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Evaluating the ability of novices to identify and quantify physical demand elements following an introductory education session: A pilot study

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ABSTRACT

A Physical Demands Description (PDD) is a resource that describes the physical demands of a job in a systematic way. PDD data are commonly used to make legal, medical, and monetary decisions related to work. Despite the fundamental importance of a PDD, data are often gathered by novice or early career ergonomists, where we have limited knowledge regarding their proficiency in performing PDDs. The purpose of this pilot study was to evaluate novices' proficiency in identifying and quantifying physical demands elements embedded within three job simulations, following a formal PDD education session. The education session was based on the revised Occupational Health Clinics for Ontario Workers (OHCOW, 2014) PDD Handbook. Participants were able to identify physical demands elements with an average success rate of 80%, but were often unable to accurately quantify measures related to each element within a prescribed error threshold of 10%. These data suggest that practitioners should exercise caution when sending novice ergonomists out on their own to complete PDDs.

1. Introduction

A Physical Demands Description (PDD) describes the physical demanding elements of a job. A description of a jobs physically demanding elements is important to different users for different reasons. Within the hiring department PDD information can be used to help clearly describe a job and its requirements to a prospective applicant (Hogan and Bernacki, 1981). In the event that a worker has become injured, claims adjudicators may use PDD information to decide if the claimed injury is plausible or consistent with the physical demands of the work (Jones et al., 2005). In a return-to-work context professionals rely on PDD information to plan out and progress rehabilitation to restore an injured workers' capability such that they can again meet the physical demands of their job (Isernhagen, 2006). However, despite the importance of PDD information in the decision making process regarding hiring, injury compensation, or return-to-work, there is limited consistency in how PDD data are gathered and reported.

Describing the physical demands of a job is the central reason for the PDD. However, when scanning PDD templates available online from Canadian health and safety related organizations (e.g. WCB Alberta, WSIB, Workplace Safety North, Workplace Safety and Prevention Services, etc.), it is clear that we lack consensus on which demands to identify, what measures to include to describe each physical demand and how to report physical demands information. While the lack of standardization is a concern, particularly for those tasked with trying to extract information from a PDD for the purpose of adjudicating over an injury claim or in planning a return-to-work, perhaps the greater concern is "who is gathering PDD information and are they doing it well?"

Accurately gathering PDD data requires expertise and training to ensure that physical demands are correctly identified and accurately quantified. Ergonomists are often tasked with completing PDDs and are well educated and experienced; where the majority of practitioners reportedly hold a Master's or Doctoral degree with over ten years of ergonomic work experience (Dempsey et al., 2005). However, anecdotally, health and safety professionals note that the established ergonomist is not completing the PDD; rather, it has been delegated to a novice ergonomist or trainee. Moreover,

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PDDs are among the most frequently completed analysis by Joint Health and Safety Committee (JHSC) members (Pascual and Naqvi, 2008), where JHSC members may have limited education or experience in the measurement and assessment of physical demands. Since there are no entry-to-practice standards regarding PDD competency, it is likely that most novice ergonomists or JHSC members have only achieved a basic level of training on the PDD process, perhaps in the form of a formal class lecture or two, or by attending a PDD workshop. Therefore it is important to evaluate novices' proficiency in completing a PDD.

It is expected that novice's will demonstrate some limitations in their proficiency. With specific reference to observationally-based ergonomics tools, Stanton and Young (2003) found that novice's demonstrate acceptable intra-observer reliability; but, exhibit poor inter-observer variability. Poor inter-observer variability may suggest that novice's do not collectively key in on the same information when observing work. While not-yet tested in the context of ergonomics, novices may lack the perceptual skills required to identify and extract only relevant information when viewing complex dynamic visual stimuli (Jarodzka et al., 2010). Indeed, enhanced perceptual proficiency with experience and training have been demonstrated in other occupations including diagnostics in x-ray images (Lesgold et al., 1988) and weather map analysis in meteorology (Canham and Hegarty, 2010). Since novice ergonomists or JHSC personnel may not have developed the perceptual proficiency of a seasoned ergonomist, it is important to evaluate the proficiency of novices to identify and measure physical demand elements accurately.

