Feedback survey on usability of enbora method for assessing an exposure to risk factors related to wmsds

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Abstract. Entire Body Risk Assessment (ENBORA) method is a new observational method assessing the risk factors that contributed with Work-related Musculoskeletal Disorders (WMSDs). To evaluate the effectiveness and ease of use of a new observational method, the usability testing is needed. This research aimed to study the usability analysis of the ENBORA method. 16 participants were involved in a day ENBORA training session. All sixteen participants were required to assess the usability of ENBORA method using feedback questionnaire. Majority of the participants agreed that it was easy to understand and use the ENBORA at work. In order to provide a simple and comprehensible interface of ENBORA, usability test had to be performed. After conducting the usability testing, some improvements were made to the ENBORA method after taking the respondents’ comments and suggestions into account.

1. Introduction

Work-related musculoskeletal disorders (WMSDs) are known as the conditions that affect the nerves, tendons, muscles, and other part of the body’s supporting structures which is due to cumulative trauma connected to non-neutral body postures, sustained static postures and repetitive motions, as well as psychosocial factors and individual characteristics [1]. Numerous factors such as physical work demands [2–4], psychosocial aspects [5, 6], work-organizational factors [7] and individual differences [8, 9] are known to be the major factors that contribute to the development of WMSDs [10]. As a result of these findings, there has been major interest in assessing the exposure to risk factors linked to WMSDs which can then be used to operate ergonomic interventions in workplace. Several methods were discovered to assess the chances that can cause WMSDs.

These methods were categorized under self-reports, observational methods, and direct measurement [11, 12]. David [11], Chiasson et al. [13], and Takala et al. [14] acknowledged that the most widely used method applied by practitioners is the observational method. It is due to the low-cost factor and its practicality in many types of workplaces.

Even though there are arrays of observational methods that are applicable to evaluate the exposure of risk factors associated with WMSDs which are; Ovako Working Posture Assessment System (OWAS) [15], Quick Exposure Check (QEC) [16], and Workplace Ergonomic Risk Assessment (WERA) [17] but majority of them are only emphasizing on assessing the physical risk factors of WMSDs especially in distinct postures which exclude other factors of WMSDs. Psychosocial risk factor, work organization risk factor, and individual risk factors are other types of WMSDs’ risk factors. On the other hand, Entire Body Risk Assessment (ENBORA) method is the recent
observational method developed to assess the exposure of risk factors for WMSDs at workplace. ENBORA is applicable in part of ergonomic workplace assessment that can provide a simple visual sign to the demand for action linked to the task. Besides, ENBORA method also evaluates the physical risk factors, psychosocial risk factors, work organizational risk factors, and individual risk factors related to WMSDs. In order to assess the efficiency and simplicity of any latest observational methods, the usability testing has to be implemented prior to prototyping.

Usability can be terminologically defined as the system’s usefulness and suitability for a specific category of users to carry out specific task in a specific setting. The simplicity will influence the users’ performance and their contentment, whereas the suitability will influence ease of use affects the users’ performance and their satisfaction [18]. In addition, Diah et al. [19] asserted usability as the element that gauges the minimalism of user interfaces to help the users in a clear, agile, and practical way of creating tasks. Alternatively, usability is defined by the International Standards Organization (ISO) as the circumstances where a product is functional for particular users with particular purposes alongside its efficiency and consumption in a particular context of application [20]. In a simpler word, an interface has to be comprehensible, memorable, practicable, and error evident. Therefore, the main purpose of usability testing is to discover more effective ENBORA methods.

2. Methods

2.1 Study design
The usability testing was conducted by researchers at Company A in one day ENBORA training session that involved 16 participants. Evaluation and analysis of results obtained from all 16 participants were the main focus in this research. All participants from Company A came from distinct skills and expertise. 10 of them worked in the executive level as process engineer, production executive, health, safety and environment (HSE) executive, quality management executive, service executive, parts executive, and warehouse assistant manager. Another six of them worked in non-executive level as mechanic, administration officer, production operator, production officer, production line leader, and health safety and environment supervisor. Among all the participants, a total of six participants had been dedicated to the company in the unchanged position for two to six years. Four of them maintained in the same duties for 11 to 18 years, whereas six more participants had stayed in the company for the longest time which was more than 20 years.

