

Feature Article

A conceptual framework of functional capacity evaluation for occupational therapy in work rehabilitation

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Functional capacity evaluation (FCE) is commonly used in work rehabilitation to assess the capacity of the injured worker for return to work. Occupational therapists are major providers of FCE, especially in Australia. Despite a history of involvement in the functional assessment of clients for work, occupational therapy has few theoretical models for work assessment in general, and for FCE in particular. This may account for some of the confusion that exists about the conceptual basis of FCE in occupational therapy practice. This paper presents a framework for FCE that parallels occupational therapy's occupational performance model and the World Health Organisation's International Classification of Functioning, Disability and Health. The framework is used to clarify some of the confusions that exist in FCE research and practice, particularly the issue of measuring a client's function versus impairment. A redefinition of FCE for occupational therapy practice in the work assessment continuum is presented that supports occupational therapy practice and research in the area.

KEY WORDS *functional assessment, functional capacity evaluation, occupational performance model, work assessment, work rehabilitation.*

INTRODUCTION

Occupational therapists can play a major role in the work rehabilitation process through assessment and rehabilitation of workers with an injury or disability for return to work (RTW) (Deen, Gibson & Strong, 2002; Jundt & King, 1999). The work rehabilitation process usually involves an assessment of the match between the demands of the worker's job or workplace and the residual functional capacity of the worker, the results of which then guide interventions to address any mismatch (Gibson, Allen & Strong, 2002). Functional capacity evaluation (FCE) is a method commonly used in practice for assessing the residual capacity of the injured worker for RTW. Occupational therapists have long been proponents

of functionally orientated assessments of capacity for work (Holmes, 1985). Functional capacity evaluation is one of the most commonly offered services in the provision of work rehabilitation by occupational therapists in the United States of America (Jundt & King, 1999) and Australia (Deen *et al.*). Yet, despite this history in functional assessment for work and the common use of FCE in current practice, occupational therapists have not played a major role in FCE research and development (Veloze, 1993).

In a critique of occupational therapy's role in the functional assessment of work, Veloze (1993) commented on the lack of occupational therapy models of work assessment practice and research. He called for research to develop and test theoretical models of work assessment

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and RTW to better assist clients in what is an important area of occupational therapy practice. Velozo and colleagues (1999) have since developed self-report tools for occupational therapists' use in work assessment which are based on the Model of Human Occupation (Velozo *et al.*, 1999). Velozo also raised concerns about the confusion that existed about definitions and terms used in functional assessment for work. In a review of design problems in work-related assessments, Innes and Straker (1998) also discussed the issue of confused definition of terms in work-related assessments, and provided an in-depth review of the conceptual confusion that exists in work assessment practice. Some of the issues they discussed included problems created by the limited specificity and flexibility of work assessments to assess items that are relevant to the context and functional level of the client. Innes and Straker provided a framework to assist practitioners to better match the type of work-related assessment they need to the functional level of the individual and his or her job requirements.

In the area of back pain rehabilitation practice and the associated literature, there also appears to be some conceptual confusion about how to assess functional capacity for RTW, especially for workers with chronic back pain. The value of so-called objective testing over self-report alone is widely lauded, including the use of machines to assist clinicians' diagnoses and decisions about readiness for RTW (Gracovetsky *et al.*, 1999; Marriott, Newman, Gracovetsky, Richards & Asselin, 1999). Tests of strength and range of motion with equipment such as dynamometers have been labelled by some authors as functional capacity evaluations (Ferguson, Marras & Crowell, 1996; Yeomans & Liebensen, 1996) and have been used to make decisions about readiness for RTW. As noted by Menard, Cooke, Locke, Beach and Butler (1994), 'the clinician is often called on to make judgements and decisions about the present and future functional capacity of patients on the basis of dynamometry, the measurement of strength with machines. This is especially so in the occupational setting' (p. 1359).

