. The research applied only to the assessment of work speed using MODAPTS as a work assessment method during the work assessment process.

1.9.2. Assumptions

It was assumed that the construct validity of MODAPTS had been proven based on the validation of MODAPTS as a predictor of task duration in the field of Industrial Engineering.[17] Construct validity involves proving that the assessment method effectively measures the construct that it intends to measure.[16] Determining construct validity involves proving that test items reflect the content of a construct.[16] Not only the assessment method itself, but also its supporting theory has to be validated. As MODAPTS have been established to be a valid predictor of task duration, it can be deducted that using it as an assessment method of work speed adequately relates to the construct of work speed.

1.10. Concept clarification

Assessment: Used to establish a baseline or change in performance.[18]

Assessment method: Refers to the manner of data collection and includes, but is not limited to: standardised assessments, non-standardised assessments, self-reporting methods, interviews, observation, and clinical interpretation.[19]

Assessment process: Includes all aspects of collecting data in order to determine the outcome/judgement of the evaluation; it includes outcome measurements and interpretation of the amount or value obtained.[19]

Expert: A person well-known in their field who has presented or published on their subject of expertise.[20]

Methods-Time-Measurement: A predetermined time standard used to predict the standard time of performing manual operations – it is one of many PTS systems.[21]

Modular Arrangement of Predetermined Time Standards (MODAPTS): A system of codes used to predict a reasonable time for an action to be completed. MODAPTS is one of many types of PTS systems.[22]

Open labour market: "The nominal market in which workers find paying work, employers find willing workers, and wage rates are determined. Labour markets may be local or national (even international) in their scope and are made up of smaller, interacting labour markets for different qualifications, skills, and geographical locations. They depend on exchange of information between employers and job seekers about wage rates, conditions of employment, level of competition, and job location."[23]

Occupation: "The profession of occupational therapy uses the term occupation to capture the breadth and meaning of 'everyday activity'."[6]

OT: Refers to a trained professional in occupational therapy, who is registered with the Health Professions Council of South Africa.

Occupational therapy: Occupational therapy is an intervention that is aimed at promoting health and participation of clients through engagement in occupation.[7]

Predetermined Time Standard (PTS): "A PTS is a work measurement technique whereby times established for basic human motion are used to build up the time for a job at a defined level of performance".[24]

Reference range: A set of values established as normal maximums or minimums for a given analyte.[25]

Sheltered employment: "These spaces offer short to long term employment to persons with disabilities who wish to participate in the development of the economy, but who lack sufficient work and technical skills and productivity levels."[8]

Time standard: The predetermined time in which an action, task or job has to be completed.

Validity: Validity depends on the occurrence that a measure actually measures the phenomenon evaluated, and that it does so accurately.[16] *Face Validity* refers to whether a test is perceived to measure what it sets out to measure.[19] *Content Validity* refers to the appropriateness of the content of a test in relation to what it intends to measure.[19] *Criterion Validity* refers to the degree that a test effectively predicts the performance of an individual in a specific activity or task.

Vocational rehabilitation: Services provided by OTs specifically focused on the area of work. It includes the assessment of work capacity, rehabilitation aimed at facilitating engagement in paid or unpaid work and return to work facilitation.

Work assessment: The comprehensive assessment of a person's ability to perform work with either the same or an alternative employer, with or without reasonable accommodations, the need for vocational rehabilitation or admittance for a disability claim. It involves the use of physical capacity evaluations, commercially available assessment methods, self-developed

work samples and standardised self-reporting questionnaires. It also includes background and collateral information in order to conclude on the individual's ability to work.[2]

Work sample: A work sample is an assessment method that includes key aspects of a job in order to predict performance in the job. It requires the client to perform tasks that are comparable to the real-life position or job.[22] Some work samples are commercially available and include generic aspects of different levels and types of jobs, or they can be self-developed.[2] Work samples are used to assess work speed, among other factors and have a predetermined time standard.[2]

Work speed: Refers to the rate at which work is performed and is a measure of productivity and ability.[26]

1.11. Overview of the chapters

The next chapter describes available literature and includes background on assessment, work assessments, work samples and MODAPTS. Chapter Three focuses on research methodology and describes the research plan, how the research was technically conducted, how the data was handled, as well as ethical considerations. In Chapter Four, the results of the realist synthesis as well as the description and analysis of quantitative data collected are described. Chapter Five contains the discussion of results and Chapter Six includes further recommendations, study limitations and indications for future research.

2. CHAPTER 2: LITERATURE REVIEW

2.1. Introduction

In order to gain insight into the application of MODAPTS as an assessment method in occupational therapy, a broad review of assessments and work assessments was first conducted. Thereafter focus was placed on the use of work samples. Lastly the review addressed the development of both MODAPTS and VCWS and their supporting research. The following diagram illustrates how the literature was analysed in order to gain insight into the use of MODAPTS as part of work assessments:

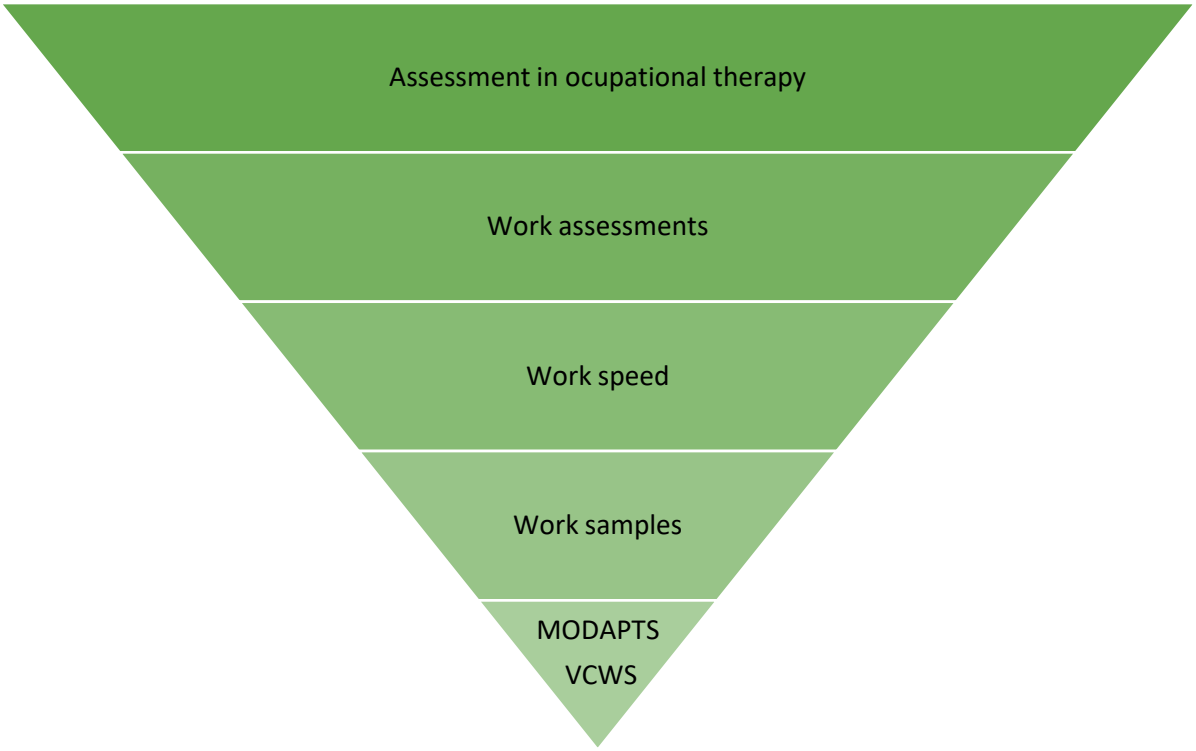

Figure 1: Flow diagram of the literature review process

Various health sciences databases as well as Science Direct and Scopus, specifically in the field of industrial engineering, were used. The keywords MODAPTS, instrument development, validation, face validity, content validity, criterion validity, assessment, work assessment, functional capacity evaluation (FCE), and occupational therapy were used. Although publications within the last five to ten years were preferred initially, older articles dating to the 1980s and 1990s were also included as fundamental research was conducted on the development and implementation of PTS in that period. The available peer-reviewed literature describing the application, validation and comparison of MODAPTS to other PTS systems is mainly in the field of industrial engineering as opposed to the field of occupational therapy. Therefore, articles in the field of engineering were also searched and included. A realist

synthesis was also conducted which focused on the content and construct of work assessments – these concepts were excluded from the literature review to avoid duplication. The methodology and results of the realist synthesis are discussed in chapters 3 and 4 respectively.

2.2. Assessment in occupational therapy

The OTPF describes the occupational therapy process as evaluation, intervention and outcome monitoring. According to the OTPF, it is further required that a certain standard is maintained through adequate credentials, abiding to ethical standards and legal standings.[7] Likewise, evidence-based practice is a fundamental requirement of current health care practice.[7, 27]

Laver Fawcett describes the following reasons for the use of objective and standardised assessments: it ensures evidence-based practice, it ensures client-centred practice, and it encourages the use of standards and protocols.[19] The OTPF describes the evaluation process as being focused on gathering information about the client's abilities, what the client has done, what the client wishes and needs to do, and the facilitators and barriers to the client's participation, health and well-being.[6] Two main aspects of evaluation are identified, namely occupational profile and occupational performance.[6] The occupational profile focuses on the client's history and provides the therapist with insight into the client's perspective regarding participation in occupation.[6] It evaluates the client's past experiences, current priorities, and facilitates the development of current targeted outcomes.[6] The evaluation of occupational performance involves measuring the degree of success of participation in a certain occupation.[6] During the analysis of occupational performance, a client's abilities and limitations or possible limitations are identified.[6]

Two main approaches to assessment are followed in occupational therapy.[28, 29] The first approach, namely the bottom-up approach that is similar to the medical model, has been widely used in occupational therapy. It focuses on assessing the client's skills on a body structure or function level according to the International Classification of Functioning, Disability, and Health (ICF).[29] The reverse is true for the top-down approach that evaluates the client's participation in occupation within a certain context and fits more with the activities and participation level of the ICF.[29] From the evaluation of the client's participation, information is gathered on the client's abilities. It is important that the approach used to assess is chosen based on the individual needs of the client, and to ensure best practice.[29]

Therapists further make use of both standardised and non-standardised assessments as part of clinical practice.[19] A study conducted on the assessment of the upper limb as part of clinical practice by De Klerk, found that South African OTs still prefer non-standardised assessments and observations in the clinical setting.[18] Suggested reasons for this occurrence are (a) lack of knowledge and (b) lack of skill in utilising standardised assessment methods.[18] De Klerk further states that consensus regarding the evaluative and discriminative value of available measuring tools has not been reached.[18] Similarly, Sansonetti and Hoffmann report that there is limited research that investigates OTs' clinical reasoning involved in the selection of especially cognitive assessments.[28] Chapleau explains that the role and scope of assessment within the occupational therapy process is affected by a number of external factors that place high demands on OTs and influence their assessment choices.[30] These demands include: information overload, continually evolving scope of practice, productivity demands and accountability demands.[30] Chapleau warns that these demands could lead to the sacrifice of the individualised approach we aim for in occupational therapy.[30]

Innes and Straker describe that assessments used to evaluate the client's skills on a body structure or function level need to be considered excellent in order to facilitate best practice.[27] They also report that clinical utility seems to be prioritised when evaluating the assessment method.[27] Laver Fawcett affirms clinical utility as an important consideration and states that validity and reliability alone will not ensure usefulness of an assessment method.[19]

2.2.1. Clinical utility

Clinical utility involves aspects such as practicality, cost-effectiveness, time-effectiveness, applicability, credibility, and value among others of assessments in clinical practice.[14, 19] In essence it refers to the extent that the assessment can be considered useful.[19] Matheson prioritised the attributes of clinical utility as follows: safety, which is the primary concern, practicality, reliability and validity.[1] Practicality refers to practical issues including, cost and time related to administering the assessment, portability, and ease of conducting the assessment.[19] Innes and Straker state that validity and reliability have to be emphasised when considering the choice of an assessment.[27]

2.2.2. Validity

2.2.2.1. Clarification of validity

Validity refers to the degree that an instrument measures what it intends to measure and the usefulness of the inferences made from the test results.[16, 19, 31] Validity thus does not refer to the assessment or instrument itself, but rather to the results obtained and inferences made from these results.[31] There is no single measure to determine whether an assessment method

has adequate validity and it is advised that multiple studies of the various forms of validity be conducted in light of the assessment's intended purpose and population.[31] Therapists should then be able to identify an appropriate assessment method based on the purpose of the assessment, test population and context.[31] Various forms of validity have been described as relevant for work assessments. All forms are equally important for work assessments: face and content validity demonstrate the relevance of the assessment, criterion validity is important to predict ability to work, and construct validity is important to discriminate between different groups, changes in ability following intervention and that the assessment adequately assesses the constructs on which it is built.[31] The next section outlines face validity.

2.2.2.2. Face validity

Face validity is considered an important attribute of clinical utility[19] and refers to the degree to which the assessment seems to measure what it intends to measure. A collective opinion of experts can determine face validity by reaching a consensus on whether the assessment seems relevant.[19, 31] It is sometimes referred to as the least scientific definition of validity as it is based on opinion and not rigorous research.[16] Face validity is reported to contribute towards acceptability.[19] A lack of acceptability could possibly have a negative effect on assessment results as the client's perception of the assessment could impact their performance. The perception of relevance is thus considered equally important when determining face validity.[16]

2.2.2.3. Content validity

Content validity refers to the degree to which the assessment items are representative of the aspect assessed.[16, 19] For example, are all the test items included in a work assessment representative of the client's job demands.[31] Laver Fawcett and De Vos explain that content validity is determined by the collective opinion of experts, and although it may seem subjective, the inclusion of a number of experts manages the risk of bias and misinterpretation.[16, 19] In order to determine content validity, the following has to be established:

1) Is the assessment truly measuring what it intends to?[16, 19]
2) Does the assessment include an adequate representation of the aspect being measured?[16]

It is achieved by further defining how assessment results correlate with overall performance in the aspect measured.[19] When determining this, the evaluation of the weight of subsections in an assessment is also important.[19]

2.2.2.4. Criterion validity

Criterion validity is more objective and involves comparing the scores of an assessment to an external criterion believed to measure the aspect intended to measure.[16] The criterion used should in essence have established validity and reliability.[16] In other words, determining criterion validity can be achieved by statistically comparing the assessment method with a "gold standard".

2.2.2.5. Construct validity

Construct validity refers to the degree to which an assessment is able to measure a hypothetical construct.[31] For example, can the assessment differentiate between clients who are able to work at a standard speed, when the construct being measured is work speed. There are numerous methods of determining construct validity: known groups method, correlation with other tests, hypothesis testing, and factor analysis.[31] Content and criterion validity can be used to support construct validity.[31]

2.3. Work assessments

Work assessments are conducted as part of work practice services or vocational rehabilitation.[4] Functional capacity evaluation (FCE) is a term used interchangeably with work assessments and involves the assessment of physical, cognitive and psychosocial abilities. The goal of work assessments includes determining an individual's ability/disability to work, and to guide decision making with regard to intervention required.[4] One of the outcomes of vocational rehabilitation is gainful employment for persons with disability.[4]

Considering the history of vocational rehabilitation in South Africa, the following key aspects are important to understand how this service has developed. In the 1960s, research was conducted on the development of work assessments, and the use of work therapy as part of mental health intervention.[4] In the 1970s to 1990s, occupational therapy was aimed at improving the economic status of their clients after the acute stages of rehabilitation.[4] This lead to the establishment of various institutions that would foster entrepreneurial opportunities for persons with disability.[4] Furthermore, a variety of community and health resources were used to facilitate job placements, and to overcome negative attitudes of employers and the community.[4] Despite these diverse and encompassing efforts, it seems as if successful integration of persons with disability was limited and one of the main reasons for this was identified as a lack of legislation to support inclusion.[4]

Since the first democratic constitution, as well as the Labour Relations Act and Employment Equity Act together with their codes of good practice, was implemented, the rights of persons

with disabilities have been more at the forefront.[4, 8] This led to increased services being provided by OTs with regard to vocational rehabilitation.[4] However, as evidenced by the continued low levels of employment of persons with disability, together with inequality with regard to income, it seems as if these acts have not been implemented broadly to reduce exclusion and inequality.[8] With the 2030 vision described in the WPRPD,[8] the need for and the role of OT in work-related practice remains significant. OTs are considered to be uniquely qualified to promote employment of persons with disability and the use of work assessments is considered to be valuable in this pursuit.[4, 11] Although it has been found that South African OTs in the private sector routinely perform work assessments, the Gauteng Vocational Rehabilitation Task Team found that therapists working in the public sector avoid writing work-assessment reports due to the possible legal implications, and a lack of confidence and skills in the field.[15] This is concerning considering that these assessments should form part of the application of a government grant.

The process of performing a work assessment has been described as dynamic and based on the worker-pathology-work profile of the client, and in keeping with the individualised philosophy of occupational therapy. The occupational profile as discussed previously remains relevant and precedes vocational testing.[4] Vocational testing, FCE or work assessments are then performed and are customised to the individual, based on the diagnosis, reported and observed limitations, their work demands and interests, so that recommendations made are relevant to the client and his/her needs.[4] Work assessments traditionally include activities with established norms such as work samples, standardised assessments, work simulation and clinical assessments.[4]

Sandqvist and Hendriksson propose that the following three dimensions should be considered when performing work assessments: *Dimension 1*: Work participation and society. This refers to the degree to which the individual has access to gainful employment, political, legislative and societal support in the endeavour, as well as the expectations placed on the individual. *Dimension 2:* Work performance and the individual. This refers to the individual's ability to deliver satisfactory work with regard to quality and quantity. *Dimension 3:* Individual capacity and physical/psychological function. This refers to the body functions and structures that indirectly affect the individual's performance in work-related activities.[32]

Matheson et al. describes the assessment of one's ability to work as the core of determining work disability.[33] It gives insight into a person's abilities that can then be matched to the demands of employment.[33] Kielhofner suggests that "functional assessment is often used to determine what freedoms a person will and will not have, what roles he or she may take on,

what activities he or she may do, and what benefits or resources he or she will receive."[34] A well-designed work assessment method needs the following characteristics: comprehensive, standardised, objective, reliable and valid.[13] The greatest challenge in general with regard to work assessment methods is a lack of validity in all areas, thus it requires further research and improvement.[1, 13, 35] Likewise, Matheson et al. also assert that focus should be placed on the procedures used to assess ability to work, which includes the choice of assessments used.[33] Emphasis is again placed on the usefulness and acceptability of the process by all stakeholders.[33]

In a survey conducted in 2004/5, it seemed as if work assessments contributed to the largest case load of South African vocational rehabilitation therapists, and that it was a pre-requisite for most other vocational rehabilitation services provided.[4] In light of the vision of increased gainful employment of persons with disability, it is important to understand what abilities, skill and freedoms an individual retains. Moving away from the medical model that focuses on diagnosis, prognosis and anticipated limitations, to a functional model that focuses on the retained abilities, is thus necessary.[8] It is only after understanding how a person can contribute to the economy and workforce that it will be possible to explore gainful employment options with equal career progression opportunities. Work assessments should thus not only determine a baseline of ability or limitation, but also guide intervention aimed at decent work for all persons and occupational justice.

As discussed previously (see Section 2.2), two main approaches to assessment exist, namely bottom-up and top-down approaches. It is noted that therapists use both approaches, as well as a bi-directional approach, in the evaluation process.[29] Work assessments often make use of the assessment of body function and structure, in order to predict a functional outcome or to understand the functional presentation of a client. Using this approach determines impairment, whereas evaluating occupational performance determines disability.[36] Chapleau reports that, despite our theoretical and philosophical base that should incline OTs to use a holistic and more functional approach to assessment, it seems that therapists are more likely to adopt the medical model of the bottom-up approach.[30] However, research has not adequately demonstrated the predictive value of this approach.[30] Gillen similarly reports that OTs should move away from using novel and abstract tasks in assessment, and back to a functional approach to assessments, simulating real-life situations in the correct context.[37] This is in essence what sets the OT profession apart and is considered more accurate in determining occupational performance.[37] A form of occupation-based assessment used in work assessments, is work samples.

2.4. Work samples

Work samples are a type of assessment that involve engaging in performance measures that are similar to that expected in the real-life position.[38] It is a method that shifts the focus from traits and predispositions to observable behaviour.[39] Gillen reports that although novelty in assessments has its place, it can place our clients at a disadvantage. This is because it requires increased attentional control and decreases overall performance as one is unable to use procedural knowledge, and it compromises secondary task performance.[37] In contrast, work samples involve the use of real-life tasks within an appropriate context to measure performance and are considered a top-down approach to assessment.

Work samples usually have time standards that form part of the evaluation. Kung et al. reported that a large number of research and systemic reviews support the overall validity of work samples as predictors of work performance.[22] They evaluated the construct and criterion validity of work samples in predicting safety in a physically demanding job.[22] Their conclusion was that work samples are able to accurately predict work performance.[22]

Matheson et al. explain that a client will have a work disability if he or she is not able to meet the minimum demands of employment due to a physical or mental limitation.[33] A qualified worker is defined by the ability to produce the adequate quality and quantity of work, leading to the importance of work speed.[24]

2.4.1. Work speed

It has been described that workforce productivity is a determining factor of the overall performance and sustainability of a business.[40] One of the aspects required for work productivity is work speed.[41] It is thus evident that work speed and the ability to deliver quality work, above being able to meet the physical demands of a job, is of importance when considering a client's work capacity. It is further described that employability is affected by the ability to deliver productive work safely.[41] Based on the importance of work speed and the ability to meet productivity standards, it is important to evaluate work speed as part of a work assessment.

A review of the literature pertaining to how OTs evaluate work speed yielded limited results, especially in recent publications. When using the keywords work speed and occupational therapy, publications related to handwriting speed and typing speed are prevalent, with limited publications that focus on the evaluation of, or importance of, work speed as part of work assessments. From numerous searches over the period April 2017 to August 2018, limited recent publications on work speed could be found. It seems that the earlier, ground breaking

work in the area of work speed has been accepted as comprehensive with seemingly limited need for further research. For instance, Burger and McCluskey found in 2011 that the most recent handwriting speed norms determined in Australia were in 1982.[42] Recent research that focused on the effect of intervention for work-related pain and disorders (especially ergonomic adjustments) often use pain and typing/writing speed to measure the effectiveness of the intervention, although no evidence is presented to support the importance of work speed.[43, 44] Another study that investigated the effect of a treadmill work station prioritised productivity as a factor that should not be negatively affected by the proposed work station.[45]

When investigating earlier work, it was found that in the 1950s, vocational rehabilitation hospitals in Australia identified the need to measure work speed of all rehabilitees in tasks that simulated their proposed employment in order to evaluate suitability.[46] Employment options at that time were mainly limited to production work where clients performed repetitive cycles that form part of a production process. This was based on the belief that it was the most basic form of employment with the lowest demands.[46] The industries that utilise repetitive cycle work, often made use of method study and work measurement techniques in order to set production standards. Method study refers to the investigation of the most effective method to perform a specific task. Work measurement refers to the determination of how long a qualified worker should take to complete the task.[46] OTs thus started using method study and work measurement, to develop work speed assessments based on what work was available for rehabilitees.[46] A work measurement technique that is widely used, especially by engineers, is the Predetermined Time Standard (PTS) system which is discussed under Section 2.4.2.

