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Is There a Clear Understanding of Using Human Factors and Ergonomics at Work?

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ABSTRACT

Human factors and ergonomics (HF/E) is a scientific discipline that aims to understand interactions among humans and other system elements. HF/E applies theory, principles, data, and methods in design to optimize overall system performance and sustainability by balancing organizational functions and the well-being of employees. However, in public discussion and in generic understanding, it is not clear what HF/E means, who HF/E specialists or ergonomists are, what they do, and where they work. Therefore, this study aimed to contribute to the above-described discussion. In this qualitative study, a questionnaire was used to collect international HF/E experts' (n = 8) opinions on the proactive design of work and work environments and interviews with Finnish professionals (n = 9) were conducted. The results suggest that there is no clear picture of HF/E specialists used in proactive design-driven activities. This finding indicates that there is a need to widen the public discussion and view on HF/E specialists in workplaces.

Keywords: Ergonomics, Human factors, Proactive, Specialist, Work

INTRODUCTION

Human factors and ergonomics (HF/E) is a scientific discipline that aims to understand interactions among humans and other system elements (Dul et al., 2012; International Ergonomics Association [IEA], 2020; Smith & Carayon-Sainfort, 1989). HF/E applies theory, principles, data, and methods in design to optimize overall system performance and sustainability by balancing organizational functions and the well-being of employees (IEA, 2020; IEA & International Labour Organization [ILO], 2020).

To put it simply, in HF/E, a system can be described as a structure where individuals perform their work tasks with different materials, tools, and technologies in a certain work environment at a given time (Dul et al., 2012; Smith & Carayon-Sainfort, 1989). The interactions between various subsystems can be of a physical, cognitive, and psychosocial nature and at different levels, from microergonomics to macroergonomics issues (Carayon, 2006). Microergonomics focuses on definite components and solutions in specific workplaces, while macroergonomics considers structures, processes, and policies in larger-scale sociotechnical systems, such as manufacturing

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facilities (Bridger, 2018; Hendrick, 2002; Zink, 2000). In HF/E, these different aspects are taken into account rather than focusing only on one: A specific aspect cannot be considered without the other aspects, or else it is not HF/E (IEA, 2021).

Even though HF/E is used reactively, the main focus should be on prevention and proactivity. The work system design aims at optimizing load and work strain, avoiding impairing effects, promoting facilitating effects, and improving system effectiveness and efficiency (Bridger, 2018; Carayon, 2006; EN ISO 6385:2016, 2016). A systematic approach uses a step-by-step, iterative process model, from analyses and assessments to design recommendations, requirements, specifications, and actions (Dul et al., 2012; EN ISO 6385:2016, 2016).

The benefits of a systems approach are taking multiple perspectives into account, ensuring appropriate trade-offs, addressing the system's functioning as a whole, maximizing buy-in from stakeholders, and avoiding placing too much weight on a single system component (IEA & ILO, 2020). HF/E design of work systems optimizes workflow and work environments and equipment; improves performance and the quality and reliability of processes, products, and services; reduces injuries and scrap rate; lowers operating costs; and enhances organizational effectiveness (Dul et al., 2012; IEA & ILO, 2020).

Based on these wide range of HF/E aspects, a question arises about who is capable of using HF/E in workplaces. IEA has defined HF/E specialists' core competencies as foundation knowledge, HF/E measurement and analysis skills, HF/E evaluation skills, HF/E recommendation skills, HF/E implementation skills, scientific skills, and professional behaviour (IEA, 2021). In addition, the Centre for Registration of European Ergonomists (CREE) has defined European ergonomists as professionals who are experienced in using knowledge from the areas of anatomy, physiology, psychology, social organization, and the physical environment to design work systems, structures, and activities to optimize human performance and well-being (CREE, 2023).

In Finland, where the authors of this study are from, based on the Occupational Health Care Act (Finlex, 2001), occupational healthcare can use professionals who have training in the field of HF/E and have adequate knowledge of occupational healthcare. This training is described as "an appropriate university or equivalent professional degree (mainly ergonomics or equivalent studies)" in the guidance provided by the Ministry of Social Affairs and Health, Finland (2016). However, in public discussion and in generic understanding, it is not clear what HF/E or ergonomics means, who HF/E specialists or ergonomists are, what they do, and where they work. This study aimed to contribute to the above presented discussion.