An alternative to such testing of strength and range of motion is to observe the person performing a range of functional work-related activities. As noted in reviews by Innes and Straker (1998) and King, Tuckwell and Barrett (1998), these activities are commonly based on the physical demands defined in The Revised Handbook of Analysing Jobs (RHAI) (United States Department of Labor, 1991b), which is a companion publication of the Dictionary of Occupational Titles (DOT) (United States Department of Labor, 1991a). The physical demands include standing, walking, sitting, lifting, carrying, climbing, kneeling and crouching. As noted by Wickstrom (1996), the US Department of Labor's taxonomy of 20 physical demands is 'the most widely used taxonomy for

matching the physical qualifications of workers with jobs' (p. 367). The value of the DOT in providing a system for evaluating the match between the person's functional capacity and the physical demands of the job has been reported (King *et al.*, 1998; Randolph, 1996). The physical demands from the DOT provide a source for a consistent framework of functional activities to be performed and observed in the FCE (Gibson & Strong, 1997). A number of existing FCE approaches use the DOT physical demands as a content source for the FCE, for example Fishbain *et al.* (1994), Gibson and Strong (1999a) and Lechner, Jackson, Roth and Straaton (1994).

In this paper, we will further clarify the conceptual confusions and highlight the limitations of some current concepts in FCE practice. We will discuss some occupational therapy models of functional assessment, and highlight the parallels that exist between occupational therapy's Occupational Performance Model (OPM), as described by the American Occupational Therapy Association (AOTA) (Moyers, 1999) and the World Health Organization's (WHO) revised International Classification of Functioning, Disability and Health (World Health Organization, 2000). Using these models, a conceptual framework of FCE is presented, based on the physical demands from the DOT, that supports occupational therapy's role in FCE practice and research. Using this framework, we will redefine functional capacity evaluation for occupational therapy practice.

Although there have been valuable contributions to the debate on theoretical issues in the broader area of work assessments for occupational therapy, such as the work of Velozo (1993), the research and development on the more specific tool of FCE has been dominated by professions other than occupational therapy (e.g. Fishbain *et al.*, 1994; Isernhagen, 1992; Lechner *et al.*, 1994; Matheson, Mooney, Grant, Leggett & Kenny, 1996). Velozo suggested that it may be that because occupational therapists have not been involved in the development of work-related assessments, the practice of functional assessment of work capacity by occupational therapists has gone unnoticed and undocumented in the wider sphere of rehabilitation. By presenting a framework for FCE that is compatible with current occupational therapy theory, this paper attempts to make a contribution to the gap in documentation of occupational therapy's involvement in this area.

OCCUPATIONAL THERAPY MODELS OF FUNCTIONAL ASSESSMENT AND OCCUPATIONAL PERFORMANCE

In 1993, Mathiowetz (1993) proposed an occupational therapy framework for functional assessment of clients

Table 1 Definitions of terms from the prefinal draft International Classification of Functioning and Disability and Health (ICIDH-2)

Terms	Definition
Impairment	Problems in body function or structure such as significant deviation or loss
Activity	The execution of a task or action by an individual
Activity limitations	Difficulties an individual may have in executing activities
Participation	An individual's involvement in life situations
Participation restrictions	Problems an individual may experience in involvement in life situations

Note. From 'ICIDH-2: International Classification of Functioning and Disability and Health' (prefinal draft full version December 2000; draft unpublished document, p. 13), by World Health Organization, 2000. Retrieved 5 March 2001, from <http://www.who.int/icidh>. Copyright 2000 by the World Health Organization. Adapted with permission.

that has since been endorsed and further extended by the AOTA (Moyers, 1999). Mathiowetz recommended that occupational therapists place emphasis on assessment of occupational performance (such as activities of daily living, work, play and leisure) or on the performance of actual roles (of worker, volunteer, homemaker, student, patient, spouse or friend) which were seen as being higher in the functional assessment hierarchy. Variables such as strength and range of motion were classified as physical performance components (PPC). Measurement of these PPC's was positioned at the bottom of the hierarchy in terms of importance for functional assessment (Mathiowetz).

The Guide to Occupational Therapy Practice, published by AOTA (Moyers, 1999), also endorsed a focus for occupational therapy evaluation on the role and occupational performance of the individual rather than performance components evaluation. Performance components were defined as 'the elements that make up or provide the ability to do ... activities' (p. 255) of occupational performance and included sensory, neuromuscular, motor, cognitive and psychological abilities. Strength, fine motor skills and problem solving are examples of performance components (Moyers). The Guide suggested that performance components be evaluated only in terms of how they contribute to problems in occupational performance of activities and to help determine options for overcoming these problems.