In contrast, occupational health psychologists use work performance (specifically work quantity and work accuracy) to measure the effect of demands and control on employees and to extrapolate results to active learning.[47] This indicates that work speed and accuracy are important measures of work ability. Industrial engineers continue to utilise work measurement and method study in an attempt to improve productivity especially in the production industries, with some work being done in the construction industry as well.[48-50] From the publications of other professionals, it seems that work speed remains an important factor of work ability. OTs have published limited data on the subject, possibly because it is accepted that new research might not add to the body of knowledge, or due to other professionals presenting enough evidence.

2.4.2. Predetermined Time Standards (PTS)

PTS is an advanced technique in which a reasonable standard of work is determined for an experienced worker.[51] In the field of engineering, PTS is widely used to describe manual

labour involved in assembly sequences.[49] It is commonly used to determine labour cost by analysing which movement is performed and under which conditions.[49]

There are numerous PTS tools available such as: MODAPTS, MTM, Work factor and Master Standard Data. MTM was the first PTS to be utilised by OTs in order to develop work assessments.[46] However, over the years MODAPTS has been preferred by engineers and OTs because there are fewer motion elements for clerical and transit work (69) to learn as opposed to the MTM (400) and MSD (150).[38, 46] MODAPTS has also been preferred for its simplicity and universal jargon, which is understood by health care and legal professionals alike.[51] At present, MODAPTS is used by international companies such as Ford Motor Company and Jaguar Land Rover.[49] Both MODAPTS and VCWS, which is based on MTM, are taught at undergraduate level at some universities in South Africa.

2.4.3. Valpar Component Work Samples (VCWS)

The VCWS were originally developed as a standardised predicting tool that could be applied to most industrial jobs and are based on MTM.[52] MTM is more complicated than MODAPTS, as it involves a significantly greater number of codes. At present, VCWS are well-known commercially available work samples and are widely used in South Africa. They have been used internationally on able-bodied as well as disabled individuals as both assessment and treatment tools.[52] They are regarded to be the gold standard for work samples. The VCWS are criterion referenced, and thus generalisable to populations outside of America where they were developed.[52]

2.4.4. MODAPTS

MODAPTS was developed by Chris Heyde, an Australian engineer, in order to determine production standards in the engineering sector.[51] MODAPTS uses a criterion-based standard based on empirical studies done in the 1960s and 1970 where individuals were chosen at random and their work speed measured.[51] The standard of MODAPTS is based on a “qualified worker”, in other words a person with experience and necessary attributes required in the assessed task.[24] The manual describes the actions and layouts clearly, which assists in controlling as many variables as possible.[53]

MODAPTS works on the assumption that all body movements can be described as a multiple of the time that it takes to move a single finger. This time is 0.129 seconds and represents one MOD. Other classes of activities such as grasping, placing, walking, foot control, using tools, mental operations and clerical operations are also included.

In the field of OT, limited peer-reviewed publications evaluate the application of MODAPTS as a means of assessing work speed. Judith Farrel, in her thesis (1986) explains how at first MTM standards were used to evaluate rehabilitation patients in order to assess their suitability for certain jobs.[46] However, the task was cumbersome and time-consuming due to the many codes included in the MTM method. When MODAPTS was developed, it was found to be far easier to learn and apply by OTs in assessing rehabilitees for a variety of jobs.[46]

Recent literature does not investigate the application of MODAPTS as an assessment method however. MODAPTS is mentioned by authors as an assessment method used as part of work assessments, although no evidence of its validity could be found. Researchers have further utilised MODAPTS as part of their methodology to assess change in performance, although no rigorous research on the assessment method itself, or the opinions of OTs of the method, could be found. A survey conducted within the South African Public Health care setting revealed that MODAPTS has not gained the confidence of South African (SA) OTs as a valid and reliable assessment method.[15] Possible reasons for limited publication on the application of MODAPTS as an assessment method could be that the profession is content with the existing body of knowledge, or that confidence is placed in the evidence provided by other professionals. It could also be that MODAPTS has not gained the confidence of SA OTs to the extent that further research was warranted.

In contrast, in the field of Engineering, MODAPTS seem to be an accepted PTS and is utilised by large international companies. MODAPTS is used in Industrial Engineering to quantify the amount of time required to perform certain tasks through analysing how the task is performed.[54] It is further used to guide the design and planning process of manufacturing and to set production standards. Additionally, it can predict the time required of a task without the task having to exist, it is also used to estimate safety and to control quality.[54]

Heris Glopîra found in his research that MODAPTS is applicable when predicting the duration of a task.[55] He concluded that MODAPTS correlates with other predefined methods and that its applicability and reliability was thus demonstrated.[55] In research published in engineering, MODAPTS is often the preferred PTS utilised in methodology for its simplicity.[49, 54] Within the field of engineering, researchers have used MODAPTS as the gold standard when investigating alternative means of predicting time required for tasks demonstrating that engineers have high levels of confidence in the method.[49]

2.5. Conclusions

Within the South African context, the need exists for an assessment method of performance that is accessible and cost and time effective. There seems to be a need for increased use of work assessments especially in the public sector.[15] MODAPTS is a cost and time effective alternative[55] to evaluate work speed as part of work assessments. As a possible solution to the above-mentioned challenges that therapists face in the South African context, and in light of the numerous statements that work assessment methods need further investigation and research, thorough evaluation of the validity firstly and reliability thereafter of MODAPTS is indicated.

3. CHAPTER 3: METHODOLOGY

3.1. Introduction

This chapter explains the process followed to conduct the study. The study design, sampling strategy and methods of data collection are discussed. The chapter is structured according to the various research objectives. Furthermore, the ethical considerations that were taken into account are explained.

3.2. Research design

A quantitative cross-sectional study design was utilised as the data was collected at one point in time from various people and is exploratory and descriptive in nature.[16] The study setting was private and public health care settings in South Africa that have occupational therapy departments providing vocational rehabilitation services. The figure below provides an overview of the research process and how it was conducted.

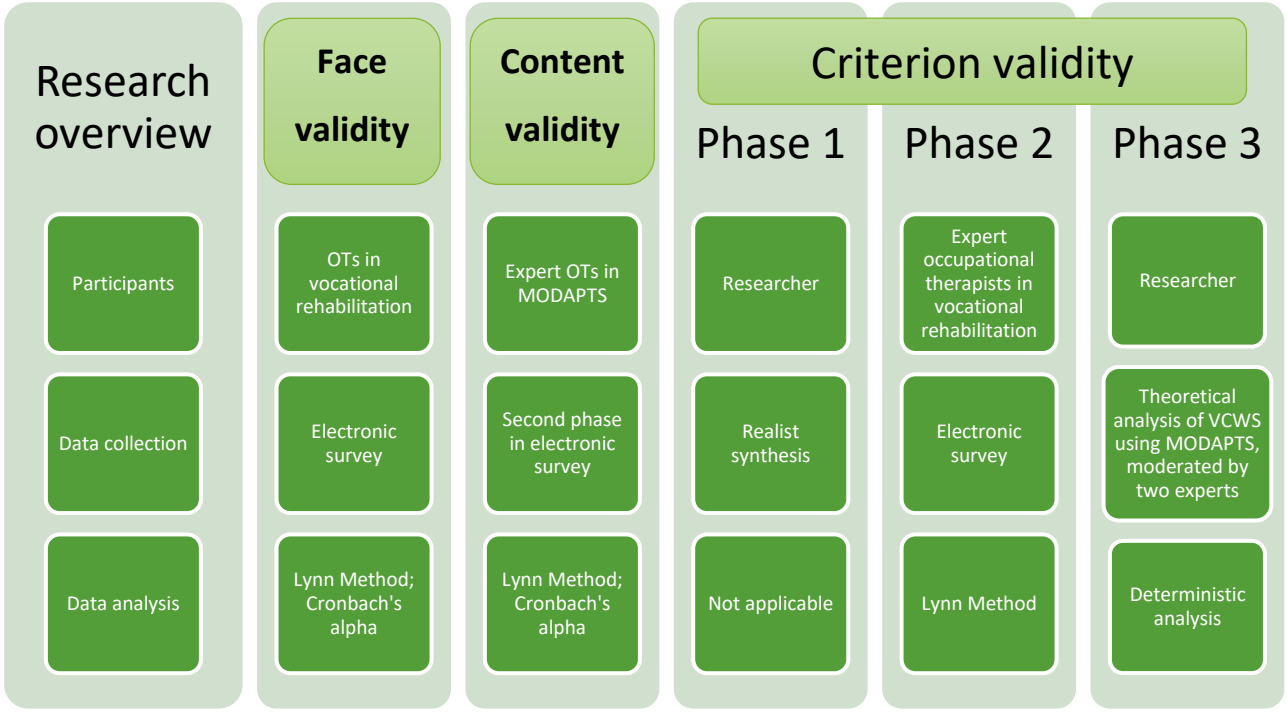

Figure 2: Diagram of research overview

3.3. Determining face validity

3.3.1. Population

The population consisted of OTs working in the field of vocational rehabilitation in the public and private health care settings in South Africa. There are 380 OTs registered at the Occupational Therapy Association of South Africa (OTASA) working in the field of vocational

rehabilitation, there are 19 members in the Gauteng Vocational Rehabilitation Task Team and approximately 18 in the KwaZulu-Natal Vocational Rehabilitation Interest Group, some who are also registered with OTASA. These therapists were chosen since most therapists in the private sector will belong to OTASA in order to access Medical Protection Insurance and those working in the public health sector are expected to be members of the mentioned task teams. These professional bodies were also the platform used to distribute the survey.

3.3.2. Sampling method

The sampling method used was purposive, total sampling. The questionnaire started with questions that determined whether a respondent met the inclusion/exclusion criteria and if the respondent did not meet the criteria, the questionnaire ended. The questionnaire was thus sent to the entire population leading to complete sampling. Additionally, snowball sampling was used to increase the response rate as the population is quite finite. Snowball sampling was applied by asking participants to send the questionnaire to all colleagues who they may feel could contribute to the study. The following inclusion and exclusion criteria were applied. In-service training in MODAPTS was considered an exclusion criterion as there is no way to determine the level and quality of such training. It was important for the respondents to have developed a moderated work sample using MODAPTS in order to evaluate face validity.

i. Inclusion criteria

- OT registered at the Health Professions Council of South Africa (HPCSA).
- Underwent undergraduate or postgraduate training in MODAPTS that involves the development of a work sample.
- Currently working and/or teaching in the field of vocational rehabilitation.

ii. Exclusion criteria

- OT registered with regulatory bodies outside South Africa.
- Underwent informal or in-service training in MODAPTS.
- Have not developed a moderated work sample using MODAPTS.

3.3.3. Sample size

The questionnaire was disseminated to OTs working in the field of vocational rehabilitation through available networks, that is OTASA and various task teams that consisted of approximately 380 OTs.

3.3.4. Method of data collection

An electronic questionnaire constructed using Qualtrics was disseminated through OTASA and various task teams. The questionnaire was sent to the target population with built-in informed consent form, inclusion and exclusion criteria and all relevant questions. A description of the questionnaire construction is described in Section 3.3.5.

3.3.5. Measurement tool

An electronic questionnaire was developed using Qualtrics (Annexure A). The questionnaire had an introductory letter and asked for informed consent (Annexure B) before the questionnaire began. The first set of questions addressed the inclusion and exclusion criteria for face validity. If a respondent did not meet the criteria, the questionnaire ended and was submitted, thanking the respondent for their participation. If the respondent met the criteria, the questions opened that related to face validity. Demographic questions were included in order to report on the representation of data with regard to settings. The questionnaire made use of a 4-point Likert scale (strongly agree, agree, disagree and strongly disagree)[20, 56] to gather the collective opinion of OTs regarding the acceptability of MODAPTS as an assessment method of work speed. Questions were formulated on the premise that face validity is based on whether the assessment method seems to assess what it intends to, and whether it is considered acceptable.[16, 19] Questionnaires that were submitted prematurely, or incomplete, were excluded in the analysis of the results since a premature or incomplete submission could be due to a participant withdrawing from answering the questionnaire. They were allowed to do so based on the ethical principle of autonomy.[57] Qualtrics is able to exclude incomplete surveys from the results generated. The following figure demonstrates the flow of the questionnaire.

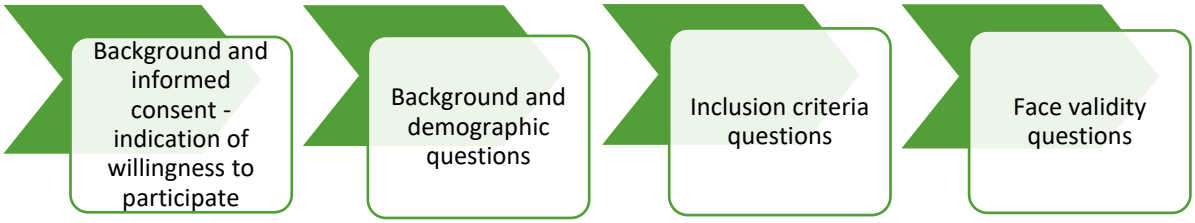

Figure 3: Overview of face validity questionnaire

3.3.6. Pilot study

A pilot study was conducted to evaluate the effectiveness and functionality of the questionnaire. The sampling was purposive and included two persons who are considered experts in questionnaire design, and three persons who had previous MODAPTS training.

The sample was derived from academic staff at South African institutions of higher learning. For the purposes of the pilot study, all questions related to face and content validity were available as it was expected that the sample of respondents would not meet the inclusion criteria. They were asked to provide written feedback on a word document with the questions provided with specific focus on whether all questions were clear and whether the questionnaire was user-friendly. The feedback was taken into consideration and a final questionnaire was drafted (Annexure A and C).

3.3.7. Data management and statistical analysis

The captured data was exported to an Excel spreadsheet. Data cleaning took place to ensure that the results of questionnaires not completed fully were not included. Only the data of respondents that completed all of the questions (and thus met the inclusion criteria) was included in the statistical analysis. The spreadsheet is kept on the researcher's computer and an external drive, with password protection. The external drive will be kept at the University of Pretoria for the prescribed storage period of 15 years. Based on a larger sample size (more than six participants), an agreement of 78% regarding the acceptability of MODAPTS was used to determine adequate face validity using the content validity index as described by Lynn.[58, 59] A descriptive analysis of the demographic information was done in order to determine the representation of respondents with regard to setting. Internal consistency of the results was evaluated using Cronbach's alpha.[60]

3.4. Determining content validity

3.4.1. Population

The same population as discussed under Section 3.3.1. was used. This is due to the fact that methods described to determine face and content validity both involve expert opinion.[16]

3.4.2. Sampling method

In order for a respondent to meet the inclusion criteria of the second research objective, they had to first meet the inclusion criteria for face validity. As a measure of convenience one questionnaire was used, with additional questions for the respondents meeting the extra inclusion criteria of this objective. The questionnaire was thus sent to the same complete sample as discussed under Section 3.3.2. Due to only one participant meeting the inclusion criteria of the objective and thus inadequate responses received, a purposive sampling strategy was utilised. The researcher personally contacted various experts and requested their participation in the study, and sent the questionnaire directly to these experts. The experts were identified on the grounds of the inclusion criteria.

i. Inclusion criteria

- Meet the inclusion criteria as discussed under face validity (Section 3.3.2).
- If not working in the field of vocational rehabilitation, be engaged in tertiary education in the field of vocational rehabilitation.
- Have experience in providing training in MODAPTS and work assessments or have published on the subject.

ii. Exclusion criteria

- Have not developed a moderated work sample using MODAPTS.

3.4.3. Sample size

A sample of five experts was identified and invited to take part in the research the five experts contacted was the only five identified based on the inclusion criteria. A total of three responses was received.

3.4.4. Methods of data collection

Please refer to Section 3.3.4. as the same method of data collection was used. As few respondents met the criteria for the content validity questions, purposive sampling was applied and the survey was sent directly to identified experts as discussed in Section 3.4.2. A shortened questionnaire with only the questions related to content validity was utilised. Please refer to Annexure C for the questionnaire.

3.4.5. Measurement tool

As a measure of convenience, the questionnaire related to content validity was attached to the questionnaire related to face validity as respondents had to meet the inclusion criteria of the face validity questionnaire firstly, in order to meet the inclusion criteria for the content validity questionnaire. After completion of the face validity questionnaire, additional questions were listed to determine whether the respondent met the additional criteria for the content validity questionnaire. If they did not meet the criteria, the questionnaire ended, thanking the respondent for their participation. If they met the criteria, the questions related to content validity opened. A four-point Likert scale (strongly agree, agree, disagree, strongly disagree) was used to determine the relevancy of each of the category codes currently depicted in the MODAPTS manual with regard to the current South African context.[20, 59]

3.4.6. Pilot study

Please refer to Section 3.3.6. as the same method, was used to pilot the questionnaire for both face and content validity using the same sample.

3.4.7. Data management and statistical analysis

The Lynn method was used to determine the content validity index.[59] As fewer than six participants responded, an agreement of 100% is needed to determine content validity. Internal consistency was determined using Cronbach's alpha.[60]

3.5. Determining criterion validity

The determination of criterion validity was done in three phases:

- Phase 1: Deciding which samples of the VCWS Series to use for comparison based on the results of a realist synthesis.
- Phase 2: Determining the relevance of the included samples for comparison and making changes if needed.
- Phase 3: Analysing the time standard of the selected four activities with MODAPTS. The MODAPTS analysis of the four activities was compiled by the researcher and moderated by two experts in order to ensure correctness of the analysis. A contact session, with both experts present, was used to facilitate the moderation process. The process of moderation is discussed in Section 3.5.4.3. The MODAPTS standard time was compared to the MTM standard time for the selected tasks.

3.5.1. Population

The population consisted of OTs registered at OTASA working in the field of vocational rehabilitation in the public and private health care settings in South Africa who are considered experts in the field.

3.5.2. Sampling method

Experts were purposively sampled in order to review the relevance of each of the chosen activities based on the following criteria.

i. <u>Inclusion criteria</u>

- OT registered with the HPSCA.
- Working in the field of vocational rehabilitation.
- Have undergraduate or postgraduate training work assessments that involved a moderated work assessment performed as part of training.

- Have at least three years' experience in the field of vocational rehabilitation.
- Have published or presented at a national or international conference within the field of vocational rehabilitation.

ii. Exclusion criteria

- OTs working outside of South Africa.
- OTs with in-service training in vocational rehabilitation and work assessments as opposed to formal training.

3.5.3. Sample size

A sample of six experts was considered ideal, although a minimum of three experts would be adequate.[59] A total of three responses was received.

3.5.4. Methods of data collection

3.5.4.1. Phase 1: Realist synthesis to develop list of tasks for comparison

A realist synthesis of literature was conducted using various databases.[61] The purpose of a realist synthesis is to transparently synthesise relevant evidence in order to gain understanding into how certain interventions work. The aim is to explain the mechanisms and contexts involved in these interventions as opposed to judging the interventions.[62] A combination of the methodology as described by Rycroft-Malone et al and Wong et al et al was followed.[61, 62] The realist synthesis was performed to inform on the relevant VCWS to use in order to compare MTM and MODAPTS standard times. The following figure summarises the process followed.

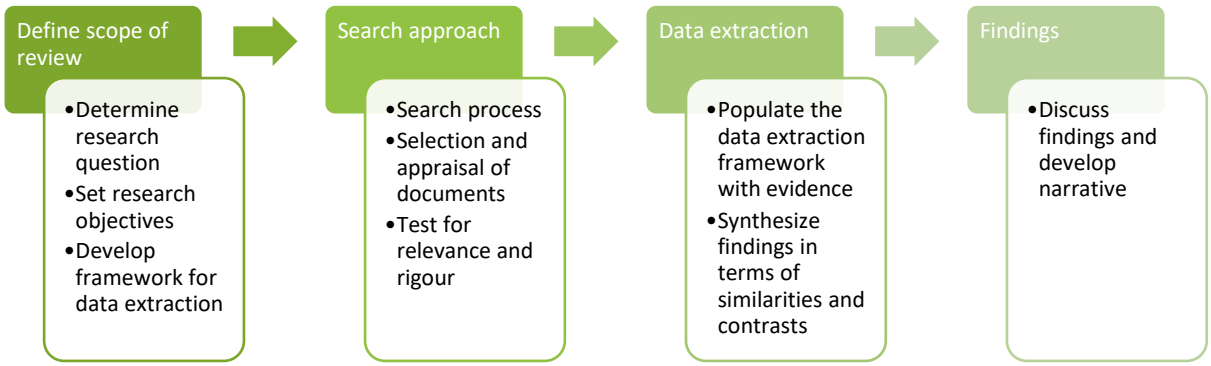

Figure 4: Realist synthesis process

i. Scoping the literature

A broad review of the literature was undertaken in order to develop the frame of reference to understand current trends in functional capacity evaluations, with specific reference to the content of such evaluations. From this review of the literature, a few themes emerged which led to the development of a provisional framework that would focus on the content of functional capacity evaluations, as well as the therapists' decisions on the content of these evaluations.

ii. Searching process

A literature search was conducted using the following databases: PubMed, Medline, CINAHL, and Web of Science Core Collection over the period July 2017 to August 2018. The following keywords and their synonyms were used: functional capacity evaluations, work assessments, disability assessments, outcome measures, vocational evaluations, job placement, job match.

iii. Selection and appraisal of documents

An iterative search was conducted using the above-mentioned process. Material was identified based on relevance demonstrated in the title and/or abstract. The search was limited to work published between 1990 and 2017. A total of 841 documents was identified based on the keyword search. Based on relevance demonstrated in the title and/or abstract, a total of 56 articles was chosen. The total of 56 complete documents was reviewed and inclusion criteria was applied. The criteria are as follows:

- Does the document conclude on or provide a guideline for the performance skills assessed in a work assessment?
- Is the methodology used scientific and does it demonstrate rigour?

After applying the inclusion criteria, a total of 20 documents was included in the review.

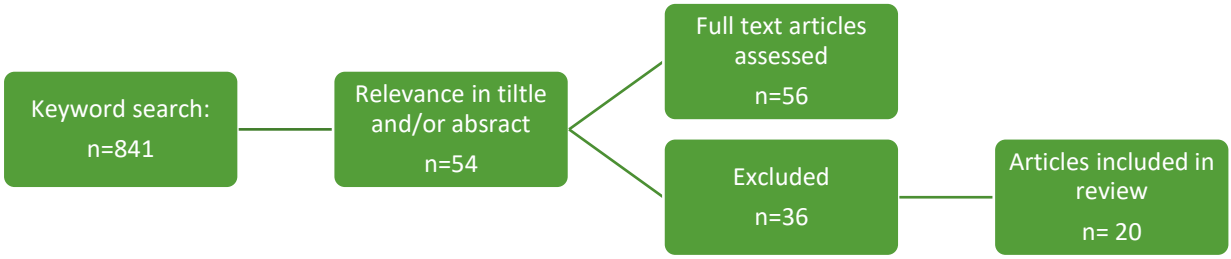

Figure 5: Flow diagram of the search process

iv. Data extraction

In order to conclude on the current trends in FCE with special regard to the content of FCEs, information was gathered regarding the process of FCEs, conceptual frameworks, professional guidelines, choice of assessments, clinical utility, and outcomes of FCEs. Data extracted spoke to the content and reason for inclusion in the FCE process.