MATERIALS AND METHODS

The aim of this study was descriptive in nature. In this study, a handbook, "People in designing work and the working environment – a handbook for the proactive planning of work and design of working environments" (hereafter referred to as the "handbook"), commissioned by the Finnish Ministry of Social Affairs and Health (Halmeenmäki & Myrsky, 2021), served as a

basis for the debate. The handbook offered "low-threshold tools for proactive planning of work and designing working environments based on work content and the person performing the work" (Halmeenmäki & Myrsky, 2021, p. 5).

In this qualitative study, a questionnaire was performed between 25 October and 8 November 2021 to collect international HF/E experts' (n = 8) opinions on the proactive design of work and work environments. In order to gain the same understanding nationally, qualitative interviews with Finnish professionals (n = 9) were conducted between 12 and 26 November 2021 with a semi-structured interview form (Gideon, 2012). The questions of both data collection methods were based on the handbook.

Questionnaire

The aim of the questionnaire was to get feedback on the implemented handbook internationally from HF/E experts in research, teaching, and practice. The questions with answer options and open-ended questions were based on the themes of the handbook, the usability of the handbook, and proposals for further measures. In this study, the focus was on the following questions: What is your image about who does the planning of work and design of work environments in workplaces? Who is responsible for taking care that all needed actions for planning and designing the work are done? Who is responsible for the whole process (designing of work and workplaces)? Who is responsible for the needed knowledge (designing of work and workplaces)? How would you define the role and tasks of an HF/E professional in this kind of process (designing of work and workplaces)?

The questionnaire was sent to international HF/E professionals. Ten specialists from universities and ten specialists from companies were approached with a letter informing them of the handbook and the questionnaire. They were asked to declare their willingness to participate in the survey. Eleven indicated their willingness to participate, and eight completed the questionnaire at the end. Seven answered in writing and one orally through Microsoft Teams. All of the respondents had academic education from HF/E, as well as tens of years of experience as teachers and researchers at universities and/or as HF/E professionals in companies in various positions. Five of them were working in companies and three in universities. The regions where respondents operated were Europe and Nordic countries (n = 6) and North and South America (n = 2). The results are summarized for each question in the Results section.

Interviews

Interviews with Finnish HF/E professionals were conducted to assess the applicability of the handbook and to obtain new perspectives for its further development. The prepared topics focused on each section of the handbook. This study focused on the answers related to generic views of HF/E, the design process, and role distribution. The request to participate in the interviews was sent via e-mail to persons having experience with HF/E, occupational safety and health, well-being at work, and/or design science either

from research or by working in companies. Nine out of ten of the contacted persons participated in the interviews. The participants were from research institutes, universities, expert companies, associations, and public authorities from different regions in Finland. Eight of the interviewees participated in a group interview, while one person was interviewed separately. Interviews were conducted with Microsoft Teams. The group interview utilized a Jamboard platform where participants were able to write anonymously in addition to the discussion. The group interview was recorded, and a student of the University of Tampere served as a secretary. Notes were made from the one individual interview. The material was analysed by applying thematic categorization (Flick, 2009; Strauss, 1990). The opinions of the interviewees and the issues they raised are presented in the Results section.

RESULTS

Questionnaire

When asked about who does the planning of work and designing of work environments in workplaces, the respondents described manufacturing engineers, the production technology department, the heads of departments, union representatives, employee representatives, users of the end product or the environment, facility management, the ergonomics department, the human resources (HR) department, the works council, HR specialists, technical crew, occupational safety and health (OSH) specialists, and ergonomists. As can be seen, there was a wide variety of answers. When considering the planning and designing of the work, the responsibility for taking care that all needed HF/E actions are done was seen to belong to either the HR department or to the employer, or to be dependent on the governance of the organization. The responsibility of the whole work design process was thought to belong to the line or production manager or to the ergonomist. Based on the answers, the responsibility for the needed HF/E knowledge belonged to the employer, HR department, HR specialist, or the production manager.

When asked specifically about the HF/E professional's role in the work design process, the respondents mentioned that the HF/E professional should monitor that the ergonomics requirements – physical, cognitive, and mental – are fulfilled and that the potential risks are minimized. They should understand how people cope with their jobs in the intended work, how they adapt, and which factors they find it difficult to adapt. On the other hand, it was described that the HF/E professional should play a supportive and controlling role in the whole process right from the beginning. One respondent mentioned that they should have more competencies in production and logistics.

Interviews

In the handbook, ergonomics experts and working environment specialists were mentioned, which caused wider discussion about their roles among the interviewees. The overall opinion was that, in Finland, there is no clear picture of ergonomics experts, how they are defined, and who they are. For

example, at the time of the interviews, there were only six persons with European Ergonomist Certification in Finland.