Within this framework, FCE that is based on observation of the performance of the physical demands of work as defined by the DOT, can be classified as an evaluation of occupational performance *in that it evaluates the person's ability to perform work-related activities*. Such FCE can include an evaluation of the impact of performance components, such as strength and range of motion, on the occupational performance of the physical demands. For example, in evaluating an individual's occupational performance on the activity of lifting loads from floor to waist level, the therapist would consider any performance component areas that may be limiting the performance,

such as strength of the thigh muscles that, if reduced, may limit the person's ability to safely lift loads from floor level. However, the focus is on the overall performance of the activity of lifting.

THE INTERNATIONAL CLASSIFICATION OF FUNCTIONING, DISABILITY AND HEALTH

The frameworks described by Mathiowetz (1993) and AOTA (Moyers, 1999) are compatible with the WHO classification of the consequences of disease, and both the International Classification of Impairments, Disabilities and Handicaps (ICIDH) (World Health Organization, 1980) and its replacement, the International Classification of Functioning, Disability and Health (ICF) (World Health Organization, 2001). The ICIDH (World Health Organization) classified the different levels of the consequences of disease into impairment, disability and handicap. Mathiowetz made parallels between these levels and the assessment levels of the functional assessment hierarchy. According to Mathiowetz, performance components assessments measure impairment, occupational performance assessments measure disability and role performance assessments measure handicap. The draft replacement classification, the ICIDH-2 (World Health Organization), retained the impairment classification, however, used the alternative terms of activity and activity limitation instead of disability, and participation and participation restrictions instead of handicap. Table 1 contains the definitions of these terms. The diagram in Fig. 1 shows the ICF's model of the interactions between the various components of functioning and disability that it defines.

A major aim of the ICIDH-2 was to provide a common language to describe the functional outcomes of health conditions across disciplines and between countries (Gray & Hendershot, 2000). The final version, the ICF (World Health Organization, 2001), has been formally approved and released by WHO, although most literature cited ICIDH-2 at the time of writing. With such international

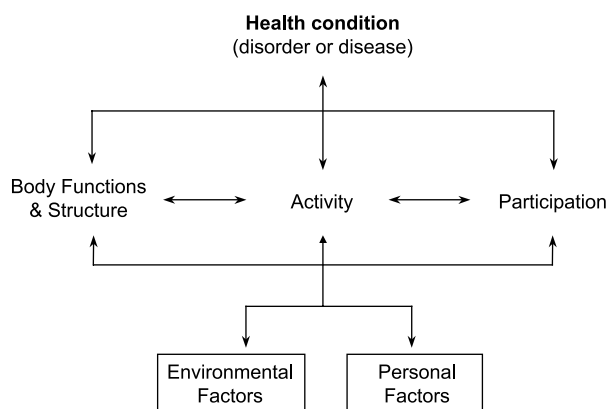


Figure 1. Current understanding of interactions between the components of International Classification of Functioning and Disability and Health (ICIDH-2). From 'ICIDH-2: International Classification of Functioning and Disability and Health' (prefinal draft full version December 2000; draft unpublished document (p. 21), by World Health Organization, 2000). Retrieved 5 March 2001, from <http://www.who.int/icidh>. Copyright 2000 by the World Health Organization. Adapted with permission.

endorsement, it has great potential as a basis for the uniform measurement of functional outcomes of health programs across the world (Gray & Hendershot). This framework has been recommended to occupational therapists as a means of classifying the focus of outcome measures in occupational therapy practice (Baum, 2001; Cusick, 2001; Law, Baum & Dunn, 2001; Unsworth, 2000). Unsworth (2000) explained how the ICIDH-2 framework could help occupational therapists to be clear about what 'level' they are measuring in terms of impairment, activity limitation or participation restriction and the relationship between measures at different levels.

When the framework described by Mathiowetz (1993) is compared with the revised classification system, even closer parallels are revealed. Deficits in occupational performance would be 'activity limitations' and deficits in role performance would be 'participation restrictions'. Deficits in performance components remain comparable to 'impairments' (World Health Organization, 2000). The Guide to Occupational Therapy Practice (Moyers, 1999) also made these parallels between the occupational therapy process framework and the ICIDH-2 definitions.