3.5.4.2. Phase 2: Determining relevance of VCWS to compare with MODAPTS

From the results of the realist synthesis (Phase 1) a list including relevant VCWS was drafted by the researcher (Annexure D). The draft list was sent by means of an electronic questionnaire to five experts as defined by the sampling criteria. They were asked to indicate the relevance of each of the VCWS to work assessment practice based on their experience (Annexure D). They were asked to rate each item on a four-point Likert Scale. Three responses were received. Based on their responses, no changes were made to the drafted list, please refer to Annexure E for the final list.

3.5.4.3. Phase 3: Developing MODAPTS analysis of VCWS and comparing MODAPTS and MTM standard times

The final list of VCWS based on the results of Phase 1 and Phase 2 was analysed by the researcher using MODAPTS. The VCWS were performed by the researcher and videotaped. The recorded video was analysed using the MODAPTS manual. The MODAPTS analysis was moderated by two experts in MODAPTS and contact sessions were used to facilitate the moderation process with the researcher and two moderators present. During the moderation session, differences were discussed, the manuals of VCWS 9, VCWS 4, and VCWS 6 (revised 2009) and MODAPTS[53] were used to clarify queries, and where needed, a person representative of a qualified worker was brought in and observed performing the tasks. Please refer to Annexure G for the MODAPTS analysis of the chosen tasks as well as moderation notes and Annexure H for the final analysis sheets. The T/PAL Mail Sort assessment was omitted from the analysis as the quest codes that one would use to analyse the task using MODAPTS could not be used based on equipment design that requires movements within the use areas (M3) and the equipment design requiring an M4 (elbow moving away from the body) move. As the analysis could not be confidently compiled and the test was omitted.

3.5.5. Measurement tools

Five experts in vocational rehabilitation were purposively selected in order to evaluate the content validity of the proposed samples for comparison. They were asked to rank each of the proposed samples on a 4-point Likert Scale (definitely relevant, relevant, not relevant, and definitely not relevant). They were asked to evaluate each sample's relevancy based on their

own experience of what the sample measures and how it is relevant to work assessments. Three responses were received.

3.5.6. Data management and statistical analysis

Phase 1: A realist synthesis of literature was conducted and integrated to develop a first list of VCWS to compare using MODAPTS. A combination of methods of data analysis as described by Wong et al. and Rycroft-Malone et al was used.[61, 62]

Phase 2: The Lynn Method was used to determine the content validity of the list of samples. Based on the sample size of three experts an agreement of 100% was required.[59]

Phase 3: The time standards obtained using MTM and MODAPTS for VCWS was obtained. MTM standard adjusted-for-learning (Trial One) was used to compare with MODAPTS based on the definition of a qualified worker as prescribed by the MODAPTS manual. MODAPTS assumes that the worker is qualified, is familiar with the task, and knows what is expected. It further extrapolates that the work rate can be sustained over an eight-hour work day.[53] The MODAPTS analysis was scrutinised in a moderation session between the researcher and two other experts in MODAPTS. Please refer to Annexure F for initial, and Annexure G for the final MODAPTS analyses. A deterministic model was applied to determine whether MODAPTS and MTM standards for the same task are in agreement.

3.6. Validity and reliability

Validity and reliability of the results obtained through the questionnaires was ensured through the pilot studies as discussed in Sections 3.3.6. and Section 3.4.6. The questionnaires were further designed based on literature describing how to determine face and content validity. The software used, Qualtrics, was used to clean the data and only relevant data was included in the statistical analysis. Statistical analysis was done by a qualified professional and confirmed by an independent statistician.

The articles included in the realist synthesis was reviewed and discussed with a supervisor who has experience in vocational rehabilitation. The list of VCWS used to compare MTM and MODAPTS standard times was validated by three experts in vocational rehabilitation. The MODAPTS analyses developed by the researcher was scrutinised in a moderation session with two other experts in MODAPTS to ensure validity and reliability of the MODAPTS analyses.

3.7. Ethical considerations

Ethical considerations were guided by the provisions of the University of Pretoria Ethics Committee and the HPCSA. Approval by the University of Pretoria Ethics Committee was granted in April 2017. Extension of the approval was requested and granted in June 2018. Please refer to Annexure H for the ethical clearance certificate.

The principle of autonomy was applied. Autonomy refers to the right to choose to participate or not.[57] Participation in the research was voluntary and participants were able to seize participation at any time during completion of the questionnaire. Incomplete responses were excluded from the results as it could be due to withdrawal from the research. However, since questionnaires were completed anonymously with no tracking system, withdrawal after submission of the questionnaire was not possible. Information regarding the research and ethical clearance was provided as part of the consent form (Annexure B). Contact details of the researcher and Ethics Department at the University of Pretoria was provided so that respondents were able to access additional information or clarify queries prior to engaging in the research.

Furthermore, anonymity and confidentiality was ensured in that the questionnaire was developed using Qualtrics software, which allowed for anonymous participation.[57] The results were stored within the program that is password protected on a computer that is also password protected to ensure confidentiality of the results.

Another principle that was applied is beneficence and non-maleficence which in essence is to do good and not harm.[57] With regard to beneficence and non-maleficence, indirect benefit was achieved by adding to the existing body of knowledge related to the assessment of work speed and MODAPTS in OT. There was no compensation or direct benefit for partaking in the research. All research carries risk, although in this study the researcher attempted to manage the risks by ensuring autonomy, confidentiality, and providing contact information should any queries or concerns arise.

3.8. Conclusions

A quantitative cross-sectional research design was used to reach four research objectives. The research objectives were investigated individually and involved numerous steps and phases. Electronic questionnaires were developed using Qualtrics and data was analysed using the Lynn Method and Cronbach's alpha. A realist synthesis was conducted using a combination of methodologies as described by Wong et al, and Rycroft-Malone et al. The

realist synthesis informed which VCWS were relevant to use in comparing MTM and MODAPTS standard times. Ethical principles were considered and adhered to throughout the process. The next chapter outlines the results obtained and is structured according to the four research objectives.

4. CHAPTER 4: RESULTS

4.1. Introduction

The following chapter reflects the results of the study. Included in this chapter is a description of the response rate and demographic information of the respondents followed by the statistical analysis of data collected with regard to face, content and criterion validity.

4.2. Face validity

4.2.1. Responses received

There are 380 OTs registered with OTASA who indicated they work in the field of vocational rehabilitation. Although snowball sampling was used to access more OTs, this number was considered the baseline as most OTs working in the field are registered with OTASA in order to access medical negligence protection. A total of 57 responses was received indicating a response rate of 15%. All of the surveys (N=57) that were started were completed, indicating that no participant withdrew their participation after starting the survey. The responses of the participants meeting the inclusion criteria (n=40) was recorded and analysed.

4.2.2. Demographic representation

The following summarises responses on demographic and background questions. The following figure describes the years of experience in OT indicated by the participants. The majority (32.5%) of participants indicated that they have more than 15 years' experience in OT, 27.5% of participants indicated 10–15 years' experience. Participants indicating 3-5 years and 10-15 years respectively were represented by 17.5%. Only 5% of participants indicated 0-2 years' experience.

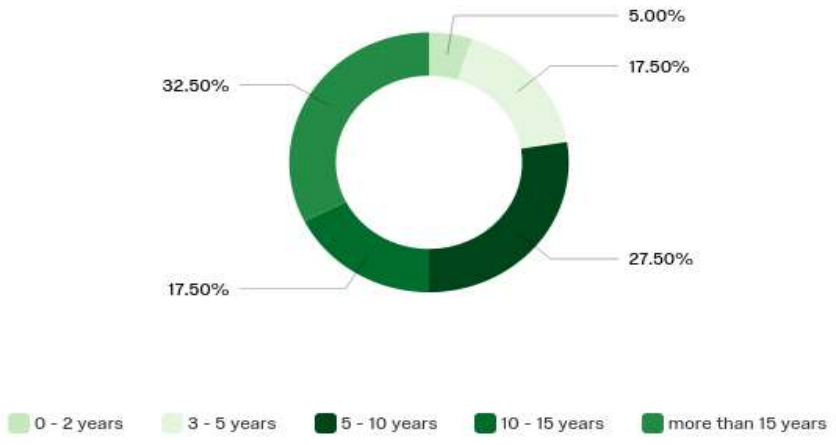

Figure 6: Respondents' years of experience in occupational therapy (regardless of the field of expertise)

As demonstrated in Figure 7: most participants (n=18) graduated from the University of Pretoria, followed by Stellenbosch University (n=8) and the University of Witwatersrand (n=6). Three respondents graduated from University of the Free State. From the University of Cape Town and Western Cape University two respondents graduated respectively.

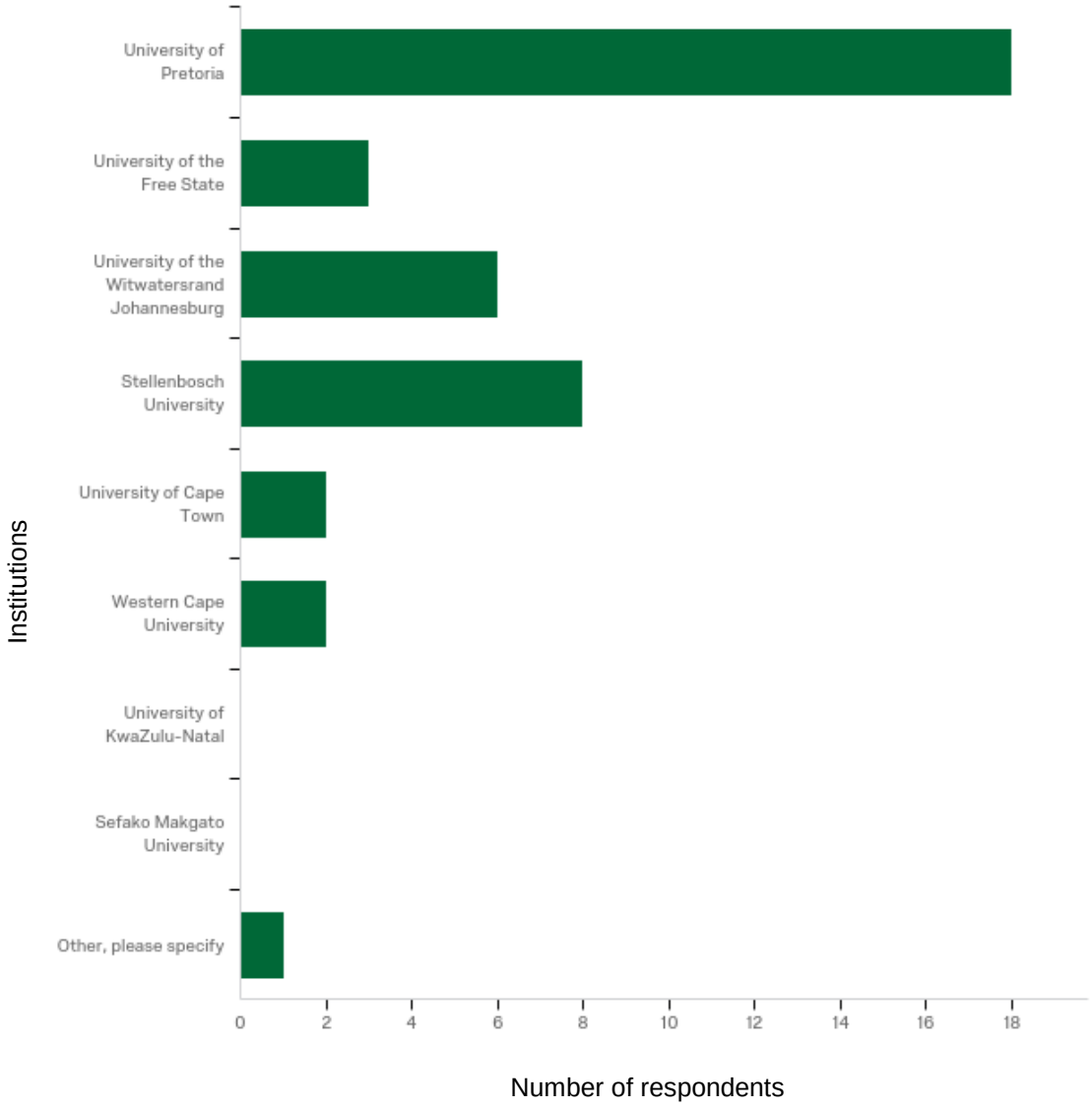

Figure 7: Institutions where respondents graduated

The number of participants (n=30) who held a postgraduate qualification represented 73.2% of the sample. The most prevalent qualification was a postgraduate diploma (n=16), followed by Masters degrees (n=7) and Honours degrees (n=6). Only one participant held a PhD. Postgraduate diplomas specified were in the fields of hand therapy and vocational rehabilitation. Ten participants indicated that they were enrolled in postgraduate qualifications at the time of completing the survey.

The majority of participants worked in private practice (n=25). Three participants indicated that they work in a private practice and at private hospitals. Two participants worked in academia and private practice, two participants worked at private hospitals. Two participants worked at schools. Five participants worked in the public sector and one participant in academia. One participant worked at a private clinic.

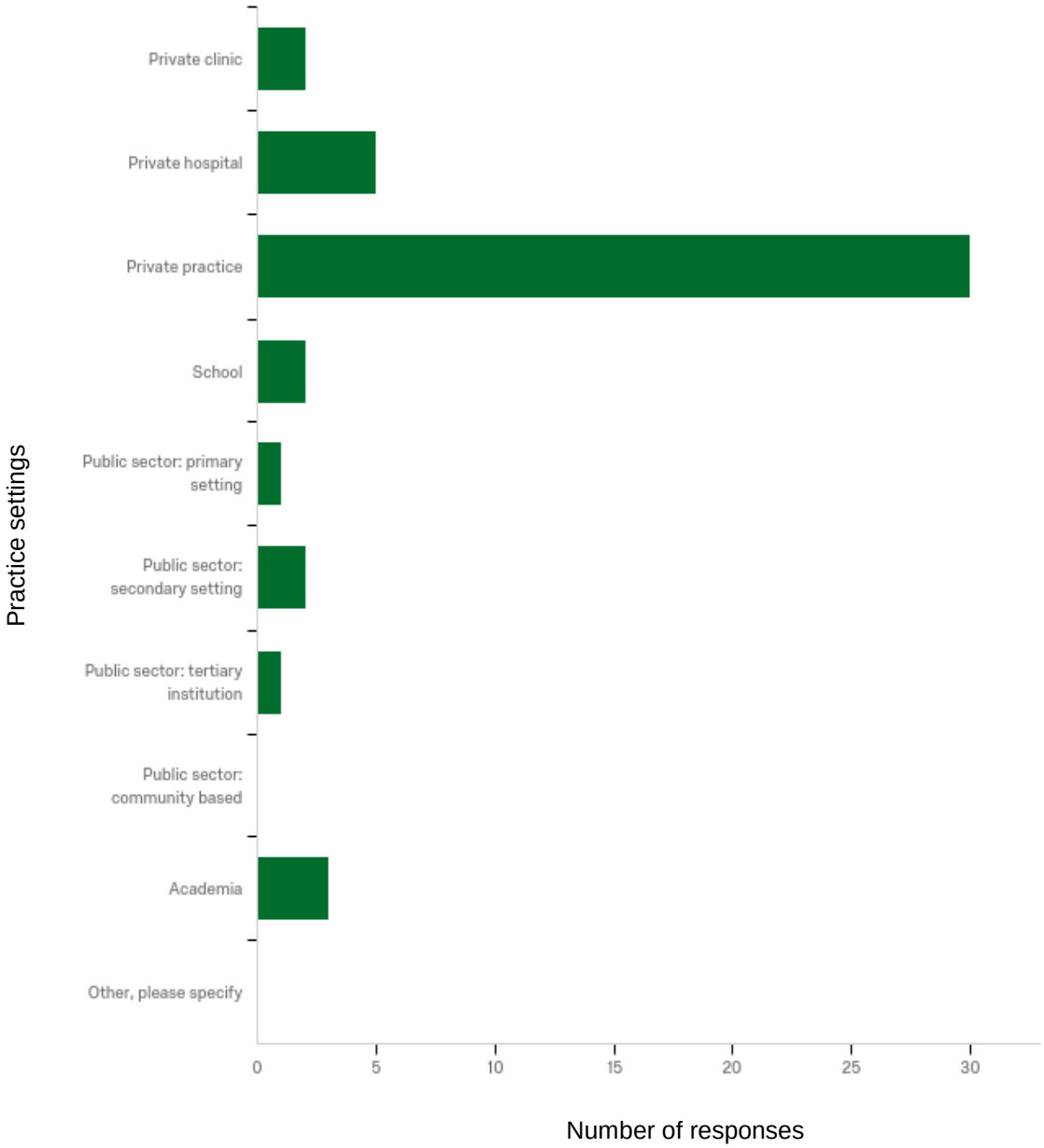

Figure 8: Practice settings indicated by respondents

Considering geographical areas where services are delivered, most respondents indicated Gauteng followed by Western Cape, Mpumalanga and North West. Northern Cape, Limpopo, Free State and Eastern Cape were least represented.

The average number of hours spent working in the field of vocational rehabilitation per week was 21.5 hours (SD=15.35). As seen in Figure 9, functional capacity evaluations form the largest representation of caseloads followed by work rehabilitation, medico-legal work, employee wellness/assistance programs, and claims assessing/consulting. Other services specified include work preparation, prevocational assessments and placement of persons with disabilities.

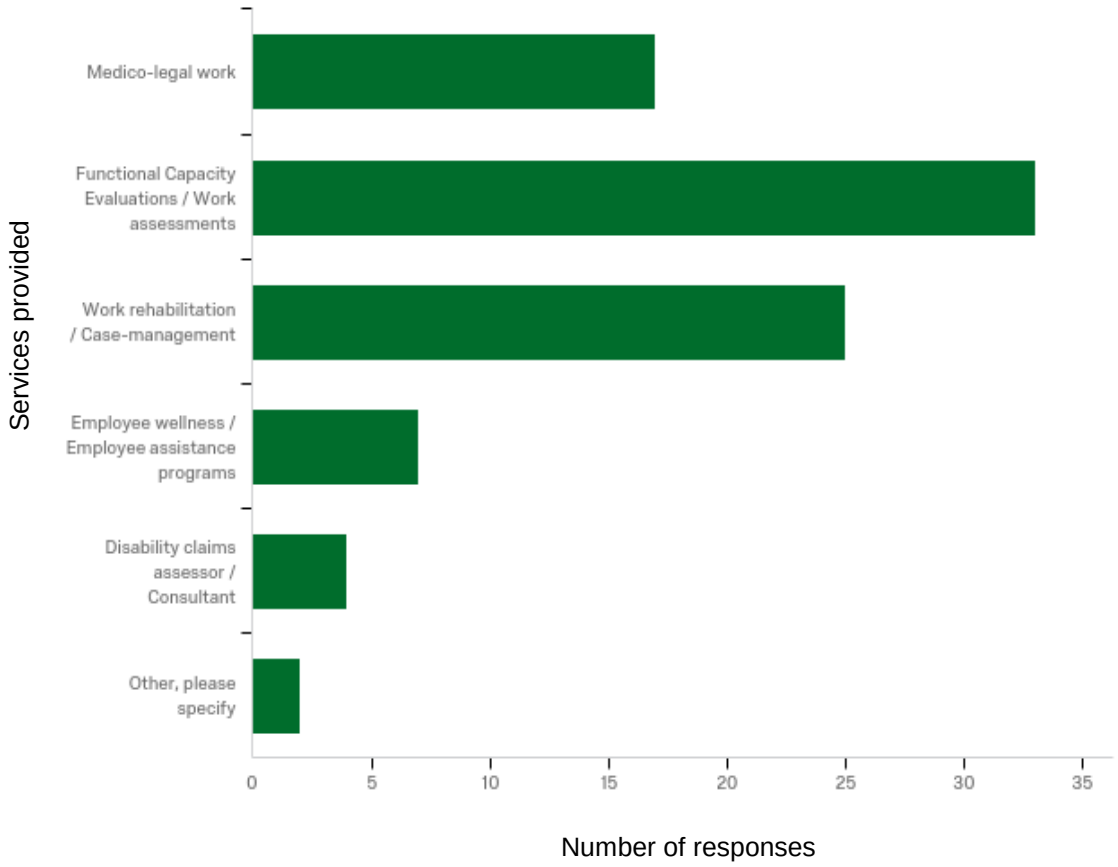

Figure 9: Vocational rehabilitation services provided by respondents

4.2.3. Face validity results

The majority of participants (n=25) indicated a reluctance to develop work samples using MODAPTS with 21 participants indicating that they never develop their own MODAPTS samples. Only 15 participants indicated that they develop work samples yearly, one participant indicated every six months and three participants indicated every three months as intervals for developing work samples using MODAPTS. In contrast, only three participants indicated that they are reluctant to use already developed MODAPTS samples.

Figure 10 demonstrates that MODAPTS samples are administered weekly by 17 participants (42.5%), monthly by 14 participants, rarely by seven and never by two participants. The majority of respondents thus indicate that they are in favour of using developed MODAPTS samples.

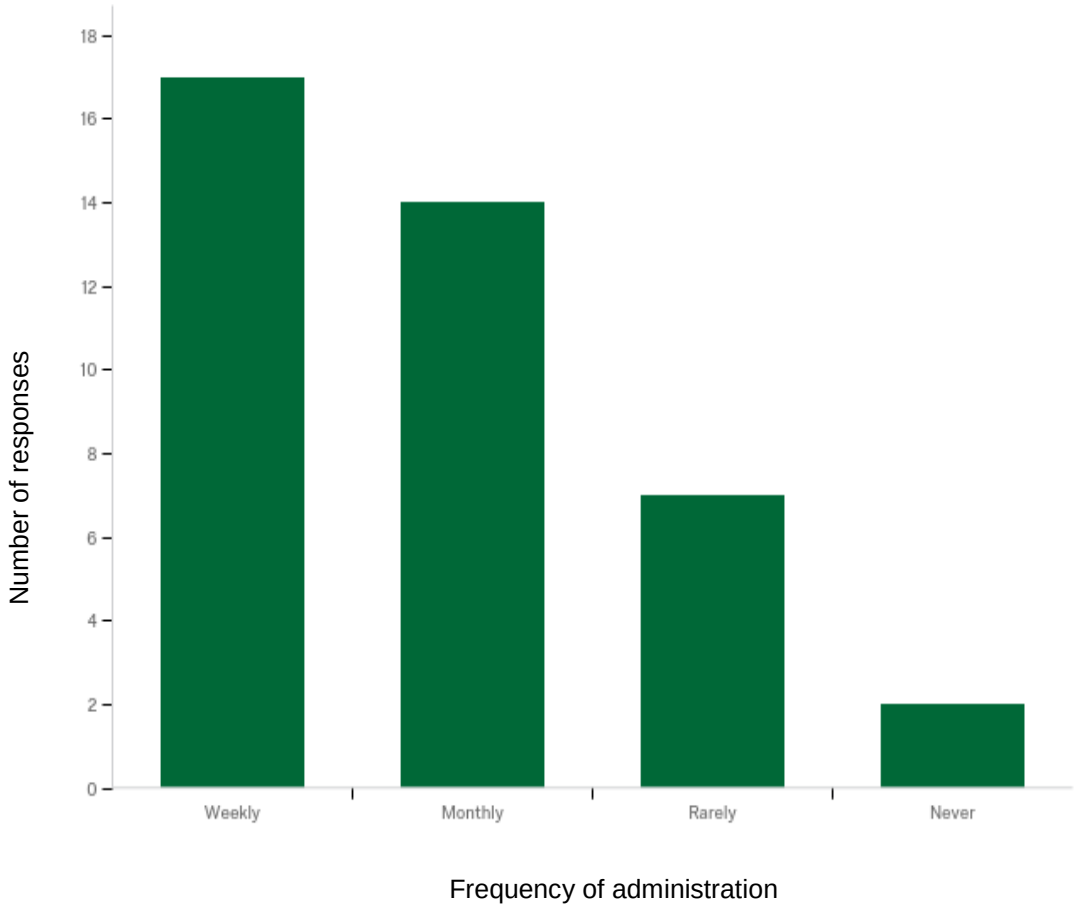

Figure 10: Frequency of administration of MODAPTS samples

Reasons for the reluctance to develop MODAPTS work samples are demonstrated in Figure 11. A lack of confidence in developing MODAPTS samples was ranked as the highest reason, followed by time consumed and the level of complication involved in developing MODAPTS samples. The lowest ranked reason is the availability of other, more useful tests. None of the respondents indicated that they do not think MODAPTS is a useful tool.