2.2 Data collection
A training to conduct an ENBORA method was given to all 16 participants who managed to take the risk assessment. Researchers then gave a one and half hours of briefing regarding the ENBORA method and the instruction to its application. All participants were also explained about its purpose, scoring system, and the terms of ENBORA method.

The usability of the ENBORA method was assessed using a structured interview with feedback questionnaires of ENBORA method from all participants after they had completed the reliability testing of ENBORA method for three jobs during the training session. The feedback survey was developed to identify the usability of the ENBORA method. There were 13 questions pertaining to ENBORA method presented in the survey. Elements such as its practicality, convenience, instructions, wordings, and clear and understandable figures were considered. In the meantime, several factors evaluated for the scoring system were; the rationale of the score, final score, and action level of ENBORA method. Additional factors were the usability to workplace assessment, applicability in a wide range of jobs, and value at work that related to its effective cost and good basis for intervention. Besides, it also consisted of close-ended questions with the 5 Likert Scale rating (1 for strongly disagree until 5 for strongly agree) as well as open-ended questions for any feedback or recommendation from the observers. The feedback survey also included demographic items such as age, working experience, and education level. The completed questionnaires were collected and stored.
securely by the researchers. Data from the feedback questionnaire were entered and collected in Microsoft Excel 2010.

2.3 Data analysis
The percentage of agreement has been calculated for the observers group, which included the executive and non-executive level team. The usability of the ENBORA method was assessed by using descriptive statistics. The mean (X), standard deviation (SD) were used to evaluate and analyse each items of the questionnaire from all participants (N=16).

3. Results and Discussion

3.1 Description of the sample
Table 1 demonstrated the observers’ demographics data in ENBORA training sessions. The participants were formed into two distinct groups which were the executive level, and non-executive level. The range between age 27 to 49 from the total mean age of the observers (N=16) was 37.06 (SD=8.27). Whereas, the range between two to 27 years of total mean for working experience was 14.19 (SD=9.53).

| GROUP OF OBSERVERS     | AGE (YEAR) MEAN | AGE (YEAR) SD | WORKING EXPERIENCE MEAN | WORKING EXPERIENCE SD |
|------------------------|-----------------|---------------|-------------------------|------------------------|
| Executive level\(^a\)  | 36.80           | 8.35          | 14.20                   | 10.51                  |
| Non-executive level\(^b\) | 37.50           | 8.89          | 14.17                   | 8.59                   |
| Total (N=16)           | 37.06           | 8.27          | 14.19                   | 9.53                   |

\(^a\) Executive level include process engineer, production executive, health, safety and environment (HSE) executive, quality management executive, service executive, parts executive and warehouse assistant manager

\(^b\) Non-executive level include mechanic, administration officer, production operator, production officer, production line leader, and health, safety and environment supervisor.

3.2 Feedback survey for usability analysis of ENBORA method
The results of feedback surveys that assessed the usability of the ENBORA tool were shown in table 2. All observers’ (N=16) ratings (1=strongly disagree, 5=strongly agree) indicated that the prototype of the ENBORA tool was easy to use and straightforward (mean 4.19 ± 0.54), quick to use (mean 4.25 ± 0.68), readable and understandable instructions (mean 3.94 ± 0.68), readable and understandable wordings (mean 3.88 ± 0.89), and clearly visible and understandable pictures or illustrations (mean 3.50 ± 0.89). For the scoring system, all observers indicated their valuation of the scoring system as results interpretable (mean 4.13 ± 0.72), score for each items as understandable (mean 4.06 ± 0.68), understandable final score (mean 4.25 ± 0.68), and understandable action level (mean 3.94 ± 0.68). It was also applicable to workplace assessment (mean 3.88 ± 0.72), applicable to work range of jobs or tasks (mean 3.75 ± 0.78), valuable at works in terms of effective cost (mean 3.69 ± 0.70), and valuable at works in terms of providing a good basis for intervention proposal (mean 4.00 ± 0.52).

Regarding the open-ended questions for general comments and suggestion about ENBORA method, most comments received from the 16 participants of usability analysis are stating that ENBORA method is an easy method for workplace survey since it can help in understanding the tool.
easier, and can be a very good reference for workplace improvement. Other than that, the observers also comment about the ambiguous picture illustration and the wordings in the ENBORA paper checklist because they are too small. Other comments also state that ENBORA method needs some improvements on the illustration of posture such as; neck rotation, back rotation, elbow supination, and pronation for the comprehension of the observers.