Using the ICIDH-2 framework (World Health Organization, 2000), FCE that is based on observation of a client on the performance of the physical demands of work as defined by the DOT can be classified as an evaluation of activity and activity limitations. In FCE, the therapist observes the person's execution of activities that are physical work-related tasks (i.e. the physical demands as defined by the DOT). Many of the physical demands as

defined by the DOT were covered in the classification of activities in the ICIDH-2, specifically activities of maintaining and changing body position, activities of carrying, moving and manipulating objects and walking and related activities. In evaluating the performance of these activities, the therapist evaluates difficulties the person may have in the execution of the activities, which the ICIDH-2 called activity limitations.

The ICIDH-2 prefinal draft version went further in its framework of activity and participation and distinguished between capacity and performance of activities. While performance referred to what the person actually does in his or her environment, capacity 'describes an individual's ability to execute a task or an action' (World Health Organisation, 2000, p. 18) and referred to the 'highest probable level of functioning that a person may reach in a given domain at a given moment' (p. 18). The ICIDH-2 suggested that assessment of capacity requires a 'standardised' environment to 'neutralise the varying impact of different environments on the ability of the individual' (p. 18). Again, similarities can be noted with the conceptual basis of FCE as an evaluation of the person's potential to perform the physical demands of work in a standard safe environment.

Extrapolating further from the ICIDH-2 model, FCE can be seen as a tool that attempts to evaluate to a certain extent, participation and participation restrictions as defined by the ICIDH-2. Based on the person's performance of the activities (i.e. the physical demands as defined by the DOT), the therapist commonly makes predictions about the person's capacity to participate in work activities and makes recommendations about restrictions that he or she may have in performance of these work activities. The FCE can also consider some of the contextual factors that affect the person's performance of the activities and that may affect the person's performance when participating in work roles. These may include personal factors, such as psychosocial factors of self-efficacy (Gibson & Strong, 1998) and fear avoidance (Gibson & Strong, 1999b). In the cases of where the person has a job to which he or she is returning and a workplace assessment can be conducted prior to the FCE, then the FCE can also consider environmental factors, such as the specific physical demands of the job (Gibson & Strong, 1997). In these cases the therapist can tailor the FCE and the recommendations made from the results to the specific requirements of the person's job and work environment.

Table 2 summarises the parallels between the Occupational Performance Model (Moyers, 1999) and the ICIDH-2 framework (World Health Organisation, 2001) and lists the components of these models that can be measured in FCE.

Table 2. A comparison of the International Classification of Functioning and Disability and Health (ICIDH-2) and Occupational Performance Model Components and what can be measured in functional capacity evaluation

Functional capacity evaluation	ICIDH-2/Occupational Performance Model
Consideration of the impairment and its impact on performance of the physical demands	Body functions and structure/ Performance components
Observation of the performance of the physical demands and any limitations in this performance	Activity limitations/ Occupational performance
Recommendation about return to work (RTW) including any restrictions for RTW, based on the measurement of impairment and performance	Participation/ Role performance
Consideration of other influencing factors that impact on performance of the physical demands and RTW	Environmental and personal factors/ Temporal aspects and environmental aspects of performance contexts

In FCEs that involve observation of the performance of the client on the physical demands from the DOT, the therapist can also consider other areas that impact on a client's performance, such as strength and range of motion. In this way, FCE therefore can include measurement of impairment as defined by the ICIDH-2. Mathiowetz (1993) conceded that measurement of the person's abilities for the physical performance components can be helpful to clarify the cause or reason for poor functional performance. Measurement of performance components, such as muscle strength or range of motion, or impairment in these components, prior to the FCE has been advocated for reasons of safety to determine any contraindications or precautions and to help identify the possible causes for limitations in performance of the physical demands (Gibson & Strong, 1997; Hart, Isernhagen & Matheson, 1993).

Consideration of body function and body structure, as defined by the ICIDH-2 (World Health Organisation, 2000), is also very important in the process of FCE to inform the therapist of progress in the person's performance of the physical activities or demands. For example, observation of signs of fatigue in the client by the therapist may indicate reduced strength or endurance, which points to areas that may be improved by physical conditioning. However, despite this important attention to evaluation of impairment in FCE, we propose that FCE is primarily an evaluation of *activity* and *activity limitations*, and as such, its content needs to be based on evaluation of activities rather than body function or body structure. Evaluations of strength and range of motion, as used by advocates of iso-testing, are evaluations more of body function or body structure and provide little information about the functional effects of injury on occupational performance. Furthermore, there is evidence that iso-testing has poor relevance to functional performance (Dempsey, Ayoub & Westfall, 1998; Loisel *et al.*, 1998; Natrass, Nitschke, Disler, Chou & Ooi, 1999; Roberson, Witt & Gross, 1997).