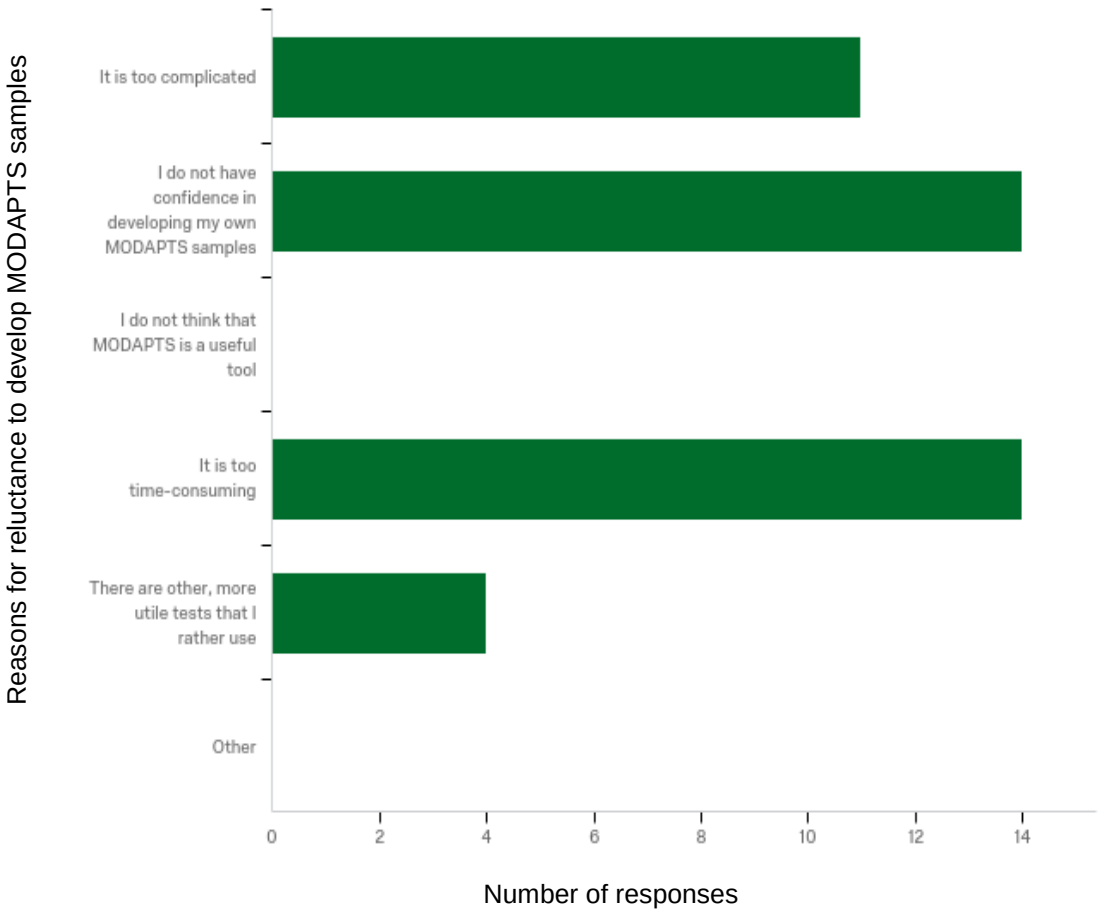

Figure 11: Reasons for reluctance to develop MODAPTS samples

When considering the reasons why OTs are reluctant to administer already developed samples (which was indicated by three respondents), the following three reasons were equally represented in the data: “I do not trust that it yields accurate results”, “I have other, more useful tools that I rather use” and “I am not sure how it works”.

Table one contains the responses on the four-point Likert scale to the questions related to the face validity of MODAPTS. A total of n=38 participants agree that MODAPTS is an adequate assessment method to evaluate work speed and that it is a useful and practical tool. A total of 12 participants indicated that MODAPTS samples are easy to develop and a total of 39 respondents indicated that MODAPTS samples are easy to administer.

Table 1: Perception of face validity of MODAPTS

#	QUESTION	STRONGLY DISAGREE	DISAGREE	AGREE	STRONGLY AGREE
1	MODAPTS is an adequate assessment tool to evaluate work speed	0.0%	5.0%	50.0%	45.0%
2	MODAPTS has adequate clinical utility, i.e., it is a useful and practical tool	0.0%	5.0%	57.5%	37.5%
3	MODAPTS samples are easy to develop	12.5%	57.5%	27.5%	2.5%
4	MODAPTS samples are easy to administer	0.0%	2.5%	62.5%	35.0%

The Lynn Method was used to determine the validity index, based on a sample size (n>6). An agreement of 80% was required to determine validity index.[20, 59] Based on the Lynn Method, MODAPTS as an assessment tool of work speed has adequate face validity (agreement of 94.73%). OTs perceive MODAPTS to be a clinically utile tool (agreement of 94.73%). MODAPTS work samples, according to OTs are not easy to develop (agreement of 30.76%), but are easy to administer once developed (agreement of 97.36%). A Cronbach's alpha test was performed to determine the internal reliability of the results. A score of 0.73 was obtained where a score of 0.7 or higher is acceptable.[63] The results thus demonstrate internal consistency.

4.3. Content validity

4.3.1. Responses received

With the initial distribution of the survey, none of the respondents met the inclusion criteria for content validity. Five experts were identified and purposively sampled. Three responses were received.

4.3.2. Demographic representation

All of the three experts indicated that they have more than 15 years of experience. Two graduated from the University of the Free State and one from the University of Witwatersrand. Two held Masters degrees in occupational therapy and a PhD in occupational therapy. With regard to service settings, academia was ranked highest, followed by private practice and research. Services provided by the participants were mostly represented by academia and research followed by functional capacity evaluations and medico-legal work.

4.3.3. Content validity results

The responses with regard to the content validity of MODAPTS on the four-point Likert Scale is depicted in Table 2. All of the participants indicated that the basic moves, gets and puts, body movement and large movement codes adequately measure work speed for the motions represented by the specific codes. Only two participants indicated that clerical codes and mental operation codes adequately measure work speed for the representative actions.

Table 2: Content validity of MODAPTS results.

#	QUESTION	STRONGLY DISAGREE	DISAGREE	AGREE	STRONGLY AGREE
1	The basic moves, gets and puts codes adequately measure work speed for basic movements	0.0%	0.0%	33.3%	66.7%
2	The body movement codes adequately measure work speed for body movements	0.0%	0.0%	33.3%	66.7%
3	The large movements gets, and puts adequately measure work speed for larger movements	0.0%	0.0%	33.3%	66.7%
4	The clerical codes adequately measure work speed and is applicable with regard to equipment design	0.0%	33.3%	66.7%	0.0%
	The mental operation codes adequately measure work speed for basic mental operations	0.0%	33.3%	66.7%	0.0%

The Lynn Method was used to determine the validity index, based on a sample size (n<6). An agreement of 100% was required to determine validity index.[20, 59] Based on the results, experts have confirmed content validity of the basic moves, gets and puts codes as well as for the body movement and large movement codes (agreement of 100% respectively). Content validity for the clerical codes and mental operation codes have not been confirmed (agreement of 67% respectively). A Cronbach's Alpha test was performed to determine the internal consistency of the results. A score of 0.92 was obtained where a score >0.7 is acceptable.

4.4. Criterion validity

4.4.1. Phase 1: Realist Synthesis

4.4.1.1. Document summary

The following table summarises the documents included and the type of data extracted from the documents.

Table 3: Document summary based on content derived from the documents and the year of publication

Content of FCE's	Construct of FCE's	Theoretical foundation of FCE
Innes and Straker (1999)[31]	Innes and Straker (1999)[31]	Lee and Kielhofner (2010)[70]
Siu (1998)[78]	Sinden, McGillivary, Chapman, Fischer (2017)[64]	Reneman, Jaegers, Westmaas, Goeken (2002)[69]
Gibson and Strong (2003)[36]	Wolf, Dahl, Auen, Doherty (2017)[74]	Gibson and Strong (2003)[36]
Sinden, McGillivary, Chapman, Fischer (2017)[64]	Reesink, Jorritsma, Reneman (2007)[77]	Johnson and Rose (2017)[66]
Bootes and Chapparo (2002)[81]	Sandqvist, Bjork, Gullberg, Henriksson, Gerdle (2009)[32]	McFadden, MacDonald, Fogarty, Merrit (2010)[68]
Anner, Brage, Donceel, Falez, Freudstein, Oancea, de Boer (2013)[75]	Johnson and Rose (2017)[66]	Hartman-Maeir, Katz, Baum (2009)[67]
Ryan, Gray, Newton, Granat (2008)[73]	Lechner et al. (1994)[71]	
Johnson and Rose (2017)[66]	Stergiou-Kita, Rappolt, Kirsh, Saw (2009)[84]	
Allen, Rainwater, Newbold, Deacon, Slatter (2004)[65]	Cheng and Cheng (2011)[79]	
Lechner et al. (1994)[71]	Hartman-Maeir, Katz, Baum (2009)[67]	
Reneman, Roelofs, Preuper (2017)[77]		
Stergiou-Kita, Yantzi and Wan (2010)[80]		
Cheng and Cheng (2011)[79]		
Hartman-Maeir, Katz, Baum (2009)[67]		

4.4.1.2. Document characteristics

Of the included articles, one article investigated and compared the validity of various available work assessment systems and assessment tools.[31] Six articles focused on work assessments as applied in various contexts.[36, 64-68] Seven articles focused on the validity and reliability of specific FCE systems or assessment tools.[69-75] Six articles focused on the application of work assessment for specific diagnoses.[76-81] The available data that focus on specific FCE systems or assessment tools are mainly based on initial test development and validation. Reproduction of results, especially with a variety of populations thus seems limited. Most of the articles focused on physical capacity and musculoskeletal disorders, with limited literature investigating the psychosocial and cognitive capacity as it relates to work assessment. Most articles identified the theoretical basis for FCE design as stemming from the Dictionary of Occupational Titles (DOT) with few articles evaluating how other theories in Occupational Therapy inform FCE design.

4.4.1.3. Main findings

According to Lechner et al., the most common cause for occupational disability is musculoskeletal impairments.[71] The classification framework by the Swedish Social Insurance Administration identifies the following groups of work-related problems: musculoskeletal problems, psychological disorders, and other problems which are mainly medical problems.[72] Many of the included articles focus on the evaluation of physical capacity and many of the FCE systems available only include physical functional assessments. Almost all of the articles identified the 20 physical demands of jobs as listed in the Dictionary of Occupational Titles (DOT) and the Revised Handbook for Analyzing Jobs (United States Department of Labor, Employment and Training Administration) as the foundation on which FCE systems are developed.[31, 36, 65, 66, 71] These demands have been categorized as dynamic strength, position tolerance and mobility. Table 4 presents the 20 physical demands and categorises the demands. The categories below are derived from work done by Lechner as well as the DOT, fourth edition.

Table 4: 20 physical demands of employment as categorised by the DOT and Lechner et al.[71, 82]

Physical demands of employment derived from the DOT			
Category as described by the DOT	**Demand**	**Category as described by Lechner et al.**	**Demand**
Strength	lifting carrying pulling pushing	Dynamic strength	lifting carrying pulling pushing
Climb	climbing balancing	Position tolerance	sitting standing stooping crouching kneeling reaching overhead
Stoop	stooping kneeling crouching crawling	Mobility	walking climbing crawling
Reach	reaching handling fingering feeling	Balance	balancing
Talk	talking hearing	Unspecified	forward reaching handling fingering feeling talking and hearing seeing
See	seeing		
Standing, walking, sitting	standing walking sitting		

Most FCE systems use the dynamic strength results to predict a person's category of work they can perform i.e. sedentary, light, medium, heavy and very heavy.[65] Recent publications however identify the need for a more universal language when describing functional capacity or incapacity and the use of the International Classification of Functioning, Disability and Health (ICF) is advocated.[75, 83] Using the ICF, evaluations could be conducted on a body functions level (cognitive functions, pain, exercise tolerance, joint mobility, and muscle power) or on an activity participation level.[75] Although some of the 20 physical demands of jobs as listed by the DOT are included, the ICF includes cognitive and social skills.

Limited frameworks and standardised protocols exist for the evaluation of cognitive and psychosocial factors as predictors of successful return to work.[80] Research done particularly on the population of persons with traumatic brain injuries have identified the need for such a structured framework.[81, 84] However, the following aspects have been highlighted as relevant when assessing work ability in this population: memory, concentration, problem solving, organisational skills, information processing, insight, communication, task performance and following of instructions, motivation, fatigue and abstract thinking.[81] Research that focused on the employment outcomes of people with chronic psychiatric illness identified task competence in simulated work tasks and psychosocial factors such as social relationship, work motivation and response to authority, as important when predicting work ability.[78] It is further emphasised that work is multifaceted and that considerations need to include the person's abilities, the work context and psychosocial factors. However, a content analysis of FCE reports revealed that limited consideration of psychosocial factors other than pain was included when making decisions about return to work or work capacity.[75]

When considering the theoretical basis of work assessments, it was found that the Assessment of Work Performance battery is an FCE system that is based on the Model of Human Occupation and assesses a client's working skills in three domains namely: motor, process and communication and interaction skills.[70, 72] The EUMASS (European Union of Medicine in Assurance and Social Security) core set is an ICF-based framework aimed at expressing capacity or incapacity in long-term work disability decision making.[75] Research specifically focused on the population of clients with traumatic brain injury, reports the use of the Person Environment and Occupation Model to guide decision making in return to work.[84] Although a consensus on the importance of performance-based assessment seems to exist, no evidence of a standardised performance-based assessment of actual or simulated work tasks exists.[85] The most likely reason for this seems to be the inherent difficulty in developing simulated tasks for the vastly different types of employment.

The following word cloud was created using WordClouds.com, a free software that creates a visual summary of text.[86] The text is populated and prevalent words are emphasized by means of size and location. The word cloud is used to visually summarise the results – and indicates by means of placement and size of words, which words and statements are most prevalent in the data analysed. Figure 12 provides a visual summary of the main findings.

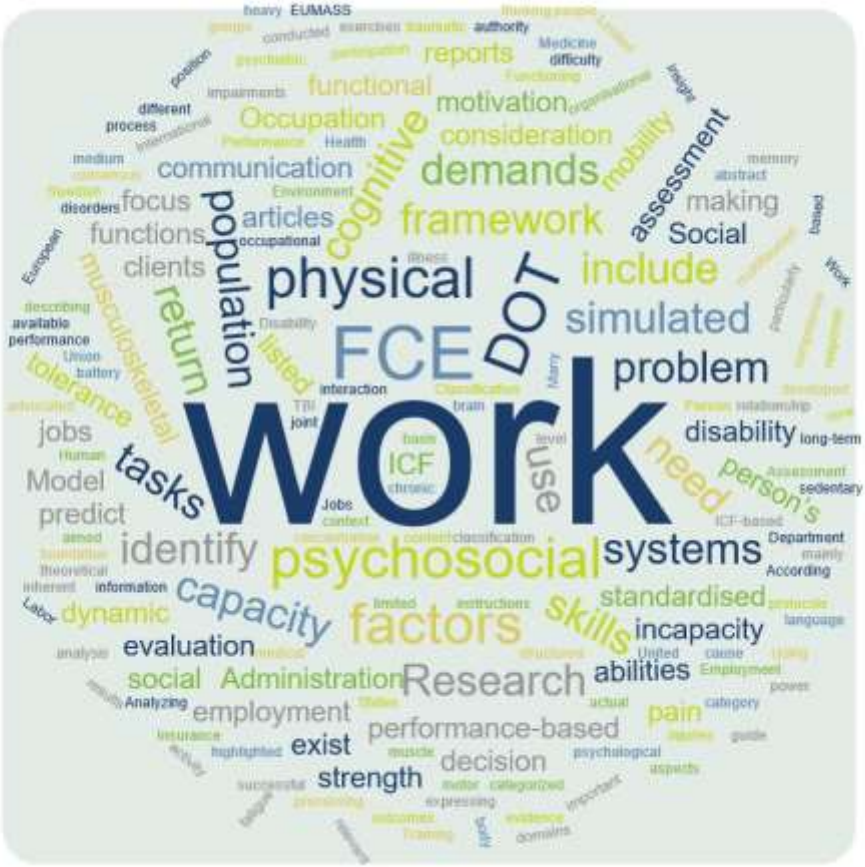

Figure 12: Summary of realist synthesis findings

4.4.2. Phase 2: Developing a list of VCWS for inclusion

Based on the results of the realist synthesis, especially the 20 physical demands of jobs as set out in Table 4. An attempt was made to choose VCWS that assess physical demands that can be representative of the categories as described in Table 4. This was largely achievable with the exception of dynamic strength as the VCWS that assesses dynamic strength has no time standard. The following list was developed to be used to compare predetermined time standards as determined by MODAPTS and MTM. The final list of tasks included are reflected below:

- VCWS 9 – a test that evaluates whole body range of motion and dexterity. It involves transferring wooden shapes from one panel to another and requires reaching, grasping, placing, bending and crouching as well as loosening and fastening of nuts.
- VCWS 4 – a test that evaluates dexterity and upper limb range of motion. The task involves screwing and unscrewing nuts of different sizes onto bolts inside a box at various angles.
- VCWS 6 – a test that evaluates problem solving. It includes looking at and comparing shapes and colours presented on a master card and test booklet; discrepancies between the master card and test booklet have to be identified and indicated.

The Mail Sort component of the T/PAL was initially included, as it can be used to assess cognition, however, omitted because the normal quest codes one would use to analyse the task could not be used. This is due to equipment design that leads to the requirement of an arm move with the elbow moving away from the body (M4), where the quest code requires all movements to occur in the use area (M3). The list was sent to six experts, three responses were received. Based on the responses, no assessments were omitted from the list.

4.4.3. Phase 3: Comparison of VCWS and MODAPTS

A total of 12 standard times was obtained by analysing the above-mentioned tasks using MODAPTS. The standard time obtained through MTM is published in the VCWS manuals. Table 5 summarises the standard times as obtained through MODAPTS and MTM. Included in the table are the standard times obtained through MTM for a score of 100%, 87,5% and 112,5%. The reason for this is that VCWS has identified 87,5% to 112,5% as the reference range in relation to the standard for the open labour market. Furthermore, it should be noted that only the total times represented by bold font in the table have an adjusted-for-learning standard time published in the VCWS manuals. These are the main scores to be compared with MODAPTS due to the definition of a qualified worker as described in the MODAPTS manual that assumes the person is familiar with the task and knows what is expected of him/her.[53] Based on this definition, it is considered more in line with the standard time adjusted-for-learning, Trial One than that unadjusted for learning.

Table 5: Standard times obtained through MODAPTS and MTM in seconds

Assessment	MODAPTS time (100%) in sec	VCWS time (100%) in sec adjusted-for-learning.	VCWS time (87.5%) in sec unadjusted for learning	VCWS time (112.5%) in sec unadjusted for learning
VCWS 4				
Assembly bottom	82	65	74	57
Assembly top	82	58	66	51
Assembly side	164	115	131	102
Assembly front	61	61	69	54
Combined assembly	389	298	340	264
Disassembly	686	490	560	435
Total time	**1464**	**1509**	**1725**	**1347**
VCWS 9				
Panel 1-2	591	357	408	317
Panel 2-3	586	345	394	306
Panel 3-4	599	412	470	366
Panel 4-1	598	393	449	349
Total	**2374**	**2112**	**2413**	**1877**
VCWS 6				
Total	1202	600	685	533
Total time	**1202**	**846**	**966**	**752**

When comparing the MODAPTS and MTM results for each of the tasks, using the adjusted-for-learning standard time (reflected in bold), it is evident that the MODAPTS standard time falls within the standard range set by MTM for VCWS 4 and VCWS 9. These tasks are physical, dexterous tasks that were analysed using the basic moves, gets and puts and body movement codes as described in the MODAPTS manual. These results are in agreement with the content validity results and expert opinion that these codes remain accurate and relevant. Considering VCWS 6 however, the standard time as developed by MODAPTS do not fall within the standard range set by MTM. This is also consistent with the content validity findings namely that experts do not believe the mental operations codes are able to accurately predict standard time for completion. It is noted that the experts involved in the content validity questionnaire and the persons involved in the MODAPTS analysis were independent from

each other and bias is thus eliminated. Figures 13, 14 and 15 display the MTM range as compared to MODAPTS time standards.