Table 2. Observers’ ratings on the feedback survey of ENBORA method.

| No | QUESTIONS                                                                 | RATING SCORES | TOTAL SCORE |
|----|---------------------------------------------------------------------------|---------------|-------------|
|    |                                                                           | 1  2  3  4  5 | Mean       | SD          |
| 1  | Easy to use and straightforward                                          | -  -  1  11  4 | 4.19       | 0.54        |
| 2  | Quick to use                                                              | -  -  2  8  6 | 4.25       | 0.68        |
| 3  | Instructions is clearly to read and understand                           | -  -  1  12  2 | 3.94       | 0.68        |
| 4  | Wordings is clearly to read and understand                                | -  -  1  4  7  4 | 3.88   | 0.89        |
| 5  | Pictures / Illustrations is clearly to see and understand                 | -  2  6  6  2 | 3.50       | 0.89        |
| 6  | Scoring system is easy to interpret the results                          | -  -  3  8  5 | 4.13       | 0.72        |
| 7  | Score for each items is easy to understand                               | -  -  3  9  4 | 4.06       | 0.68        |
| 8  | Final score is easy to understand                                        | -  -  2  8  6 | 4.25       | 0.68        |
| 9  | Action level is easy to understand                                       | -  -  4  9  3 | 3.94       | 0.68        |
| 10 | Applicable to workplace assessment                                       | -  -  5  8  3 | 3.88       | 0.72        |
| 11 | Applicable to work range of jobs / tasks                                 | -  -  7  6  3 | 3.75       | 0.78        |
| 12 | Valuable at works (cost effective)                                       | -  -  7  7  2 | 3.69       | 0.70        |
| 13 | Valuable at works (provide a good basis for intervention proposal)       | -  -  2  12  2 | 4.00      | 0.52        |

Most observers suggest to have the ENBORA form in dual-language (Bahasa Malaysia and English), so that it will be easier for the users to understand during an assessment. Besides that, the participants also suggest in making ENBORA method in software form so that it can show the result directly after an assessment. The ENBORA form is too compact, which means it can be extended to three pages with larger wordings and pictures illustration.

For specific comments of ENBORA method, the observers were commenting on physical risk factors items and individual risk factors items. The posture of the neck rotation, shoulder medial rotation, shoulder lateral rotation, elbows supination, elbows pronation and back rotation were quite confusing. The illustration was not clear and difficult to be understood by observers [21]. Burt and Punnett [22] claimed that unclear definition of postures can be the reason of disagreement between observers. Besides that, the question of forceful exertion was a bit confusing with the choices (or) and no neck repetition column in ENBORA form. There was a difference between maximum force for female and male workers. The observers also stated that underweight should be in high risk level for individual risk factors.

Some specific suggestions from the observers were to change the picture of shoulders medial rotation and lateral rotation since it needs to show the head position clearly. For elbows pronation and supination items, the researchers need to show clear rotation and the direction of elbows posture. Furthermore, the ENBORA method should add the range of neck repetition and separated for female and male workers standard weight of load.
From the feedback survey, all comments and suggestions from the participants were taken into account for the purpose of ENBORA final version improvement. Some of the comments and suggestions received from the participants were vague illustration, tiny wordings and body region angle. Therefore, for ENBORA final version the researchers have enlarged the picture and wordings of working posture items. On the other hand, recommendation to separate load for male and female workers in accordance with standard load was also given for forceful exertion item. Hence, separate load for male and female workers of final version ENBORA had been prepared by the researchers. In addition, researchers had discovered that the contact stress question in prototype was not suitable and the scale was quite difficult to be measured by observers. Thus, for final version of ENBORA, the contact stress question and answer were modified.

4. Conclusion
The establishment of Entire Body Risk Assessment (ENBORA) method offers an instant screening technique that encompasses physical risk factors, psychosocial risk factors, work organisational risk factors, and individual risk factors associated with WMSDs. The usability testing is provided to develop a new observational method aimed for achieving more usable of ENBORA method to make an interface useful for the users. After conducted the usability testing, some improvement had been carried out to develop the ENBORA final version with considering the respondents’ comments and suggestions.

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