THE QUESTIONABLE FUNCTIONAL VALUE OF IMPAIRMENT TESTING

Research on strength testing has shown that it has limited relevance to the actual functional performance of the individual. For example, a comparison of trunk extensor strength and squat lifting ability by Roberson *et al.* (1997) showed that isoinertial and isometric trunk extensor strength did not estimate functional lifting ability. The authors recommended that lifting ability be tested in a functional way, rather than based on strength testing. Similarly, Dempsey *et al.* (1998) reported on a literature review of the use of lifting tests in pre-employment testing for manual handling jobs and concluded that dynamic measures of lifting capacity are better predictors than static measures.

Other studies using trunk strength dynamometry in people with back pain have shown that performance in this testing is not correlated with self-report measures of function or disability (Natrass *et al.*, 1999) nor work status (Loisel *et al.*, 1998). In an authoritative evidence-based review for the development of occupational health guidelines for the management of low back pain (LBP) at work, Carter and Birrell (2000) concluded that 'there is strong evidence that back-function testing-machines (isometric, isokinetic or isoinertial measurements) have no predictive value for future LBP or disability' (p. 22). Studies and reviews such as these lend support to the need for the functional limitations of people with injury or disability to be evaluated *in a functional way*.

Further support for the questionable value of impairment testing comes from a recent systematic review of studies on the prognostic value of physical examination findings for patients with chronic LBP (Borge, Leboeuf-Yde & Lothe, 2001). Physical examination findings were defined as tests or observations commonly used in clinical practice to evaluate LBP and/or symptoms of nerve root

compromise. They included range of movement testing of the lumbar spine, postural observation, palpation for pain, nerve root tension tests, reflex testing, specific muscle tests and other such tests. The main conclusion from this review was that inadequate research had been undertaken on these commonly used tests. However, it was unable to find much evidence for their value in predicting outcome, including return to work.

New theories and research in motor behaviour and control also support the need for functionally oriented evaluation of performance (Trombly, 1995). Such research has found that the purpose or goal of an action determines the motor execution of that action within the personal and environmental constraints. Trombly gave examples of research where different individuals use different muscle combinations and patterns of movement to perform the same task. It is posited that motor behaviour is more dynamic than previously theorised. Trombly argued that if the purpose or meaningfulness of a task determines how it is performed, then assessment of such task performance needs to be as functional and contextually specific as possible. Re-framing FCE in the occupational performance model and ICF frameworks, FCE is a functional method of evaluating the performance of the physical demands of work.

A REDEFINITION OF FCE IN THE WORK ASSESSMENT CONTINUUM

Using the ICF (World Health Organisation, 2000; 2001) and the occupational performance model (Moyers, 1999), FCE can be redefined as primarily a measure of activity and activity limitation or occupational performance of a client, that is used to make recommendations for participation in work or the worker role while considering the person's impairment, environment and other influencing factors. Using these frameworks, work assessments can be conceptualised as on a continuum from the measurement of impairment, through to the measurement of occupational performance to the measurement of role performance (Fig. 2). On this continuum, strength testing using dynamometers would be positioned at the impairment or performance component end of the continuum. FCE would be in the middle of the continuum as an assessment of activity limitation or occupational performance. The use of workplace-based trials and modified RTW programs as assessments of potential for RTW would be at the participation or role performance end of the continuum.

There is an argument that workplace-based role assessments may be more valid measures of capacity for RTW, at least having more face and content validity, as

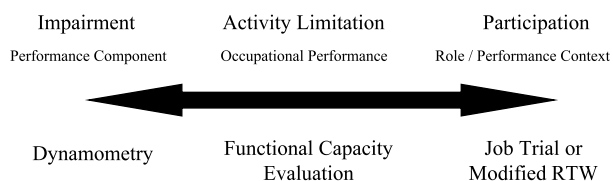


Figure 2. Work Assessment Continuum.

they may be better able to measure the actual demands of the job (Innes & Straker, 1999). The arguments used above against iso-testing could be similarly used against FCE, in that FCE is often conducted in controlled settings external to the workplace, where the activities are actually performed. However, workplace-based evaluations may not always be feasible or practical. Therefore, FCE can be used as a compromise for workplace-based role assessments. There may also be issues of safety and productivity if the evaluation is conducted in the workplace.