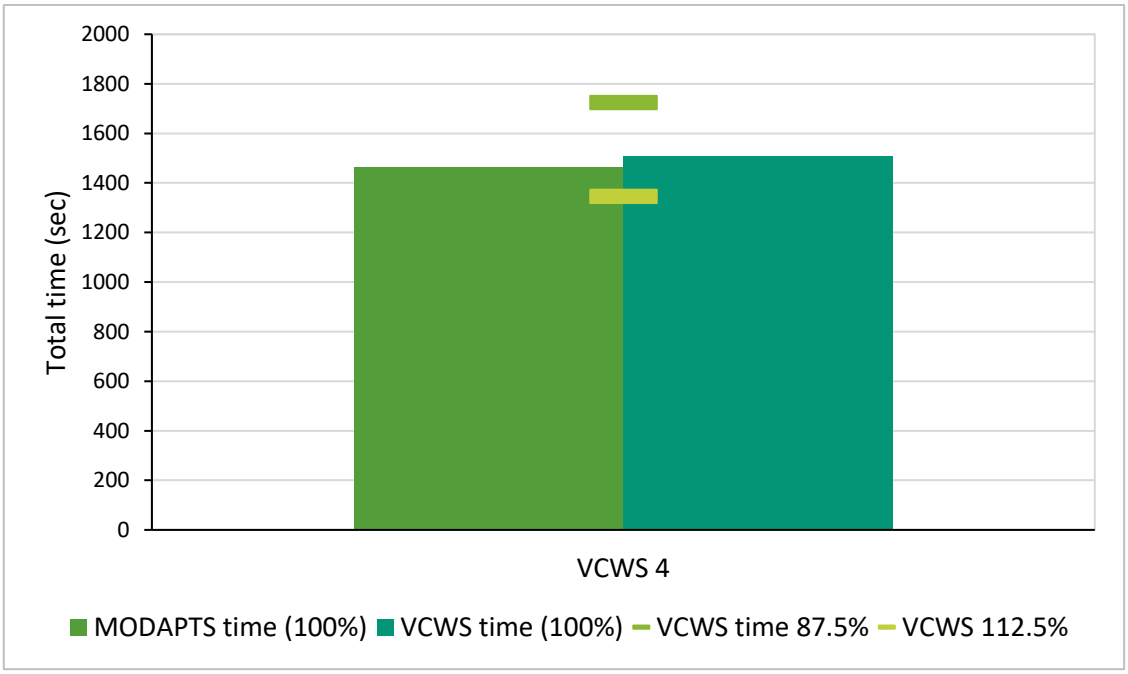

Figure 13: VCWS 4 - MODAPTS and MTM (adjusted-for-learning) time standards

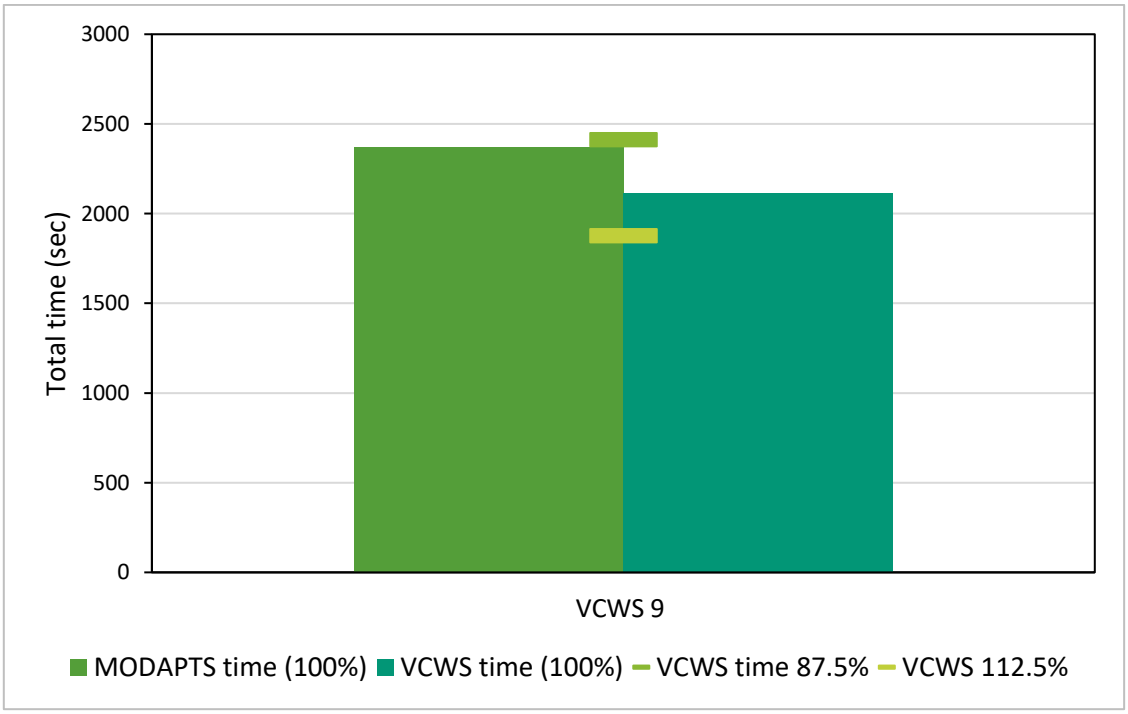

Figure 14:VCWS 9 - MODAPTS and MTM (adjusted-for-learning) time standards

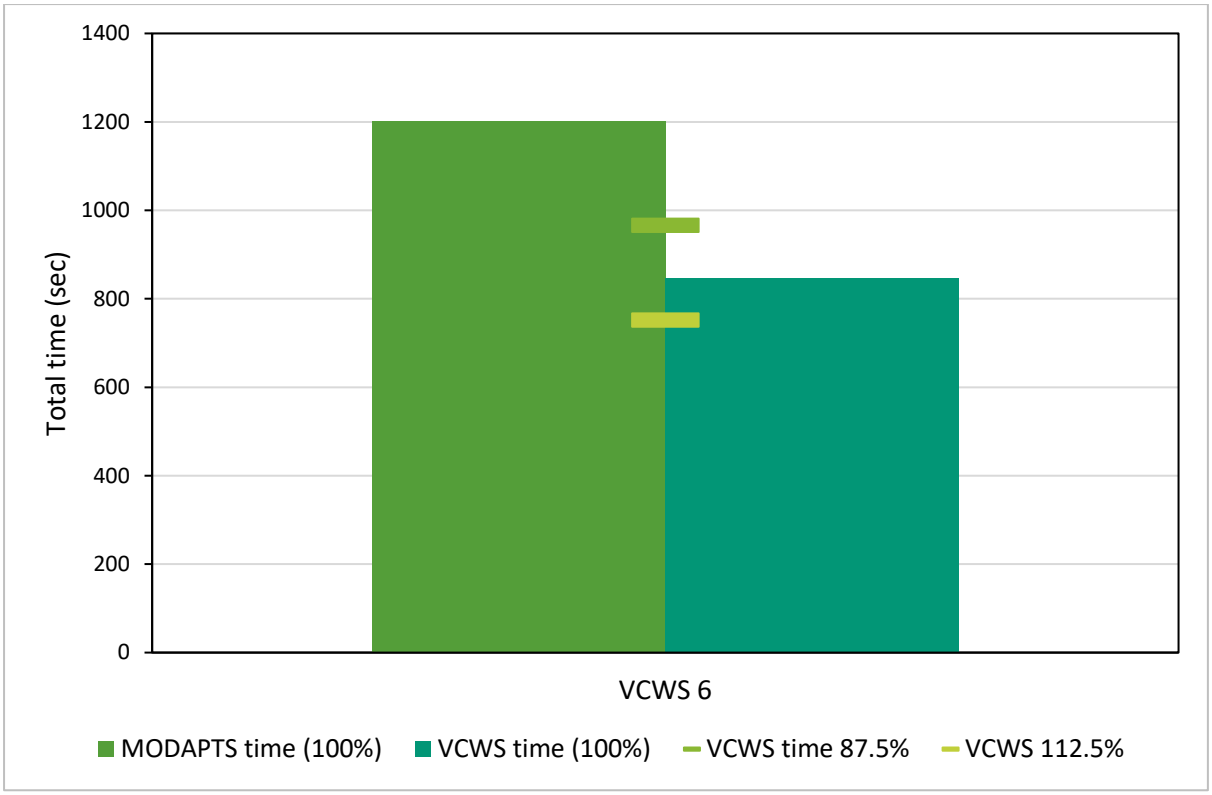

Figure 15: VCWS 6 - MODAPTS and MTM (adjusted-for-learning) time standards

Figures 16, 17 and 18 present the comparison of MODAPTS and MTM times unadjusted for learning. The findings support the theoretical basis of comparing MODAPTS to the adjusted MTM time as supported by the assumptions made by MODAPTS on a qualified worker.

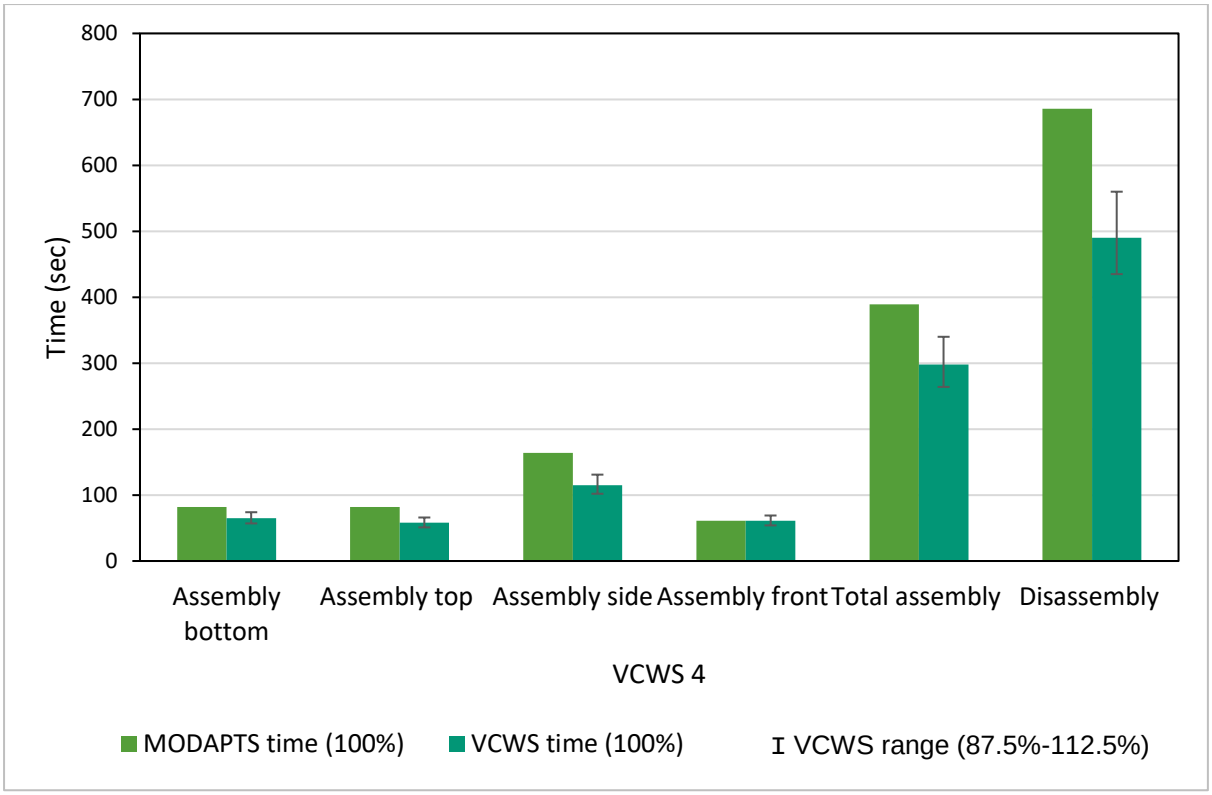

Figure 16: VCWS 4 - MODAPTS and MTM time standards unadjusted for learning

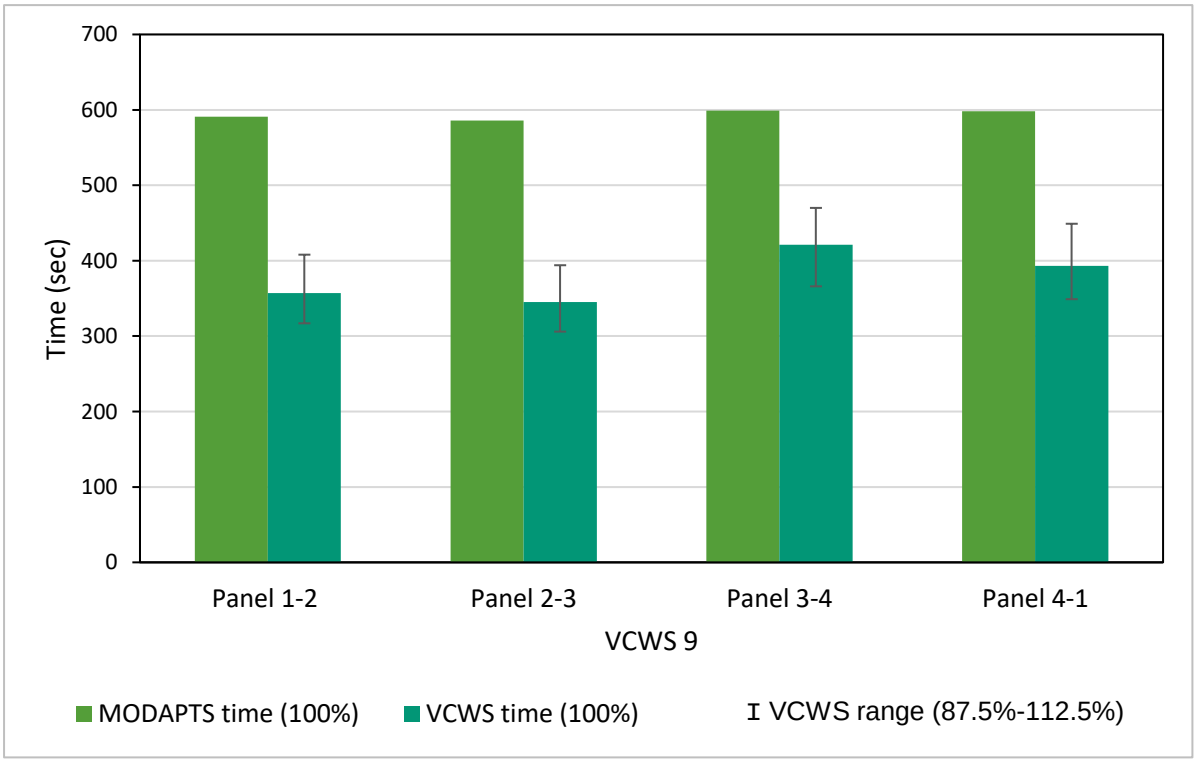

Figure 17: VCWS 9 - MODAPTS and MTM time standards unadjusted for learning

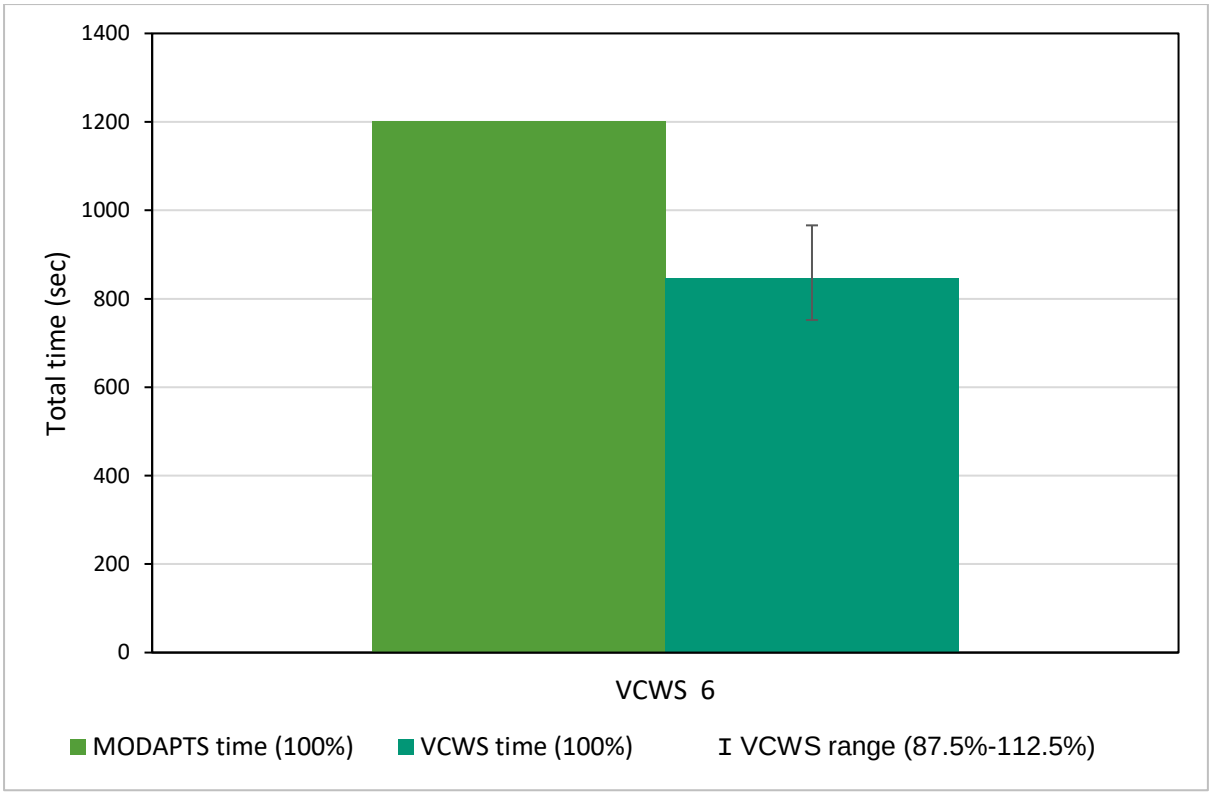

Figure 18: VCWS 6 - MODAPTS and MTM time standards unadjusted for learning

4.5. Conclusions

This chapter demonstrated the results obtained in relation to the research objectives. Face validity for MODAPTS as an assessment method of work speed was confirmed. Varying results was obtained in relation to content and criterion validity. The results of the realist synthesis indicate that the DOT informs most physical aspects of FCEs, and although the importance of cognitive and psychosocial assessment is identified, limited evidence of how these aspects are assessed could be found. The results obtained for various research objectives the study was consistent. Results for the fourth objective could not be obtained and is discussed in Chapter 5.

5. CHAPTER 5: DISCUSSION

5.1. Introduction

This chapter elaborates on the results as presented in Chapter 4. The results are discussed as they pertain to the research objectives and comparisons are drawn between different data sets. The results are further compared to similar research studies.

5.2. Face validity of MODAPTS

Face validity, the term used to describe whether an assessment seems to measure what it intends to, is important for a few reasons.[16] Face validity has been reported to contribute towards clinical utility and acceptability.[19] It has further been stated that a lack of acceptability (or whether a test seems relevant) could negatively affect assessment results and sincerity of effort.[19] Although it is often referred to as the least scientific component of validity, it is an important factor to consider when validating and assessment method. Face validity is confirmed by the collective opinion of experts.[16]

In order for an OT to access medical protection insurance, registration with OTASA is required. As many OT positions in vocational rehabilitation require access to this insurance it is assumed that most of the therapists involved in vocational rehabilitation would be registered with OTASA. According to information received from OTASA there are 380 OTs registered that indicated working in the field of vocational rehabilitation. A total of 57 responses were received, leading to a response rate of 15%. Only 40 participants met the inclusion criteria which is representative of 10.5%. However, it should be noted that research based on the practice profile of OTs providing work practice services in SA (2015) indicated 1193 OTs registered with OTASA indicated interest in the field.[87] It is thus difficult to determine the actual population size and representation of the respondents. Generalisability of the results may thus prove to be difficult. However, based on the requirements of sample size using the Lynn method, the number of responses was adequate.

Moreover, the collective opinion of the respondents is considered with high regard as most respondents indicated more than 15 years' experience and 73% of respondents indicated that they have a postgraduate qualification. Based on the results of the questionnaire, OTs consider MODAPTS to be an adequate assessment method of work speed. Enquiry into the application of MODAPTS indicated that OTs do not frequently develop MODAPTS work samples, although developed samples are often administered. Majority of OTs indictaed that they administer MODAPTS work samples weekly – which is in agreement with the opinion that it is an adequate assessment of work speed. Reasons for reluctance to develop work samples

include that OTs have limited confidence in their ability to develop work samples. The second most prevalent reason was that it is too time-consuming, and lastly OTs indicated that it is too complicated. OTs further indicated that MODAPTS work samples are not easy to develop.

A reluctance to administer developed samples was only reported by three respondents, a relatively low (7.5%) representation of the sample. This is in agreement with most OTs indicating that MODAPTS work samples are easy to administer. Reasons for not administering MODAPTS samples include insufficient understanding of the samples, the availability of other assessment methods and limited confidence in its results.

The results of the validity index as determined by the Lynn Method, indicate that MODAPTS has adequate face validity as an assessment method of work speed. This is consistent with the results of questions related to the administration of MODAPTS work samples. The clinical utility of MODAPTS work samples has also been proven in explicit questions related to clinical utility, as well as the fact that no respondent chose the option “I do not think it is a useful tool” to identify reasons for not developing MODAPTS work samples. From the results of the questions related to the development, administration and usefulness of MODAPTS work samples, it seems as if the assessment method is most utilised where developed samples are readily available as opposed to developing new samples.

It is evident from the responses received that OTs have confidence in MODAPTS as an assessment method of work speed. However, it seems from the reported reluctance to develop MODAPTS work samples that OTs do not have confidence in their ability to develop work samples. Reasons for this may be the MODAPTS manual that is not explicitly clear on certain fundamentals or the use of specific codes. Perhaps it is due to insufficient training at an undergraduate and postgraduate level, or limited continued professional development courses that provide training in the development of work samples. Ver Loren Van Themaat found that OTs providing vocational rehabilitation services in South Africa indicated specific FCE training as the most common continued professional development course attended.[87] Based on personal experience and these courses are expensive and qualifies attendees to administer commercially available FCEs. Since OTs have indicated willingness to administer MODAPTS samples it seems likely that they would attend further MODAPTS training that may be more cost effective than other FCE training. Additional training as well as updating the MODAPTS manual based on technological advances may lead to increased use of MODAPTS to develop work samples.

5.3. Content validity of MODAPTS

In order to assess content validity of MODAPTS, a stricter inclusion was applied which limited the population and sample size, this correlates with similar validation studies.[88] The total number of persons purposively sampled was five, a total of three responses was received. According to the requirements of the Lynn Method, a sample size of three experts is adequate, although a confidence interval of 100% has to be applied.

All of the respondents indicated that they have more than 15 years of experience. Two held Masters degrees in OT and one PhD. Their collective opinion can thus be considered with high regard based on their experience and qualifications. Based on their responses, the codes that analyse basic movements, handling of small and large articles as well as other body actions are relevant and can accurately determine a standard time for completion of these tasks. However, the codes used to analyse clerical and mental operations are not considered to be relevant. This is likely due to the fact that MODAPTS was developed in the 1960s and equipment design, workstation layouts and technology have changed to the extent that these codes no longer seem relevant. Furthermore, experience suggests that tasks such as writing and typing are often measured as words per minute instead of using a standard time, and the type of computers used, for instance, will influence data processing speed.

In choosing to use MODAPTS work samples for these tasks one has to consider whether there are other, more utile tools that could be used. From these results it is evident that when choosing to utilise MODAPTS, focus should be placed on physical tasks as opposed to cognitive and clerical tasks. Given that many authors have indicated difficulty in assessing cognitive and psychosocial skills, especially executive functioning, it is understandable that a PTS that in essence analyses body movements cannot accurately determine the speed at which one thinks, reasons and decides.[28, 37, 65, 74] Although work samples do meet the criteria for performance-based assessments, which is commonly advised in terms of assessing cognitive and psychosocial skills, it seems as if MODAPTS will not be able to accurately measure work speed in relation to cognitive and psychosocial skills. It should be noted that the effect of slow processing or psychosocial limitations may be observable in work speed even in physical tasks. It does however seem that there is no single answer to the assessment of cognition and psychosocial skills. Normative data or qualitative observations and sound clinical reasoning may prove to be of more value in this regard than a mere measure of work speed.

5.4. Criterion validity of MODAPTS

The evaluation of criterion validity involved three phases and the results of each phase is discussed separately. Please refer to Figure 2 for an overview of the Phases.