The purpose of this study was to conduct a preliminary evaluation of the ability of novices to identify and measure physical demand elements following a PDD education session. It was hypothesized that participants would not be perfect in their ability to correctly identify physical demand elements; however, they would correctly identify physical demand elements with a success rate of at least 80%. It was also hypothesized that participants would be able to accurately quantify demands with an absolute percentage error (APE) threshold of less than 10% relative to criterion measurements obtained by two ergonomic professionals.

2. Methods

2.1. Participants

Ten university aged students (3 males, 7 females) volunteered to participant in this study. They were recruited from an undergraduate occupational biomechanics and physical ergonomics class, where they took part in a 3-h education session on PDDs (described below) early in the semester. Prior to the class they had no prior knowledge or experience with PDDs. This project was approved by the University's Research Ethics Board and all participants provided informed consent.

2.2. Research design and PDD education session

A one-shot case study experimental design was employed as a pilot investigation to evaluate the ability of novices to identify and quantify physical demand elements following an introductory level PDD education session. This model was employed to facilitate the research team in recruiting undergraduate students directly from an undergraduate-level ergonomics class where PDDs were taught as part of the normal curriculum.

The education session was based on the Occupational Health Clinics for Ontario Workers (OHCOW) Revised PDD Handbook (OHCOW, 2014). This foundational resource was selected as it represented the most current, publically available document describing the PDD process as a series of easy to follow steps. During the session participants were presented with information and activities corresponding to the three steps of a PDD (Fig. 1). While working through each step instructors provided drill-down opportunities to discuss pertinent details in great depth, such as: considerations when scheduling a data collection, how to take measurements in the field, how to identify physical demand elements, etc. During drill-down activities course instructors provided specific feedback and reminders to students as they completed associated activities. While all three high-level steps are fundamental to conducting a proper PDD, the education session focused primarily on step two (observation & data collection) as it represents the actual data gathering portion of the process. At the conclusion of the education session students were invited to participate in this study, where we scheduled them into the laboratory for testing one-week after completing the in-class training.

2.3. Physical demand element identification task

During the testing phase, participants independently observed three job simulations: two video-based examples, and one live example. Video 1 portrayed a road construction labourer, where the worker used a shovel and rake to spread and level asphalt (Fig. 2 – left pane). The video was approximately one minute in length, during which time the following physical demand elements were performed: Push, Pull, Reach, Grip, Stand, Walk, Balance, and Vision. Video 2 portrayed an automotive quality control tester, where the worker manually inspected the worthiness of a car door by exerting forces using a series of different techniques (Fig. 2 – centre pane). The video was approximately one minute in length, during which time the following physical demand elements were performed: Push, Pull, Crouch, Grip, Stand, Walk, Feel, and Vision. The live job simulation was performed by an actor mimicking a manual materials handling task of stocking shelves (Fig. 2 – right pane). The task was approximately 3 min in length, during which time the following physical demand elements were performed: Lift/Lower, Push, Pull, Grip, Crouch, Stand, Walk, and Vision. Participants were instructed to identify and list all of the physical demand elements observed across the three job simulations.

Within other PDD models, specific elements are often grouped under broader headings such as “Strength”, “Mobility”, “Hand-Activity”, and, “Sensory” (WSPS, 2011). Physical demand elements existing in the three job simulations used in this study were divided among these groupings (Strength – Lift/Lower, Push, and Pull; Mobility – Stand, Walk, Reach, Crouch, and Balance; Hand-Activity – Grip; and Sensory – Feel and Vision). Beyond proficiency in listing all physical demands existing across the job simulations, we aimed to conduct a descriptive analysis to identify if novices may be more, or less accurate at identifying elements within these overarching groupings, where we believed that the identification of sensory- or mobility-based demands may require greater perceptual proficiency, and thus be more challenging for novices to identify.

2.4. Physical demand element quantification task

During the live job simulation, participants were also asked to quantify requisite dimensions for each physical demand element identified. To reduce the potential for inter-rater variability due to actual differences in the actor's performance of the task, the actor followed a clearly defined script when performing the live job simulation. This ensured that each participant observed the same physical demand elements in the same sequence. Special attention was given to the performance of the push and pull demands. These tasks were performed by initiating cart movement at a gradual and