The unclear definitions of ergonomists in Finland may lead to false impressions. The interviewees thought that ergonomics in public discussion is understood only as physical ergonomics. If there is no understanding about the other aspects, occupational healthcare service providers use physiotherapists and offer their services when asked for a professional in ergonomics (named in the Occupational Health Care Act). Occupational physiotherapists are professionals in their field but not ergonomics experts in a wider sense. Some physiotherapists may have university studies in the ergonomics field, but this is not the norm. The above-discussed false impressions were seen as a serious deficiency.

DISCUSSION

Based on the questionnaire, there is no clear understanding of what planning of work and designing of work environments means, who does the planning of work and designing of work environments in workplaces, who has the responsibility for taking care that all needed HF/E actions are done, who has the responsibility for the whole work design process, or who has the responsibility for the needed HF/E knowledge. The responsible parties were described as, for example, facility management, the ergonomics department, the HR department, HR specialists, the technical crew, line managers, production managers, employers, OSH specialists, and ergonomists. The HF/E professional's role in the work design process was understood widely, including knowledge of the physical, cognitive, and mental requirements, which are, in fact, included in the international guidelines (CREE, 2023; IEA, 2021). Surprisingly, the capabilities to act as a design specialist and project manager were not mentioned at all, nor were the tasks and responsibilities of HF/E professionals in a development project.

The same ambiguity was seen in the interviews. The interviewees concluded that, in the overall picture, there is no consensus about HF/E professionals and their roles in Finland. The lack of consensus affects the use of HF/E professionals in occupational healthcare as described in the Occupational Health Care Act (Finlex, 2001).

As presented, IEA has defined HF/E as the scientific discipline concerned with the understanding of the interactions among humans and other system elements and as the profession that applies theoretical principles, data, and methods in design to optimize human well-being and overall system performance (IEA, 2020). Based on this study's results, it can be asked how the work system is described and on what the focus is in different roles and tasks of the actors in the different institutes and workplaces when the performance of the entire system and the well-being of a human at work need to be improved. Healthcare-driven professionals do not necessarily have skills and competencies in analysing systems, e.g., manufacturing lines, design processes, logistics, and hospital ward. Similarly, managers often do not have the skills and competencies to design and analyse the effect of changes in work processes on the entire process performance and well-being of humans. Hence, there is a

need for professionals who can utilize HF/E theory, principles, and standards as part of their daily work.

In the case of using the definitions of IEA (2020; 2021) and CREE (2023), a map of interfaces and needed HF/E proactive design-driven actions, competencies, and skills in different places and positions in the organizations and workplaces could be created. This is a focus for further studies, as there is a risk of staying and being too engaged in reactive activities. Overall, material and guidelines for managers and designers are needed to describe organizational needs and ways of working with internal and external stakeholders for utilizing HF/E in design-driven activities on micro- and macro levels. This would help stakeholders find the interfaces where collaboration is needed and conduct systematic fact-based design-driven proactive activity. Now, these data-based actions are often missing in workplaces (Reiman et al., 2021; Takala et al., 2021).

The limitations of this study include the small number of international respondents and national participants. This means that generalizations are not possible at this point, and further studies with more respondents and participants are needed. However, even though the sample was small, it can be seen that there were no unanimous answers in the questionnaire between the international professionals. On the other hand, the interviewees agreed that there is no clear understanding of HF/E in workplaces and therefore such HF/E professionals are not available for workplaces in Finland. This raises questions regarding how well HF/E is understood in institutions, public authorities, occupational healthcare services, and workplaces. The results suggest that there is a lack of common understanding about the roles, responsibilities, needed skills, and competencies that are needed for promoting and developing HF/E at each level of the organization.

The interaction between the researcher and the interviewees may have affected the conduct of the interview. In group interviews, attention needs to be focused on the group's power dynamics (Morgan & Hoffman, 2018). In this study, the participants in the group interview also had an opportunity to express their thoughts anonymously via the Jamboard platform. In addition, slight variations in the words used in a questionnaire or in the context of a question can also affect the results (Strauss & Corbin, 1998).

CONCLUSION

In the interviews, the overall opinion was that there is no clear picture of HF/E specialists used in proactive design-driven activities in Finland. In the questionnaire, roles and responsibilities in planning and designing the work and workplaces by utilizing HF/E in it were described with a wide variety of answers. These preliminary results suggest that the responsibilities and roles in design-driven activities were unclear, indicating a strong need to widen the public discussion and view on HF/E specialists in workplaces and sharpen the education and utilization of them.

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