5.4.1. Realist synthesis

The purpose of the realist synthesis was to inform the list of VCWS used to compare MODAPTS and MTM standard times. However, additional information became evident and the findings of the review are discussed in relation to the objectives of the realist synthesis.

i. <u>What is usually assessed during an FCE?</u>

The primary goal of an FCE is to evaluate a client's ability against the demands of their job, or to determine a baseline of performance.[2] Furthermore, the results of an FCE are used to determine rehabilitation goals and/or entitlement to financial compensation.[65] In light of the purpose of these assessments, it is fair to say that two things need to be considered: firstly, the client's job demands (which includes physical, psychosocial and cognitive demands) and secondly, the client's abilities. When considering job demands, the DOT is considered a useful tool to gather information about various jobs in various industries. Caution should, however, be given to not neglect input from the client and/or employer as specific and significant information may be omitted which could possibly lead to poor predictions of work ability.

It seems that the general practice is to use the physical demands as described by the DOT or at least part thereof when assessing physical capacities which is then translated into a category of work (sedentary to very heavy work). However, additional cognitive and/or psychosocial assessment may be necessary depending on the condition or injury sustained and the work demands. Literature has identified various cognitive skills and processes to be important when considering work ability and the following are prioritised: memory, concentration, problem solving, organisational skills, information processing, insight, communication, task performance and following of instructions, and abstract thinking.[81]

Psychosocial assessment usually includes the assessment of pain, although the following work-related psychosocial factors have also been identified: the client's perception of pain, disability and effort, their expectation of return to work and self-efficacy.[65] It seems from literature that psychosocial assessment is often neglected in the work assessment process.[65] The importance of transparency and accurate predictions of work ability cannot be overstated in light of the financial implications related to work assessments. As such, information about activities of daily living, role fulfilment, leisure engagement and instrumental activities of daily

living is also included and compared with assessment findings in order to form conclusions and make predictions of work ability.[65]

ii. What assessment tools are used, and based on what evidence are they chosen?

Most authors prioritise scientific evidence of validity and reliability, when considering which assessment tool to use, together with clinical utility and safety.[1, 2, 27, 64] The majority of the research pertaining to this scientific evidence is limited to initial test development and validation. Due to the need for transparent reports with valid and reliable results, it seems as if commercially available assessment tools are preferred for their supporting research.[2] However, a few reviews of current practice (in various countries) identified the flexibility and adaptability of assessment tools to override scientific evidence in the choice of assessment tools used.[64, 89, 90] Although not prevalent, cost effectiveness has been identified as a contributing factor when choosing assessment tools.[73]

Most of the commercially available assessment tools are based on the physical functions as outlined by the DOT, with cognitive tests developed to assess specific cognitive skills and domains as opposed to work performance. Wolf et al. found that although neuropsychological assessments are considered the gold standard of assessing cognitive function, specifically executive function, this means of assessment has significant limitations.[74] A performance-based assessment of executive function is thus advised as neuropsychological assessments are often too structured with clear goals, which lowers the sensitivity to executive dysfunction. It is further advised that a combination of subjective (self-report) and objective (observed or measured) information be used with clearly described clinical reasoning to make decisions with regard to a person's work capacity.[65, 74]

iii. What constitutes a well-designed FCE?

Due to the vast implications of the results and recommendations based on FCEs, transparent, objective results and sound clinical reasoning are prioritised.[2, 27, 65] Matheson et al. also assert that focus should be placed on the procedures to determine ability to work, including the choice of assessments used.[33] Emphasis is again placed on the usefulness and acceptability of the process by all stakeholders, which is affected by the safety, validity, reliability, and practicality of assessments used.[33] Apart from using standardised, objective and transparent assessment tools to evaluate work capacity, comparison of these results to other areas such as activities of daily living, driving, and leisure pursuits is also advised as it not only affects a person's ability to maintain gainful employment, but also provides insight and supports clinical reasoning.[2, 65]

Many authors identify the need to use performance-based assessments, in line with the core philosophy of occupational therapy.[30, 37, 83] Understandably though, it seems as if therapists are inclined to use generic and standardised assessments for their objectivity and credibility.[2] Furthermore, a standard and consistent framework of performing assessments has been identified as a need by OTs.[65, 81]

Based on the purpose of the FCE, a therapist may choose a variety of approaches and assessment tools to gather both subjective and objective information in order to make decisions about work ability. Flexibility is important to ensure an individualised approach, as opposed to generic assessment and interpretation of results. It is, however, essential that the clinical reasoning behind the decision-making process be sound and transparent for the recommendations to be practical and feasible.

5.4.2. Comparability of MODAPTS to MTM

Criterion validity is usually assessed by comparing the new instrument to the gold standard.[16] Although VCWS that are based on MTM are seemingly the gold standard in work samples, they are expensive and not portable. Given the results of the realist synthesis, OTs need performance-based assessments, that are flexible and adaptable to the specific case and that demonstrates adequate clinical utility. Although MTM remains a possible PTS to use to develop work samples, training is not provided to OTs in MTM in South Africa. It has further been found that developing work samples with MTM is much more complicated and time consuming as opposed to MODAPTS.[46]

In order to compare MODAPTS to MTM time standards, three VCWS were analysed using MODAPTS, and the standard times obtained were compared to the standard times adjusted-for-learning Trial One as published in the VCWS manuals. The 2009 revision of the VCWS 4, VCWS 9, and VCWS 6 manuals and the 2001 revision of the MODAPTS manual were used. During the analysis process and moderation sessions, it became evident that the VCWS manuals do not have explicitly clear instructions to the examiner and examinee. Assumptions had to be made based on experience, and the evaluation of qualified workers using these tasks. These assumptions are described in the analysis forms, Annexure F. This is of concern as it affects the validity of results obtained as well as the inter-rater reliability of the test. Furthermore, the MODAPTS manual was not clear on the application of all of the codes. The manual is not written in a manner that is easily understood. This is in agreement with the findings of the face validity survey and the fact that most OTs perceive MODAPTS to be a

difficult tool to use in the development of work samples, although they may believe that it accurately measures work speed.

Although reliability of MODAPTS samples was not a research objective it was found that the contact sessions to moderate MODAPTS analyses which involved three experts may be useful in determining the validity and reliability of the MODAPTS analysis. Using contact sessions involving more than one expert is a feasible manner in which to validate MODAPTS analyses, and to ensure inter-rater reliability of the samples analysed. Utilising the knowledge and input of colleagues could further address the lack of confidence indicated by OTs in developing their own work samples.

The results, of the comparison of MODAPTS and MTM time standards using MTM tasks, revealed that the MODAPTS standard time falls within the time range as set by MTM for VCWS 4 and VCWS 9. These tasks measure performance in physical, dexterous tasks. It involves reaching, grasping, placing, handling of material, bending and crouching. These actions are analysed by the basic movement and handling of smaller articles codes in the MODAPTS manual. When comparing the results of the content validity survey to this result, it is consistent.

The results further revealed that the MODAPTS standard time does not fall within the standard range set by MTM for the VCWS 6 task. This is a cognitive task that involves comparing shapes and colours, deciding on and indicating errors between a test card and master card. It is a repetitive, three-step task that simulates administrative type work. The result of the content validity questionnaire is consistent with this finding, as well as the collective expert opinion, which indicated that the mental and clerical operations codes are not accurate in measuring work speed in appropriate tasks.

Criterion validity for physical tasks that would be analysed using the codes for moving and handling articles and other body movements is thus confirmed. However, the codes for mental and clerical operations have failed to demonstrate adequate comparability to the gold standard in this research study.

When comparing the standard times for subsections of the tasks set by MODAPTS and MTM, it is noted that only unadjusted standard times for MTM are available. When comparing MODAPTS times and these unadjusted MTM times, they are not adequately comparable. This is, however, to be expected given the theoretical assumptions that MODAPTS makes about a qualified worker, and justifies the comparison using adjusted-for-learning standard times.

5.4.3. MODAPTS reference range.

The VCWS have a published reference range that is accepted with regard to the standard of the open labour market.[52] In contrast, MODAPTS manual does not mention what the standard of the open labour market is. Based on personal experience OTs have made extrapolations from the construct of MODAPTS that 100% should be representative of the standard of the open labour market. Others have adopted the reference range as determined by MTM of 87.5% to 122.5%. No published evidence to support either extrapolation could, however, be found.

Although determining a reference range was a research objective, the inconsistency of the comparability of MODAPTS to MTM, resulted in the inability to determine a reference range for MODAPTS. When considering the deviation between MODAPTS and MTM it is recommended that a 100% score is used as the standard for the open labour market, and clinical experience be used to identify leniency when interpreting results in terms of the likelihood that the examinee will meet the demands of the open labour market. Further normative testing of the South African population could inform a possible reference range.

5.5. Strengths and limitations of the research

This is one of the first research studies to investigate the application of MODAPTS as an assessment method of work speed. As no peer-reviewed data could be found that proves MODAPTS as a valid and reliable assessment method of work speed, gathering information regarding the validity of MODAPTS as an assessment method of work speed is essential. With the numerous advantages that MODAPTS potentially has, as described in the previous chapters, it is necessary to determine its validity in order to potentially develop more assessment batteries that are cost and time effective and relevant in the South African context.

Due to the organisations and methods used to disseminate the survey, it is difficult to determine an exact population size and subsequently the response rate and generalisability of results. Due to these limitations, it is not possible to accurately determine how representative the respondent sample is. However, considering the requirements of statistical methods used, the sample size is considered adequate in terms of a collective opinion of face and content validity. Based on the years of experience and qualifications of the respondent sample, one can consider the results with high regard.

The design of the survey was based on similar studies and guidelines published in literature; it was piloted by experts in occupational therapy and survey design.[20, 88] The survey was thus

considered appropriate for its intended use. However, not all of the respondents answered all of the questions. This could possibly be due to questions not being formulated clearly and should be investigated should a similar study be conducted. The survey was designed using Qualtrics which lends itself to many formatting and structuring options; data were captured in the software and exported in a csv file. The software was used to clean the data before analysis. Using software with such extensive functions, limits the room for human error and contributes to the validity and reliability of the results.

Throughout the process an independent statistician was consulted to contribute to the study design and data management. Since this type of study has not been done before, known methodology could not be used and a combination of methodologies was used from similar studies in social and health sciences as well as engineering. This led to some unexpected difficulties in data management, especially of the results related to criterion validity or comparability if MODAPTS and MTM. Due to the nature of the data collected and the absence of chance, mathematical as opposed to statistical analysis had to be done. In order to evaluate the comparability statistically, one would have to assess clients using MODAPTS work samples, which is beyond the scope of this study.

The MODAPTS analysis of the VCWS tasks was scrutinised in moderation sessions. During this session both the MODAPTS and VCWS manuals were used as reference, where consensus could not be determined an evaluation of a qualified person performing the task was done. Due to the nature of data collected when comparing MTM and MODAPTS using the VCWS tasks, statistical analysis was not possible and a deterministic model was used. This relied on clinical experience and mathematical equations rather than statistical analysis. Furthermore, criterion validity was proven for two out of the three tasks. The two tasks that had proven criterion validity evaluate physical ability and are analysed using the basic movement and handling of small and larger articles. The task that did not demonstrate adequate criterion validity involved cognitive processes and is analysed through the mental and clerical operation codes. Due to the study only evaluating three tasks, generalisability of these findings is poor. It is difficult to accurately predict that all MODAPTS work samples involving basic moves and material handling will have adequate criterion validity and those involving mental and clerical operations will not have adequate criterion validity. These results do however give an indication of an emerging pattern, and is consistent with expert opinion regarding content validity of the MODAPTS codes. MODAPTS work samples can, and is advised to, be used to assess work speed of tasks involving physical abilities.

This study further set out to determine a reference range for MODAPTS should it be a valid assessment method of work speed. This could not be accurately determined due to the nature of the results and inconsistency between tasks analysed. Since no previous work on this has been published, this serves as a good foundation for future research.

5.6. Summary

This research study aimed to determine face, content and criterion validity of MODAPTS as an assessment method of work speed. It is difficult to accurately determine the population size and subsequently the response rate and whether the respondent sample is representative of South African OTs providing vocational rehabilitation services. The respondent sample, however, collectively has many years of experience, and a high rate of postgraduate qualifications was reported.

Face validity was established as most OTs consider MODAPTS to be an adequate assessment method of work speed. Most OTs also indicated that they feel that MODAPTS is a clinically utile tool. Most OTs indicated that developing work samples using MODAPTS is difficult and time-consuming – this is concerning given that a certain level of MODAPTS training with the development and moderation of a work sample was an inclusion criterion. The results correlate with a survey conducted by the Gauteng Vocational Rehabilitation Task Team that indicated OTs have limited confidence in utilising MODAPTS.[5]

Content validity for the codes used to analyse basic movements, material handling and other body actions was determined. In contrast, content validity for the codes used to analyse mental and clerical operations was not determined. This correlates with the criterion validity results indicating adequate comparability of MODAPTS to MTM when analysing tasks involving basic movements, material handling and other body actions but not for tasks involving mental and clerical operations.

The results of the realist synthesis conducted on the content of FCEs and work assessments indicated that the 20 physical demands as described by the DOT are the main theoretical basis for assessment methods. Latest findings, however, indicate a need for more performance-based evaluations as opposed to conventional abstract tasks. Furthermore, it seems as if OTs prioritise flexibility and adaptability of assessment methods over supporting research when choosing assessment methods.

This is one of the first research studies to investigate the validity of MODAPTS as an assessment method of work speed. A unique methodology was utilised as similar studies have not been published. Some of the limitations of the study include limited statistical analysis being possible due to the nature of the data collected. The results, however, indicate emerging patterns and can guide future research.

6. CHAPTER 6: CONCLUSIONS AND RECOMMENDATIONS

6.1. Introduction

This chapter summarises the findings of the research study and implications thereof to vocational rehabilitation and OT practice. Recommendations are made with regard to the use of MODAPTS, OT education, and future research.

6.2. Conclusions

This quantitative cross-sectional study aimed to evaluate validity of MODAPTS as an assessment method of work speed. The study had four main objectives, the first being to evaluate face validity of MODAPTS as an assessment method of work speed. An electronic survey was sent to OTs working in the field of vocational rehabilitation. Informed consent and inclusion criteria were built into the survey for ease of administration and data management. The data were cleaned using the survey software and analysed using STATA. The Lynn Method was used to analyse the data. Results indicated that MODAPTS has adequate face validity and that it is also considered to be a clinically utile tool. However, OTs indicated that MODAPTS samples are difficult to develop, yet easy to administer.

The second research objective was to evaluate content validity of MODAPTS codes. An electronic survey was sent to a sample of experts purposively chosen based on the inclusion criteria. The collective expert opinion reflects that the codes used to analyse basic movement and handling of small and large articles as well as other body actions are relevant and applicable. In contrast, the codes used to analyse mental and clerical operations are not considered relevant and applicable.

The third objective was to determine the criterion validity of MODAPTS as an assessment method of work speed. This was done in three phases. Phase 1 involved conducting a realist synthesis on the content of FCEs and the theoretical basis of FCEs. Based on the results of the realist synthesis, Phase 2 involved drafting a list of relevant VCWS to be used to compare MODAPTS and MTM time standards. Phase 3 involved the analysis of VCWS tasks using MODAPTS and comparing the standard times determined by MODAPTS and MTM. Criterion validity were established for two of the three tasks. The two tasks that had proven criterion validity was analysed using codes for basic movements and handling of small and large articles and other body actions. The task that did not have proven criterion validity was analysed using codes for mental and clerical operations. The results of the criterion and content validity are consistent. MODAPTS could, in light of these results, prove to be a cost-

effective and performance-based alternative to the current and expensive FCE assessment methods utilised in South Africa.

The fourth objective was to determine a reference range for MODAPTS in relation to the standard of the open labour market. Due to the variation in results obtained for criterion validity, this was not possible. It is advised that 100% be used as a benchmark, with clinical judgement with regard to leniency. Further study involving clients may inform on a reference range, although that is beyond the scope of this research study.

6.3. Recommendations

Based on the results of this enquiry, additional research is indicated and the following is recommended in terms of occupational therapy research. Criterion validity needs to be further evaluated by comparing results obtained through a MODAPTS assessment to those obtained with other assessments. Furthermore, it is advised that the specific code sets be evaluated individually and in combination to determine their comparability to other assessment methods. Determining concurrent validity of MODAPTS with a larger sample size is also advised. This study did not evaluate the reliability of MODAPTS as an assessment method. In terms of reliability, two things need to be determined: the inter- and intra-reliability of the development of MODAPTS work samples as well as the administration of work samples.

Since the results of this study indicated that MODAPTS work samples are perceived as difficult to develop by OTs (who have received training in MODAPTS), it is advised that the institutions that provide this training investigate the level of training and competence at the end of training. Furthermore, additional continued professional development courses, or mentorship, could assist in additional training and subsequently increased confidence of OTs to utilise this method.

It was found during this study that the manuals of the VCWS and MODAPTS are not consistently clear and descriptive. It is advised that the manuals be revised in order to increase the validity and reliability of results obtained. With changes in equipment design and technology, it is also advised that tasks involving equipment such as computers be revised and possibly new applicable codes be developed.

Based on the results of the realist synthesis, OTs prioritise flexibility and adaptability over supporting research when choosing assessment methods to use as part of an FCE. Many authors urge OTs to utilise performance-based assessments that are in line with the core

philosophy of OT together with sound and transparent clinical reasoning when making decisions about a person's capacity to work. It is advised that the proposal to develop a performance-based assessment battery based on the ICF be conducted with specific relevance to the South African context. This assessment battery has to be standardised and validated with possible norm references obtained for the South African population.

This study together with other studies have found that within vocational rehabilitation services provided in South Africa, an emphasis is placed on FCEs and evaluation, with intervention services provided at a lesser extent.[87] It is advised that possible protocols be developed and training be provided to increase the provision of the services provided to the South African public especially with the latest WPRPD in mind.

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ANNEXURE A: Electronic Questionnaire – face validity

Face validity Questionnaire

Start of Block: Background

Q1 PARTICIPANT'S INFORMATION & INFORMED CONSENT DOCUMENT Researcher's name: Suzanne Harmse. Student Number: 10080521 Department of Occupational Therapy University of Pretoria Dear Participant EVALUATING VALIDITY OF MODAPTS AS AN ASSESSMENT METHOD OF WORK SPEED. I am a postgraduate student in vocational rehabilitation in the Department of Occupational Therapy, University of Pretoria. You are invited to volunteer to participate in my research project on EVALUATING VALIDITY OF MODAPTS AS AN ASSESSMENT METHOD OF WORK SPEED. This letter gives information to help you to decide if you want to take part in this study. Before you agree you should fully understand what is involved. If you do not understand the information or have any other questions, do not hesitate to ask me. You should not agree to take part unless you are completely happy about what I expect of you. The purpose of the study is to determine face, content, and criterion validity of MODAPTS as an assessment of work speed. I would like you to complete an electronic questionnaire. This may take about 8 minutes. The questionnaire results will automatically be sent to me upon your completion. It will be kept in a safe place to ensure confidentiality. You do not have to indicate your name on the questionnaire. This will ensure confidentiality. The Research Ethics Committee of the University of Pretoria, Faculty of Health Sciences, telephone numbers 012 356 3084 / 012 356 3085 granted written approval for this study. Your participation in this study is voluntary. You can refuse to participate or stop at any time without giving any reason. As you do not write your name on the questionnaire, you give me the information anonymously. Once you have submitted the questionnaire, you cannot recall your consent as I will not be able to trace your information. Therefore, you will also not be identified as a participant in any publication that comes from this study. Note: The implication of completing the questionnaire is that informed consent has been obtained from you. Thus, any information derived from your form (which will be totally anonymous) may be used for e.g. publication, by the researcher. I sincerely appreciate your help. Yours truly, Suzanne Harmse

Q2 Do you agree to take part in the research?

- ○ Yes, I agree (1)
- ○ I do not wish to partake in the research${l://OptOutLink} (2)

Q3 Thank you for your assistance.

Q4 Please indicate your years of work experience (regardless of the field of expertise):

- 0 - 2 years (1)
- 3 - 5 years (2)
- 5 - 10 years (3)
- 10 - 15 years (4)
- more than 15 years (5)

Q5 From which institution did you graduate?

- ○ University of Pretoria (1)
- ○ University of the Free State (2)
- ○ University of the Witwatersrand Johannesburg (3)
- ○ Stellenbosch University (4)
- ○ University of Cape Town (5)
- ○ Western Cape University (6)
- ○ University of KwaZulu-Natal (7)
- ○ Sefako Makgato University (8)
- ○ Other, please specify (9) _____

Q6 Please indicate the highest post-graduate qualifications and the institution where it was obtained. If you hold no post graduate qualification, proceed to the next question.

- ○ Postgraduate Diploma (1) _____
- ○ Honours Degree (2) _____
- ○ Master's Degree (3) _____
- ○ PhD or DocTher (4) _____
- ○ Other, please specify (5) _____

Q7 Are you enrolled for any postgraduate qualification at present?

- ○ Yes, please specify (1) _____
- ○ No (2)

Q8 Are you currently working in South Africa?

- ○ Yes (1)
- ○ No (2)

Q9 Please indicate your practice setting (you can choose more than one option if need be)

- ☐ Private clinic (1)
- ☐ Private hospital (2)
- ☐ Private practice (3)
- ☐ School (4)
- ☐ Public sector: primary setting (5)
- ☐ Public sector: secondary setting (6)
- ☐ Public sector: tertiary institution (7)
- ☐ Public sector: community based (8)
- ☐ Academia (9)
- ☐ Other, please specify (10) _____

Q10 Please indicate in which province your practice is located (you can choose more than one option if need be)

- ☐ Gauteng (1)
- ☐ Northern Cape (2)
- ☐ Eastern Cape (3)
- ☐ Western Cape (4)
- ☐ Kwa-Zulu Natal (5)
- ☐ Free State (6)
- ☐ North West (7)
- ☐ Mpumalanga (8)
- ☐ Limpopo (9)
- ☐ Other, please specify (10) _____

Q11 Please specify the location of practice (you can choose more than one option if need be)

- ☐ Urban/ Suburban (1)
- ☐ Town/ Country (2)
- ☐ Semi-rural (3)
- ☐ Rural (4)
- ☐ Other, please specify (5) _____

Q12 Are you currently working and/or teaching in the field of vocational rehabilitation in either private or public sector?

- ○ Yes (1)
- ○ No (2)

Q13 If you are engaged in tertiary education: Please indicate the number of hours spent teaching **per year**, and indicate which subjects/modules you teach.

_____ Hours per year (1)

Q14 Please indicate the number of hours working in the field of vocational rehabilitation **per week**.

_____

Q15 Please choose the **most relevant** option to describe your practice.

- ○ Sole practice / working alone at the setting (1)
- ○ Working with a supervisor / mentor (2)
- ○ Working within a team of other occupational therapists (3)
- ○ Working in a multi-disciplinary team that provide shared services (4)
- ○ Other, please specify (5) _____

Q16 Please indicate the type of intervention that you provide (you can choose more than one option if need be)

- ☐ Medico-legal work (1)
- ☐ Functional Capacity Evaluations / Work assessments (2)
- ☐ Work rehabilitation / Case-management (3)
- ☐ Employee wellness / Employee assistance programs (4)
- ☐ Disability claims assessor / Consultant (5)
- ☐ Other, please specify (6) _____

Q17 Have you received any undergraduate or postgraduate training in MODAPTS that involved the development of your own work sample?