It must be acknowledged that there is limited evidence to support the relevance of people's performance of the physical demands from the DOT to RTW. The only study examining this relationship (Fishbain *et al.*, 1999) examined the value of performance of the DOT physical demands by patients with chronic back pain for predicting RTW. The findings showed that performance on eight of the physical demands discriminated between employed and unemployed patients on follow-up. However, this study did not look at the predictive value of the overall performance on FCE or the overall recommendations of the administering therapist, as is common practice in FCE. The little research that has been undertaken on the relationship between therapists' recommendations for RTW (participation or role performance) and actual RTW provides some evidence that therapists' predictions of RTW are predictive of RTW (Veloza *et al.*, 1991). Using the framework of FCE practice described in this paper and a new approach to FCE that we have developed, called the Gibson Approach to FCE (GAPP FCE) (Gibson & Strong, 1999a), we are currently examining the predictive validity of therapists' ratings of RTW and the predictive value of the clients' activity limitations or occupational performance for RTW. We are also examining the interrater reliability of therapists' ratings of RTW and the clients' activity limitations from performance of the physical demands from the DOT.

The framework of FCE we have presented is not as broad as the framework of work-related assessments presented by Innes and Straker (1998) and in some ways conflicts with that framework. The Innes and Straker framework classified work-related assessments at levels of body system, skill, task, activity and role. FCE was not classified as an assessment of activity. Rather it was

classified lower in the hierarchy at the skill level, with assessments such as workplace-based assessments, work simulations and work samples of the actual job classified as assessments of activity. Another framework, reported by Matheson, Gaudino, Mael and Hesse (2000) and Matheson (2001) and called a conceptual model of work disability, did not include the term activity in its hierarchy of functional assessments. Rather, DOT physical demands such as sitting, standing, kneeling are listed as examples of 'actions' while other physical demands such as lifting and carrying objects are provided as examples of the next level higher on the hierarchy called 'simple tasks'. In this model, difficulties in these actions or simple tasks were called 'functional limitations'. As with the Innes and Straker framework, this model is another helpful contribution to the need for a conceptual framework for measurement of the effects of work injury. It is also a broad model that attempts to classify all the levels of measurement in work assessment.

These frameworks or models illustrate the conceptual differences in classifications and terminology that exist in this area. Rather than address this debate of terminology or provide another broad model of work disability or work assessment, this paper has focused on FCE and has simply aimed to make parallels between FCE and the existing classification systems of the Occupational Performance Model proposed by AOTA (Moyers, 1999) and the ICIDH-2/ICF proposed by WHO (2000; 2001). Our framework is an attempt to classify the focus of FCE based on the physical demands from the DOT within the OPM and ICF frameworks, thereby conceptualising an operational framework of FCE for occupational therapy practice and research. It also provides a framework for clarifying the purpose of the FCE in terms of whether it measures performance components or impairment versus occupational performance or activity and activity limitations versus occupational roles or participation.

Despite the discrepancies in terminology and classification systems discussed above, most authors are in accord in differentiating between the physical component or impairment level and higher levels of function. They also concur in their concern about the lack of evidence for a relationship between these levels (Innes & Straker, 1998). The functional assessments we use in work rehabilitation need to have clear and sound conceptual bases (Innes & Straker). Indeed occupational therapy assessments in general need to be clear about what they do and don't measure so that we can choose appropriate measures or tools for the specific purpose of the assessment. In addition, we can then better document our decision-making and thus we can build the evidence required to demonstrate the value of our services to clients and payers alike (Dunn, 2001).

CONCLUSIONS

This study has presented a framework of FCE for occupational therapy FCE practice and research that supports the role of occupational therapy in FCE provision. The framework nests comfortably within the ICF classification system. In this framework, FCE is distinguished as a test primarily of activity limitations or occupational performance of the client rather than a test of his or her impairment. The framework provides a guide for our FCE research. We contend that such a framework can empower occupational therapists as providers of FCE in the work assessment and rehabilitation processes.

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