- ○ Yes (1)
- ○ No (2)

Q18 Have you provided training in the field of MODAPTS?

- ○ Yes, please specify (1) _____
- ○ No (2)

Q19
Have you published an article on MODAPTS or in the field of vocational rehabilitation? Please give the title and place of publication.

- ○ Yes (1) _____
- ○ No (2)

End of Block: Background

Start of Block: Face validity

Display This Question:

If Are you currently working and/or teaching in the field of vocational rehabilitation in either pri... = Yes

And Have you received any undergraduate or postgraduate training in MODAPTS that involved the develop... = Yes

And Are you currently working in South Africa? = Yes

Q20 How often do you develop your own MODAPTS work samples?

- ○ Weekly (1)
- ○ Monthly (2)
- ○ Every 3 months (6)
- ○ 6 monthly (3)
- ○ Yearly (5)
- ○ Never (4)

Display This Question:

If Are you currently working in South Africa? = Yes

And Have you received any undergraduate or postgraduate training in MODAPTS that involved the develop... = Yes

And Are you currently working and/or teaching in the field of vocational rehabilitation in either pri... = Yes

Q21 Are you reluctant to develop MODAPTS work samples?

- ○ Yes (1)
- ○ No (2)

Display This Question:

If Are you currently working in South Africa? = Yes

And Have you received any undergraduate or postgraduate training in MODAPTS that involved the develop... = Yes

And Are you currently working and/or teaching in the field of vocational rehabilitation in either pri... = Yes

And Are you reluctant to develop MODAPTS work samples? = Yes

Q22

If you are reluctant to develop MODAPTS, please indicate possible reason/s (you can choose more than one option)

- ☐ It is too complicated (1)
- ☐ I do not have confidence in developing my own MODAPTS samples (2)
- ☐ I do not think that MODAPTS is a useful tool (3)
- ☐ It is too time-consuming (4)
- ☐ There are other, more utile tests that I rather use (5) _____
- ☐ Other (6) _____

Display This Question:

If Are you currently working in South Africa? = Yes

And Are you currently working and/or teaching in the field of vocational rehabilitation in either pri... = Yes

And Have you received any undergraduate or postgraduate training in MODAPTS that involved the develop... = Yes

Q23 How often do you make use of MODAPTS samples when assessing clients?

- ○ Weekly (1)
- ○ Monthly (2)
- ○ Rarely (3)
- ○ Never (4)

Display This Question:

If Are you currently working in South Africa? = Yes

And Are you currently working and/or teaching in the field of vocational rehabilitation in either pri... = Yes

And Have you received any undergraduate or postgraduate training in MODAPTS that involved the develop... = Yes

Q24 Are you reluctant to administer already developed work samples?

- ○ Yes (1)
- ○ No (2)

Display This Question:

If Are you currently working in South Africa? = Yes

And Are you currently working and/or teaching in the field of vocational rehabilitation in either pri... = Yes

And Have you received any undergraduate or postgraduate training in MODAPTS that involved the develop... = Yes

And Are you reluctant to administer already developed work samples? = Yes

Q25 If you are reluctant to use MODAPTS samples (already developed) to evaluate clients, please indicate possible reasons (you can choose more than one option)

- ☐ I do not trust that it yields accurate results (1)
- ☐ I do not have developed samples available to make use of (2)
- ☐ I have other, more useful tools that I rather use (3)
- ☐ Other (4) _____

Display This Question:

If Are you currently working and/or teaching in the field of vocational rehabilitation in either pri... = Yes

And Have you received any undergraduate or postgraduate training in MODAPTS that involved the develop... = Yes

And Are you currently working in South Africa? = Yes

Q26 Please select the most relevant option for the questions below with regard to MODAPTS:

	Strongly disagree (1)	Disagree (2)	Agree (3)	Strongly agree (4)
MODAPTS is an adequate assessment tool to evaluate work speed (1)	○	○	○	○
MODAPTS has adequate clinical utility, i.e., it is a useful and practical tool (2)	○	○	○	○
MODAPTS samples are easy to **develop** (3)	○	○	○	○
MODAPTS samples are easy to **administer** (4)	○	○	○	○

End of Block: Face validity

Start of Block: Content validity

Display This Question:

If Are you currently working in South Africa? = Yes

And Are you currently working and/or teaching in the field of vocational rehabilitation in either pri... = Yes

And Have you received any undergraduate or postgraduate training in MODAPTS that involved the develop... = Yes

And Have you provided training in the field of MODAPTS? = Yes, please specify

And Have you published an article on MODAPTS or in the field of vocational rehabilitation? Please giv... = Yes

Q27 Please select the most relevant option for the questions below:

	Strongly disagree (1)	Disagree (2)	Agree (3)	Strongly agree (4)
The basic **moves, gets and puts** codes adequately measure work speed for basic movements (1)	○	○	○	○
The **body movement** codes adequately measure work speed for body movements (2)	○	○	○	○
The **large movements gets, and puts** adequately measure work speed for larger movements (3)	○	○	○	○
The **clerical codes** adequately measure work speed and is applicable with regard to equipment design (4)	○	○	○	○
The **mental operation codes** adequately measure work speed for basic mental operations (5)	○	○	○	○

End of Block: Content validity

Start of Block: Block 3

Q28

Thank you for taking the time to complete the questionnaire. Your assistance is appreciated. Please

note that your response is anonymous and cannot be retracted as it cannot be traced. Please note that reminder communication will be sent out periodically to all members, please ignore if you have already completed the survey. Please forward the survey to any colleague who you feel might have valuable insight into the topic.

Kind Regards

Suzanne Harmse

End of Block: Block 3

ANNEXURE B: Informed consent form

PATIENT OR PARTICIPANT'S INFORMATION & INFORMED CONSENT DOCUMENT

Researcher's name: Suzanne Harmse

Student Number: 10080521

Department of Occupational Therapy

University of Pretoria

Dear Participant .....

EVALUATING VALIDITY OF MODAPTS AS AN ASSESSMENT METHOD OF WORK SPEED.

I am a postgraduate student in **vocational rehabilitation** in the Department of **Occupational Therapy,** University of Pretoria. You are invited to volunteer to participate in my research project on **EVALUATING VALIDITY OF MODAPTS AS AN ASSESSMENT METHOD OF WORK SPEED.**

This letter gives information to help you to decide if you want to take part in this study. Before you agree you should fully understand what is involved. If you do not understand the information or have any other questions, do not hesitate to ask me. You should not agree to take part unless you are completely happy about what we expect of you.

The purpose of the study is **to determine face, content, and criterion validity of MODAPTS as an assessment of work speed.**

I would like you to complete an electronic questionnaire. This may take about **10** minutes. The questionnaire results will automatically be sent to me upon your completion. It will be kept in a safe place to ensure confidentiality. You do not have to indicate your name on the questionnaire. This will ensure confidentiality.

The Research Ethics Committee of the University of Pretoria, Faculty of Health Sciences, telephone numbers 012 356 3084 / 012 356 3085 granted written approval for this study.

Your participation in this study is voluntary. You can refuse to participate or stop at any time without giving any reason. As you do not write your name on the questionnaire, you give me the information anonymously. Once you have submitted the questionnaire, you cannot recall your consent. I will not be able to trace your information. Therefore, you will also not be identified as a participant in any publication that comes from this study.

Note: The implication of completing the questionnaire is that informed consent has been obtained from you. Thus, any information derived from your form (which will be totally anonymous) may be used for e.g. publication, by the researcher.

I sincerely appreciate your help.

Yours truly,

Suzanne Harmse

Please note that the Informed consent will serve as an introduction to the electronic survey and the participant will have to choose an option to agree before filling out the questionnaire.

ANNEXURE C: Electronic Questionnaire – content validity

Content validity questionnaire

Start of Block: Background

Q1 PARTICIPANT'S INFORMATION & INFORMED CONSENT DOCUMENT Researcher's name: Suzanne Harmse Student Number: 10080521 Department of Occupational Therapy University of Pretoria Dear Participant EVALUATING VALIDITY OF MODAPTS AS AN ASSESSMENT METHOD OF WORK SPEED. I am a postgraduate student in vocational rehabilitation in the Department of Occupational Therapy, University of Pretoria. You are invited to volunteer to participate in my research project on EVALUATING VALIDITY OF MODAPTS AS AN ASSESSMENT METHOD OF WORK SPEED. This letter gives information to help you to decide if you want to take part in this study. Before you agree you should fully understand what is involved. If you do not understand the information or have any other questions, do not hesitate to ask me. You should not agree to take part unless you are completely happy about what I expect of you. The purpose of the study is to determine face, content, and criterion validity of MODAPTS as an assessment of work speed. I would like you to complete an electronic questionnaire. This may take about 8 minutes. The questionnaire results will automatically be sent to me upon your completion. It will be kept in a safe place to ensure confidentiality. You do not have to indicate your name on the questionnaire. This will ensure confidentiality. The Research Ethics Committee of the University of Pretoria, Faculty of Health Sciences, telephone numbers 012 356 3084 / 012 356 3085 granted written approval for this study. Your participation in this study is voluntary. You can refuse to participate or stop at any time without giving any reason. As you do not write your name on the questionnaire, you give me the information anonymously. Once you have submitted the questionnaire, you cannot recall your consent as I will not be able to trace your information. Therefore, you will also not be identified as a participant in any publication that comes from this study. Note: The implication of completing the questionnaire is that informed consent has been obtained from you. Thus, any information derived from your form (which will be totally anonymous) may be used for e.g. publication, by the researcher. I sincerely appreciate your help. Yours truly, Suzanne Harmse

Q2 Do you agree to take part in the research?

- Yes, I agree (1)
- I do not wish to partake in the research${l://OptOutLink} (2)

Q3 Thank you for your assistance.

Q4 Please indicate your years of work experience (regardless of the field of expertise):

- 0 - 2 years (1)
- 3 - 5 years (2)
- 5 - 10 years (3)
- 10 - 15 years (4)
- more than 15 years (5)

Q5 From which institution did you graduate?

- ○ University of Pretoria (1)
- ○ University of the Free State (2)
- ○ University of the Witwatersrand Johannesburg (3)
- ○ Stellenbosch University (4)
- ○ University of Cape Town (5)
- ○ Western Cape University (6)
- ○ University of KwaZulu-Natal (7)
- ○ Sefako Makgato University (8)
- ○ Other, please specify (9) _____

Q6 Please indicate the highest post-graduate qualifications and the institution where it was obtained. If you hold no post graduate qualification, proceed to the next question.

- ○ Postgraduate Diploma (1) _____
- ○ Honours Degree (2) _____
- ○ Master's Degree (3) _____
- ○ PhD or DocTher (4) _____
- ○ Other, please specify (5) _____

Q7 Are you enrolled for any postgraduate qualification at present?

- ○ Yes, please specify (1) _____
- ○ No (2)

Q8 Are you currently working in South Africa?

- ○ Yes (1)
- ○ No (2)

Q9 Please indicate your practice setting (you can choose more than one option if need be)

- [ ] Private clinic (1)
- [ ] Private hospital (2)
- [ ] Private practice (3)
- [ ] School (4)
- [ ] Public sector: primary setting (5)
- [ ] Public sector: secondary setting (6)
- [ ] Public sector: tertiary institution (7)
- [ ] Public sector: community based (8)
- [ ] Academia (9)
- [ ] Other, please specify (10) _____

Q10 Please indicate in which province your practice is located (you can choose more than one option if need be)

- ☐ Gauteng (1)
- ☐ Northern Cape (2)
- ☐ Eastern Cape (3)
- ☐ Western Cape (4)
- ☐ Kwa-Zulu Natal (5)
- ☐ Free State (6)
- ☐ North West (7)
- ☐ Mpumalanga (8)
- ☐ Limpopo (9)
- ☐ Other, please specify (10) _____

Q11 Please specify the location of practice (you can choose more than one option if need be)

- ☐ Urban/ Suburban (1)
- ☐ Town/ Country (2)
- ☐ Semi-rural (3)
- ☐ Rural (4)
- ☐ Other, please specify (5) _____

Q12 Are you currently working and/or teaching in the field of vocational rehabilitation in either private or public sector?

- ○ Yes (1)
- ○ No (2)

Q13 If you are engaged in tertiary education: Please indicate the number of hours spent teaching **per year**, and indicate which subjects/modules you teach.

_____ Hours per year (1)

Q14 Please indicate the number of hours working in the field of vocational rehabilitation **per week**.

_____

Q15 Please choose the **most relevant** option to describe your practice.

- ○ Sole practice / working alone at the setting (1)
- ○ Working with a supervisor / mentor (2)
- ○ Working within a team of other occupational therapists (3)
- ○ Working in a multi-disciplinary team that provide shared services (4)
- ○ Other, please specify (5) _____

Q16 Please indicate the type of intervention that you provide (you can choose more than one option if need be)

- ☐ Medico-legal work (1)
- ☐ Functional Capacity Evaluations / Work assessments (2)
- ☐ Work rehabilitation / Case-management (3)
- ☐ Employee wellness / Employee assistance programs (4)
- ☐ Disability claims assessor / Consultant (5)
- ☐ Other, please specify (6) _____

Q17 Have you received any undergraduate or postgraduate training in MODAPTS that involved the development of your own work sample?

- ○ Yes (1)
- ○ No (2)

Q18 Have you provided training in the field of MODAPTS? OR have you published an article on MODAPTS or in the field of vocational rehabilitation? Please provide information on the training provided or title and place of publication.

- ○ Yes, please specify (1) _____
- ○ No (2)

End of Block: Background

Start of Block: Content validity

Q27 Please select the most relevant option for the questions below:

	Strongly disagree (1)	Disagree (2)	Agree (3)	Strongly agree (4)
The basic **moves, gets and puts** codes adequately measure work speed for basic movements (1)	○	○	○	○
The **body movement** codes adequately measure work speed for body movements (2)	○	○	○	○
The **large movements gets, and puts** adequately measure work speed for larger movements (3)	○	○	○	○
The **clerical codes** adequately measure work speed and is applicable with regard to equipment design (4)	○	○	○	○
The **mental operation codes** adequately measure work speed for basic mental operations (5)	○	○	○	○

End of Block: Content validity

Start of Block: Block 3

Q28

Thank you for taking the time to complete the questionnaire. Your assistance is appreciated. Please note that your response is anonymous and cannot be retracted as it cannot be traced.

Kind Regards

Suzanne Harmse

End of Block: Block 3

ANNEXURE D: First draft VCWS list with expert rating

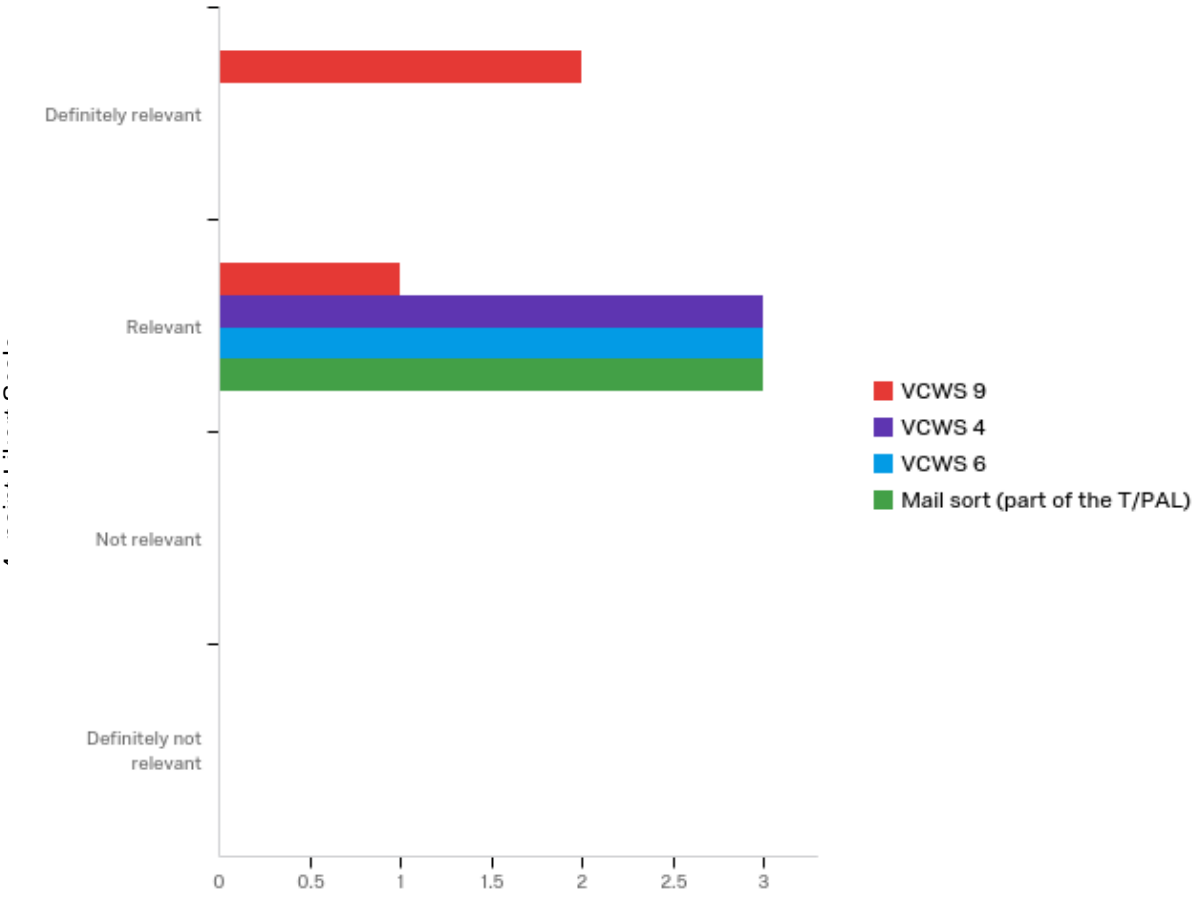

Figure 19: VCWS relevance rating

Table 6: Relevance rating of VCWS on 4-point Likert Scale

#	AWA.FIELD	Definitely relevant	Relevant	Not relevant	Definitely not relevant	SIMPLETABLEWIDGET.TOTAL
1	VCWS 9	66.67% 2	33.33% 1	0.00% 0	0.00% 0	3
2	VCWS 4	0.00% 0	100.00% 3	0.00% 0	0.00% 0	3
3	VCWS 6	0.00% 0	100.00% 3	0.00% 0	0.00% 0	3
4	Mail sort (part of the T/PAL)	0.00% 0	100.00% 3	0.00% 0	0.00% 0	3

SIMPLETABLEWIDGET.SHOWING_ROWS_OF

ANNEXURE E: Final VCWS list with descriptions

VCWS	Description	Picture
VCWS 9: whole body range of motion	Assesses physical skills in a work sample that simulates light work. Reaching, bending, stooping, feeling and gingering is included.	
VCWS 4: Upper extremity range of motion	This task simulates light work and assesses tolerance for dexterous work involving the upper limbs. It involves reaching, touching, feeling and fingering.	
VCWS 6: Independent problem solving	Assesses attention to detail and identification of differences. The task simulates sedentary and clerical type work.	

Available from: www.thevalpar.com

ANNEXURE F: Results of MODAPTS moderation session

VCWS 9 P1 - 2						
Left hand analysis				Right hand analysis		
Description	MODAPTS	F	MODS	F	MODAPTS	Description
			36	6	M5G1	Get nut
			234	6x13	M3G0	Loosen nut
			270234	6x135	C2M3P0	Loosen nut
			4220	6	M5P20	Place nut in bowl
Get triangle	M5G1	1	68	1	M5G13	Get triangle
Place triangle on panel two	M5P0	1	10	1	M5P5J2	Place triangle on panel two
Stabilise triangleReposition hand	M5G0M3P0	1	485	61	M2G0M5G3	Hold triangleGet nut from bowl
			36	6	M5G1	Get nut
Drop arm	M5P0	1	42	6	M5P2J2	Place nut on bolt
			288	6x16	M3G0	Screw nut
			270288	6x165	C3M3P0	Screw nut
			24	6	X4	Tighten
			5	1	W5	Adjust feet
			-			
			30	5	M5G1	Get nut
			195	5x13	M3G0	Loosen nut
			195225	5x135	C2M3P0	Loosen nut
			3525	5	M5P20	Place nut in bowl
Get square	M5G1	1	86	1	M5G13	Get square
Place square on panel two	M5P0	1	10	1	M5P5J2	Place square on panel two

Left hand analysis				Right hand analysis		
Description	MODAPTS	F	Mods	F	MODAPTS	Description
			3	1	W5	Adjust feet
			66	11	M5G1	Get nut
Stabilise kidney	M5G0		485429	11x13 6	C2M3G0	Loosen nut
Stabilise kidney	M5G0	1	429	11x13	M3P0	Loosen nut
Drop arm	M6P0		7765	11	M5P20	Place nut in bowl
Get kidney	M3G1	1	68	1	M5G2M5G 1	Get kidney
			3	1	D3	Decide on correct orientation of kidney
Place kidney on panel three	M7P0	1	12	1	M7P5J2	Place kidney on panel three
			6677	11	M45G31	Get nut from bowl
		1	7766	11	M48P2J2	Place nut on bolt
			408328	11x16 6	C2M3G0	Screw nut
			328	11x16	M3P0	Screw nut
			44	11	X4	Tighten
		TOTAL	36664548			
		Sec	242.914586.63			
		Allowance	40%	Mental and physical monotony		
		Sec	378.36			

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		~~Allowance~~	~~10%~~	~~Mental and physical monotony~~		
		~~See~~	~~379.58~~			

Notes on moderation process:

1. The frequency of turns used to loosen and fasten nuts was disputed. An average of two persons, who represent qualified manual workers, completing the task was taken.
2. It is agreed that M5 movements will be used as scapula displacement took place during the movements.
3. No time allowance is provided as the task is too short and has intermittent rest breaks.
4. A decide on correct orientation was allowed for the kidney only as the other two shapes can be oriented with one glance and while moving toward the panel. The kidney requires a more conscious decision.

VCWS 9 Panel 2 – 3						
Left hand analysis				Right hand analysis		
Description	MODAPTS	F	Mods	F	MODAPTS	Description
			36	6	M5G1	Get nut
			~~370~~234	6x1~~3~~	~~C3~~M3G0	Loosen nut
Stabilise triangle	M5G0		234	6x13	M3P0	Loosen nut
~~Stabilise triangle~~	~~M5G0~~		~~420~~	6	M5P~~2~~0	Place nut in bowl
~~Drop arm~~Get triangle	~~M5P0~~M3G1	1	~~8~~6	1	M5G1~~2~~	Get triangle
Place triangle on panel three	M7P0	1	12	1	M7P0J2	Place triangle on panel three
Drop arm	M3P0		~~364~~2	6	M~~4~~5G3~~4~~	Get nut from bowl
		1	3~~64~~3	6	M~~4~~5F2J2	Place nut on bolt
			288~~270~~	6x1~~63~~	~~C3~~M3G0	Screw nut
			288	6x16	M3P0	Screw nut
			24	6	X4	Tighten
			~~5~~	~~1~~	~~W5~~	~~Adjust feet~~
			30	5	M5G1	Get nut
			~~225~~195	5x1~~3~~5	~~C3~~M3G0	Loosen nut
Stabilise square	M5G0		195	5x13	M3P0	Loosen nut
~~Stabilise square~~	~~M5G0~~	1	~~235~~	5	M5P~~2~~0	Place nut in bowl
~~Drop arm~~Get square	~~M5P0~~M5G1	1	~~6~~0	1	M5G1~~3~~	Get square
Place square on panel three	M7P0	1	12	1	M7P0J2	Place square on panel three
Drop arm	M3P0		3~~4~~0	5	M~~4~~5G3~~4~~	Get nut from bowl
		1	~~23~~30	5	M~~4~~5F2J2	Place nut on bolt
			~~225~~240	5x1~~63~~	~~C3~~M3G0	Screw nut
			240	5x16	M3P0	Screw nut
			20	5	X4	Tighten

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Left hand analysis				Right hand analysis		
Description	MODAPTS	F	Mods	F	MODAPTS	Description
			3	1	W3	Adjust feet
			66	11	M5G1	Get nut
Stabilise kidney	M5G0		495429	11x13	G2M3G0	Loosen nut
Stabilise kidney	M5G0	1	429	11x13	M3P0	Loosen nut
Drop arm	M5P0		7786	11	M5P20	Place nut in bowl
Get kidney	M3G1	1	68	1	M3G2M5G1	Get kidney
			3	1	D3	Decide on correct orientation of kidney
Place kidney on panel three	M7P0	1	12	1	M7P0J2	Place kidney on panel three
			6677	11	M45G31	Get nut from bowl
		1	7766	11	M4P2J2	Place nut on bolt
			4045528	11x16	G2M3G0	Screw nut
			328	11x16	M3P0	Screw nut
			44	11	X4	Tighten
		TOTAL	266664548			
		Sec	242.814586.63			
		Allowance	40%	Mental and physical monotony		
		Sec	370.36			

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Place kidney on panel four	M5P12	1	710	4	M3P8J2	Place kidney//pit
Drop arm	M5P0	1	6	1	M4P2	Drop flap
			6888	11	M37G36	Get nut from bowl
			8877	11	M37P2J2	Place nut on bolt
			528	11x16	M3G0	Screw nut
			4085528	11x16	63M3P0	Screw nut
			44	11	X4	Tighten
			9	0.5	B18	Arise
		TOTAL	37834692			
		Sec	358.007605.27			

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Notes on analysis

1. A decide on correct orientation was allowed for each of the shapes as one could not process the visual information before lifting the flap and observing the bolts.
2.

VCWS 9 Panel 4-1						
Left hand analysis				Right hand analysis		
Description	MODAPTS	F	Mods	F	MODAPTS	Description
			9	0.5	B18	Crouch
			~~36~~48	6	M5G1	Get nut
			234	6x13	M3G0	Loosen nut
			~~3~~234	6x1~~3~~	~~G2~~M3P0	Loosen nut
			42	6	M~~5~~P2~~0~~	Place nut in bowl
Get triangle	M5G1	1	~~8~~6	1	M5G1~~2~~	Get triangle
			9	0.5	B18	Arise
Place triangle on panel one	M5P0	1	10	1	M5P0J2	Place triangle on panel one
			~~36~~48	6	M5G3~~6~~	Get nut from bowl
			42	6	M5P1J2	Place nut on bolt
			288	6x16	M3G0	Screw nut
			~~3~~70288	6x16~~5~~	~~G2~~M3P0	Screw nut
			24	6	X4	Tighten
			9	0.5	B18	Crouch
			30	5	M5G1	Get nut
			~~33~~6192	5x13~~8~~	~~G2~~M3G0	Loosen nut
			192	5x13	M3P0	Loosen nut
			35	5	M~~5~~P2~~0~~	Place nut in bowl
Get square	M5G1	1	~~8~~6	1	~~M8G3~~M2G1	Get square
			9	0.5	B18	Arise
Place square on panel one	M5P0	1	10	1	M5P1J2	Place square on panel one
			~~39~~40	5	M5G3~~6~~	Get nut from bowl
			35	5	M5P2J2	Place nut

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			240	5x16	M3G0	Screw nut
			~~336~~240	5x16~~8~~	~~G3~~M3P0	Screw nut
			20	5	X4	Tighten
			9	0.5	B18	Crouch
			66	11	M5G1	Get nut
			~~408~~429	11x13~~.5~~	~~G3~~M3G0	Loosen nut
			429	11x13	M3G0	Loosen nut
			77	11	~~M3P0~~M5P2~~.~~	Place nut in bowl
Get kidney	M5G1	1	~~86~~	1	~~M5G2~~M5G1~~.~~	Get kidney
			9	0.5	B18	Arise
			3	1	D3	Decide on correct orientation of kidney
Place kidney on panel on	M3P0	1	10	1	M5P0J2	Place kidney on panel one
			~~66~~88	11	M5G3~~6~~	Get nut from bowl
			77	11	M5P2J2	Place nut on bolt
			528	11x16	M3G0	Screw nut
			~~408~~528	11x16~~.5~~	~~G3~~M3P0	Screw nut
			44	11	X4	Tighten
		TOTAL	~~3764~~4619			
		Sec	~~354.870~~595.85			
		~~Allowance~~	~~10%~~	~~Mental and physical monotony~~		
		~~Sec~~	~~280.26~~			

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			4086	86	M4G1M8G6	Get nut from first two rows Get nut
			4864	816	M3G1X4	Get nut from second two rows Untighten
			64480	1646n65	X4M3G0	UntightenUnscrew
			224480	8x1466n65	M2G0M3P0	Unscrew large nuts Unscrew
			224412	8x1416	M2P0M3P1	Unscrew large nuts Place nut
			368	8x23	M2G0	Unscrew small nuts
			368	8x23	M2P0	Unscrew small nuts
			80	16	M3P2	Place nut in tray
				Disassembly front		
			7360	12	M4G1	Get nut
			64	12	X4	Untighten
			260168	11x136x14	M2G0	Unscrew large nuts
			360168	13n686x14	M2P0	Unscrew large nuts
			276	6x23	M2G0	Unscrew small nuts
			276	6x23	M2P0	Unscrew small nuts
			8460	12	M3P2	Place nut in tray
		TOTAL	46306320			
		Sec	607.37686.28			

VCWS 6						
Left hand analysis				Right hand analysis		
Description	MODAPTS	F	Mods	F	MODAPTS	Description
Get pageMove hand to testing booklet	M3G03	150	3300	1	M3G1J2	Get pin
Put pageGet page	M4P0M2G3	150	5200			
Turn page	M4P0	1	4100	50	J2	Look at letter
Get page	M4G3	49	343350	50	J2D2	Find letter Decide
Turn page	M4P0	49	1961250	250	J2	Look at shapes
			100	50	R2	Read at letter on testing card
			450	50	E4R2D3	Find letter on master cards, decide on correct letter
			1750	250	E4R3	Look at numbered shape on testing card
			2500	250	E4R3D3	Find numbered row on master card
			22501250	250	E4E2D32D3	Compare shapes on master card
			150100	50	R3J2	Find next row on answer sheet
			343		E4R2	Read row number on testing card
			490147	49	E4R3D3D3	Decide errorson correct hole to punch
-	-	-	588441	49	E4E2D3	Find hole
			147588	49	M3P5X4	Move pin stylus to hole and punch
			3	49	M3P0	Move hand to resting position
			33	1	M3P0	Put down pin stylus
		TOTAL	46289322			
		Sec	1202.538 597.141			

Notes on moderation process:

1. It was decided that the analysis will start with the stylus in the client's hand as sample questions have to be answered before timing starts, during which the client picks up the stylus.

ANNEXURE G: Final MODAPTS analysis

VCWS 9 P1 – 2						
Left hand analysis				**Right hand analysis**		
Description	**MODAPTS**	**F**	**MODS**	**F**	**MODAPTS**	**Description**
			36	6	M5G1	Get nut
			234	6x13	M3G0	Loosen nut
			234	6x13	M3P0	Loosen nut
			42	6	M5P2	Place nut in bowl
Get triangle	M5G1	1	6	1	M5G1	Get triangle
Place triangle on panel two	M5P0	1	10	1	M5P5J2	Place triangle on panel two
Reposition hand	M3P0	1	48	6	M5G3	Get nut from bowl
Drop arm	M5P0	1	42	6	M5P2J2	Place nut on bolt
			288	6x16	M3G0	Screw nut
			288	6x16	M3P0	Screw nut
			24	6	X4	Tighten
			30	5	M5G1	Get nut
			195	5x13	M3G0	Loosen nut
			195	5x13	M3P0	Loosen nut
			35	5	M5P2	Place nut in bowl
Get square	M5G1	1	6	1	M5G1	Get square
Place square on panel two	M5P0	1	10	1	M5P5J2	Place square on panel two
Reposition hand	M3P0	1	40	5	M5G3	Get nut from bowl
Drop arm	M5P0	1	35	5	M5P2J2	Place nut on bolt
			240	5x16	M3G0	Screw nut
			240	5x16	M3P0	Screw nut
			20	5	X4	Tighten

Left hand analysis				Right hand analysis		
Description	**MODAPTS**	**F**	**MODS**	**F**	**MODAPTS**	**Description**
			66	11	M5G1	Get nut
			429	11x13	M3G0	Loosen nut
			429	11x13	M3P0	Loosen nut
			77	11	M5P2	Place nut in bowl
Get kidney	M5G1	1	6	1	M5G1	Get kidney
			3	1	D3	Decide on correct orientation for kidney
Place kidney on panel two	M5P0	1	10	1	M5P5J2	Place kidney on panel two
Reposition hand	M3P0	1	88	11	M5G3	Get nut from bowl
Drop arm	M5P0	1	77	11	M5P2J2	Place nut on bolt
			528	11x16	M3G0	Screw nut
			528	11x16	M3P0	Screw nut
			44	11	X4	Tighten
		TOTAL	**4583**			
		Sec	**591.207**			

Notes on moderation process:

1. The frequency of turns used to loosen and fasten nuts was disputed. An average of two persons, who represent qualified manual workers, completing the task was taken.
2. It is agreed that M5 movements will be used as scapula displacement took place during the movements.
3. No time allowance is provided as the task is too short and has intermittent rest breaks.

4.

VCWS 9 Panel 2 – 3						
Left hand analysis				**Right hand analysis**		
Description	**MODAPTS**	**F**	**Mods**	**F**	**MODAPTS**	**Description**
			36	6	M5G1	Get nut
			234	6x13	M3G0	Loosen nut
Stabilise triangle	M5G0	1	234	6x13	M3P0	Loosen nut
			42	6	M5P2	Place nut in bowl
Get triangle	M3G1	1	6	1	M5G1	Get triangle
Place triangle on panel three	M7P0	1	12	1	M7P502	Place triangle on panel three
Drop arm	M5P0	1	42	6	M4G3	Get nut from bowl
			36	6	M4P202	Place nut on bolt
			288	6x16	M3G0	Screw nut
			288	6x16	M3P0	Screw nut
			24	6	X4	Tighten
			30	5	M5G1	Get nut
			195	5x13	M3G0	Loosen nut
Stabilise square	M5G0	1	195	5x13	M3P0	Loosen nut
			35	5	M5P2	Place nut in bowl
Get square	M5G1	1	6	1	M5G1	Get square
Place square on panel three	M7P0	1	12	1	M7P502	Place square on panel three
Drop arm	M5P0	1	35	5	M4G3	Get nut from bowl
			30	5	M4P202	Place nut on bolt
			240	5x16	M3G0	Screw nut
			240	5x16	M3P0	Screw nut
			20	5	X4	Tighten

Left hand analysis				Right hand analysis		
Description	**MODAPTS**	**F**	**Mods**	**F**	**MODAPTS**	**Description**
			66	11	M5G1	Get nut
			429	11x13	M3G0	Loosen nut
Stabilise kidney	M5G0	1	429	11x13	M3P0	Loosen nut
			77	11	M5P2	Place nut in bowl
Get kidney	M3G1	1	6	1	M5G1	Get kidney
			3	1	D3	Decide on correct orientation of kidney
Place kidney on panel three	M7P0	1	12	1	M7P502	Place kidney on panel three
			77	11	M4G3	Get nut from bowl
			66	11	M4P202	Place nut on bolt
			528	11x16	M3G0	Screw nut
			528	11x16	M3P0	Screw nut
			44	11	X4	Tighten
		TOTAL	**4545**			
		Sec	**586.305**			

VCWS 9 Panel 3-4						
Right hand analysis				**Left hand analysis**		
Description	**MODAPTS**	**F**	**Mods**	**F**	**MODAPTS**	**Description**
			8	1	M7G1	Stoop and get nut
			25	5	M4G1	Get nut
			234	6x13	M3G0	Loosen nut
			234	6x13	M3P0	Loosen nut
			36	6	M4P2	Place nut in bowl
Get triangle	M4G1	1	5	1	M4G1	Get triangle
			9	0.5	B18	Crouch
			5	1	M4G1	Lift flap
			4	1	M4P0	Lift flap
			3	1	D3	Decide on correct orientation of triangle
Place triangle on panel four	M5P5J2	1	10	-	-	Wait
Drop arm	M5P0	1	6	1	M4P2	Drop flap
			48	6	M5G3	Get nut from bowl
			42	6	M5P2J2	Place nut on bolt
			288	6x16	M3G0	Screw nut
			288	6x16	M3P0	Screw nut
			24	6	X4	Tighten
			9	0.5	B18	Arise
			8	1	M7G1	Stoop and get nut
			20	4	M4G1	Get nut
			195	5x13	M3G0	Loosen nut
			195	5x13	M3P0	Loosen nut
			30	5	M4P2	Place nut in bowl
Get square	M4G1	1	5	1	M4G1	Get square
			9	0.5	B18	Crouch
			5	1	M4G1	Lift flap
			4	1	M4P0	Lift flap

Right hand analysis				Left hand analysis		
Description	**MODAPTS**	**F**	**Mods**	**F**	**MODAPTS**	**Description**
			3	1	D3	Decide on correct orientation of kidney
Place square on panel four	M5P5J2	1	10	-	-	Wait
Drop arm	M5P0	1	40	5	M5G3	Get nut from bowl
			35	5	M5P2J2	Place nut on bolt
			240	5x16	M3G0	Screw nut
			240	5x16	M3P0	Screw nut
			20	5	X4	Tighten
			9	0.5	B18	Arise
			8	1	M7G1	Stoop and get nut
			50	10	M4G1	Get nut
			429	11x13	M3G0	Loosen nut
			429	11x13	M3P0	Loosen nut
			66	11	M4P2	Place nut in bowl
Get kidney	M4G1	1	5	1	M4G1	Get kidney
			9	0.5	B18	Crouch
			5	1	M4G1	Lift flap
			4	1	M4P0	Lift flap
			3	1	D3	Decide on correct orientation of kidney
Place kidney on panel four	M5P5J2	1	10	-	-	Wait
Drop arm	M5P0	1	6	1	M4P2	Drop flap
			88	11	M5G3	Get nut from bowl
			77	11	M5P2J2	Place nut on bolt
			528	11x16	M3G0	Screw nut
			528	11x16	M3P0	Screw nut
			44	11	X4	Tighten
				0.5	B18	Arise
		TOTAL	**4644**			
		Sec	**599.076**			

Notes on moderation process:

1. A decide on correct orientation was allowed for each of the shapes as one could not process the visual information before lifting the flap and observing the bolts.

VCWS 9 Panel 4-1						
Left hand analysis				**Right hand analysis**		
Description	**MODAPTS**	**F**	**Mods**	**F**	**MODAPTS**	**Description**
			9	0.5	B18	Crouch
			36	6	M5G1	Get nut
			234	6x13	M3G0	Loosen nut
			234	6x13	M3P0	Loosen nut
			42	6	M5P2	Place nut in bowl
Get triangle	M5G1	1	6	1	M5G1	Get triangle
			9	0.5	B18	Arise
Place triangle on panel one	M5P0	1	10	1	M5P5J2	Place triangle on panel one
			48	6	M5G3	Get nut from bowl
			42	6	M5P2J2	Place nut on bolt
			288	6x16	M3G0	Screw nut
			288	6x16	M3P0	Screw nut
			24	6	X4	Tighten
			9	0.5	B18	Crouch
			30	5	M5G1	Get nut
			195	5x13	M3G0	Loosen nut
			195	5x13	M3P0	Loosen nut
			35	5	M5P2	Place nut in bowl
Get square	M5G1	1	6	1	M5G1	Get square
			9	0.5	B18	Arise
Place square on panel one	M5P0	1	10	1	M5P5J2	Place square on panel one
			40	5	M5G3	Get nut from bowl
			35	5	M5P2J2	Place nut
			240	5x16	M3G0	Screw nut
			240	5x16	M3P0	Screw nut

Left hand analysis				Right hand analysis		
Description	**MODAPTS**	**F**	**Mods**	**F**	**MODAPTS**	**Description**
			20	5	X4	Tighten
			9	0.5	B18	Crouch
			66	11	M5G1	Get nut
			429	11x13	M3G0	Loosen nut
			429	11x13	M3G0	Loosen nut
			77	11	M5P2	Place nut in bowl
Get kidney	M5G1	1	6	1	M5G1	Get kidney
			9	0.5	B18	Arise
			3	1	D3	Decide on correct orientation of kidney
Place kidney on panel on	M5P0	1	10	1	M5P5J2	Place kidney on panel one
			88	11	M5G3	Get nut from bowl
			77	11	M5P2J2	Place nut on bolt
			528	11x16	M3G0	Screw nut
			528	11x16	M3P0	Screw nut
			44	11	X4	Tighten
		TOTAL	**4637**			
		Sec	**598.173**			

VCWS 4 Assembly						
Left hand analysis				**Right hand analysis**		
Description	**MODAPTS**	**F**	**MODS**	**F**	**MODAPTS**	**Description**
				Assembly bottom panel		
			48	8	M3G3	Get nut from tray
			36	4	M4P5J2	Place nut on first two rows
			40	4	M5P5J2	Place nut on last two rows
			104	4x13	M2G0	Screw large nut
			104	4x13	M2P0	Screw large nut
			136	4x17	M2G0	Screw small nut
			136	4x17	M2P0	Screw small nut
			32	8	X4	Tighten
				Assembly top panel		
			48	8	M3G3	Get nut from tray
			36	4	M4P5J2	Place nut in first two rows
			40	4	M5P5J2	Place nut in last two rows
			104	4x13	M2G0	Screw large nut
			104	4x13	M2P0	Screw large nut
			136	4x17	M2G0	Screw small nut
			136	4x17	M2P0	Screw small nut
			32	8	X4	Tighten
				Assembly side panel		
			96	16	M3G3	Get nut from tray
			72	8	M4P5J2	Place nut on first two rows
			80	8	M5P5J2	Place nut on last two rows

			208	8x13	M2G0	Screw large nut
			208	8x13	M2P0	Screw large nut
			272	8x17	M2G0	Screw small nut
			272	8x17	M2P0	Screw small nut
			64	16	X4	Tighten
				Assembly front panel		
			36	6	M3G3	Get nut from tray
			54	6	M4P502	Place nut
			78	3x113	M2G0	Screw large nut
			78	3x13	M2P0	Screw large nut
			102	3x17	M2G0	Screw small nut
			102	3x17	M2P0	Screw small nut
			24	6	X4	Tighten
		TOTAL	**3018**			
		Sec	**389.322**			

VCWS 4 Disassembly						
				Disassembly bottom		
			40	8	M4G1	Get nut from first two rows
			48	8	M5G1	Get nut from second two rows
			64	16	X4	Untighten
			224	8x14	M2G0	Unscrew large nuts
			224	8x14	M2P0	Unscrew large nuts
			368	8x23	M2G0	Unscrew small nuts
			368	8x23	MsP0	Unscrew small nuts
			80	16	M3P2	Place nut in tray
				Disassembly top		
			40	8	M4G1	Get nut from first two rows
			48	8	M5G1	Get nut from second two rows
			64	16	X4	Untighten
			224	8x14	M2G0	Unscrew large nuts
			224	8x14	M2P0	Unscrew large nuts
			368	8x23	M2G0	Unscrew small nuts
			368	8x23	MsP0	Unscrew small nuts
			80	16	M3P2	Place nut in tray
				Disassembly side		
			40	8	M4G1	Get nut from first two rows
			48	8	M5G1	Get nut from second two rows

			64	16	X4	Untighten
			224	8x14	M2G0	Unscrew large nuts
			224	8x14	M2P0	Unscrew large nuts
			368	8x23	M2G0	Unscrew small nuts
			368	8x23	MsP0	Unscrew small nuts
			80	16	M3P2	Place nut in tray
				Disassembly front		
			60	12	M4G1	Get nut
			64	12	X4	Untighten
			168	6x14	M2G0	Unscrew large nuts
			168	6x14	M2P0	Unscrew large nuts
			276	6x23	M2G0	Unscrew small nuts
			276	6x23	M2P0	Unscrew small nuts
			60	12	M3P2	Place nut in tray
		TOTAL	**5320**			
		Sec	**686.28**			

VCWS 6						
Left hand analysis				**Right hand analysis**		
Description	**MODAPTS**	**F**	**Mods**	**F**	**MODAPTS**	**Description**
Move hand to testing booklet	M3G0	1	3			
Get page	M2G3	1	5			
Turn page	M4P0	1	4			
Get page	M4G3	49	343			
Turn page	M4P0	49	196			
			100	50	R2	Read at letter on testing card
			450	50	E4R2D3	Find letter on master cards, decide on correct letter
			1750	250	E4R3	Look at numbered shape on testing card
			2500	250	E4R3D3	Find numbered row on master card
			2250	250	E4E2D3	Compare shapes on master card
			150	50	R3	Find next row on answer sheet
			343	49	E4R2	Read row number on testing card
			490	49	E4R3D3	Decide on correct hole to punch
			588	49	M3P5X4	Move stylus to hole and punch
			147	49	M3P0	Move hand to resting position
			3	1	M3P0	Put down stylus
		TOTAL	**9322**			
		Sec	**1202.538**			

Notes on moderation process:

1. It was decided that the analysis will start with the stylus in the client's hand as sample questions have to be answered before timing starts, during which the client picks up the stylus.

ANNEXURE H: Ethical clearance certificate

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Faculty of Health Sciences

DATE: 29/06/2018

Miss Suzanne Harmse
Dept: Occupational Therapy

Dear Miss Suzanne Harmse

RE.: 146/2017 ~ Letter dated 31 May 2018 Extension of approval until 31 December 2018

146/2017 Harmse	Initial Application
Study Title	Evaluating validity of MODAPTS as an assessment method of work speed.
Principal Investigator	Miss Suzanne Harmse Tel: 0825666148 Email: suzanneharmse@gmail.com Dept: Occupational Therapy
Sub Investigators	Harmse, Suzanne S~Buys, Tania TL~Claassen, Nicolaas N~
Study Degree	Marb
Duration of Study	Start Date:01-May-2017 End Date:30-Mar-2018 Duration:10 months. Extent until December 2018
Documents submitted electronically	30-Mar-2017

We hereby acknowledge receipt of the following document:

- Renewal of ethics approval of study granted for 1 year until end of 31 December 2018.

which has been approved at 27 June 2018 meeting.

With regards

Dr R Sommers; MBChB; MMed (Int); MPharmMed; PhD
Deputy Chairperson of the Faculty of Health Sciences Research Ethics Committee, University of Pretoria

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