CATEGORIZATION OF FACTORS CAUSING ASTHENOPIA IN RESEARCH PROFESSORS AT THE ITCJ BY READING WITH VDT: A SHARED EXPERIENCE

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Abstract: The objective of this work was to classify the factors that may generate a risk of asthenopia among the researchers of the ITCJ, as a result of reading with VDT, thanks to the work of a focal team. A descriptive study was done. Twelve research professors participated: their age ranking between 25 to 55 years. The methodology used was of quality and participation nature (focusing on emic). The following activities were carried out: brainstorming from an investigation question, ranking and classifying the information, analyzing and interpreting data and determining the categories. The research participation techniques used were brainstorming and focal group. The risk factors identified by the focal team were: screen brightness, exposition time, lighting, type of monitor, size of screen, font type, font size, reader posture, colors used, quality of text printing, human factors and amicable software. The proposed categories by the participants were: equipment, material, environment and people. The main conclusion unfolds the rescuing of the strength displayed by the participation techniques in the investigations towards explaining any problem, and the abundance of knowledge of the group of people. In this work, we have accomplished the classification of factors that cause visual problems, by the general consensus of the participants which coincides with international literature; furthermore, it shows the practicability of using the focal group technique in explaining an ergonomic problem related to labor health.

Key words: asthenopia, focal group, brainstorming, research professors.

Resumen: El objetivo del trabajo fue categorizar los factores que pueden provocar riesgo de astenopia entre los profesores investigadores del ITCJ como resultado de la actividad de lectura con VDT, por medio del trabajo de un grupo focal. Se realizó un estudio descriptivo. Participaron 12 profesores investigadores, con un rango de entre los 25 y 55 años. La metodología empleada fue de naturaleza cualitativa y participativa (enfoque emic). Se realizaron las siguientes actividades: generar las ideas a partir de la pregunta de investigación, ordenar y clasificar la información, analizar e interpretar los datos y determinar las categorías. Las técnicas participativas utilizadas fueron tormenta de ideas y grupo focal. Los factores de riesgo identificados por el grupo focal fueron: brillo de la

pantalla, tiempo de exposición, iluminación, tipo de monitor, tamaño de pantalla, tamaño de letra, formato de texto, postura del lector, tipo de letra, calidad de impresión, colores utilizados, factores humanos y amigabilidad del software. Las categorías propuestas por los participantes fueron: equipo, material, ambiente y persona.La principal conclusión permite rescatar la fortaleza que presentan las técnicas participativas en las investigaciones orientadas a explicar alguna problemática, y la riqueza del conocimiento que posee un grupo de personas .En este trabajo se logra categorizar los factores que influyen en la fatiga visual , a partir del conocimiento empírico de los participantes el cual coincide en gran parte con la literatura internacional ,además se muestra el uso de las técnica de grupo focal en la explicación de un problema ergonómico relacionado con la salud laboral.

Palabras clave: astenopia, grupo focal, tormenta de ideas, profesores investigadores.

1. INTRODUCTION

In 1978, the amount of PCs used in work places in the United States, was of 600,000 units which at present has increased to more than 100 million. This massive phenomenon came about at the beginning of the 70s when a series of special visual alterations happened. The computer visual syndrome, which was present among workers using screens, has increased the visits to ophthalmologists in the U. S. (Ansell, 2007; AOA, 1995; Sheedy, 2007).

Most of the studies related to visual problems show that the symptoms of visual problems occur in more than a 75% in computer users (Dain, McCathy, and Chang-Ling, 1988; Smith, Cohen, and Stammerjohn, 1981; Ashel, 2007; Leavitt, 1995; AOA, 1995; Tamez, Ortiz and Martinez, 2003). Among the more frequently reported problems are: farsightedness, blurry vision, headache, dry eye or eye irritation, pain on the neck or back and double sight. A study about health risks and damages among newspaper workers, who were exposed to the use of visual screens, found out that the most frequent illness was asthenopia (visual fatigue) in 85%, lightly higher to the rest of other users (Tamez et al, 2003; Gobba, Broglia, Sarti, Luberto y Cavalleri, 1988).

Working with a PCs may contribute to increase asthenopia due to the reduced blinking that increases the symptomology of dry eye (Sheedy, 2007; Isreb et al, 2003; Clark, 2006; U.S. Department of Labor, 2004; Ousler, Gomes, Crampton and Abelson, 1999; Nakamory, Odawara, Nakajima, Mizutani and Tsubota, 1999; Nakaishi and Yamada, 1999; Yaginuma, Yamada and Nagai, 1990; Tsubota and Nakomon, 1993; Dianoff, Happ and Crane, 1981; Rossignol, Pechter, Summers and Pagnotto, 1987). The people devoted to research who read electronic material from a screen are subject to suffer asthopia symptoms (Ukai and Howarth, 2008). It is under this setting where the interest of studying this problem in a labor group little dealt with research professors.

The problem of asthopia produced by reading electronic material has been studied from the quantitative paradigm and none were found from the use of the emic (the actor's point of view).For that reason, it was decided to do this work as a start to contribute to the

identification of the factors producing asthenopia, using shared investigation, which rescues the rich experience and knowledge of the participants. Discussing the matter within focal groups provides a technique for this purpose.

According to Morgan (1998), the focal groups were developed in three periods: the first one in 1920 to 1930 and emphasizes its use in a large variety of aims, among them the development of widespread questionnaires by social scientists. The second period, between the Second World War and the 70s which was used by the focal groups mainly by the mark researchers to have an insight on the wishes and needs of the people. Finally, from 1980 on, they have been used by different kind of professionals to investigate about health, family, education and sexual behavior and other social issues. In the last few years, the social scientists have considered that, sure enough, the focal group is an important research quality technique and its use has spread considerably in every field of human science.

The objective of the investigation by the focal was: to categorize the factors that generate a risk of asthenopia among the ITCJ research professors as a result of reading with VDT, focused on emic (from the knowledge and experience of the participants.)

2. METHODOLOGY

The focal group is a collective method for doing research, more than being individualistic; it is centered in the variety of different attitudes, knowledges, experiences and beliefs of the participants, thus obtaining information in a relatively short period. Its essential objective is to pursue the discovery of a structure with a sense of sharing, by consensus if possible, or, in any case, well based on the group members contributions.

The focal group technique can be used during the preliminary or exploratory stages of a study, to evaluate, develop or complement a scientific feature of such a study, or when it has been completed to evaluate its impact or to produce new investigation procedures. They can be used as a specific technique of data collection as complement to others, specially the triangulation and validating techniques (Morgan, 1998).

The focal group was formed by twelve research professors: two of which are PhDs, four Masters and six undergraduates, five Master students and one PhD student, between 25 to 55 years old. It was established that the participants were doing investigation by reading electronic material from a computer screen and that they devoted to this activity a minimum of two hours daily. Nineteen professors complying with these requirements were summoned. They volunteered to participate under the exclusion criteria of lacking of interest and/or time.

2.1 Methodology description

The focal group technique for data collection was used. It was done during a three-hour session. At the beginning of the session, written material describing the techniques being used was handed out to the participants. An ice-breaking dynamics for introducing the

participants was directed to enhance a friendly atmosphere and participation. The introductions were made by couples.

The instructor suggested to the group the following investigation questions: 1) Which are the factors that can produce the risk of visual fatigue among the ITCJ research professors as a result of reading electronic material from a VDT? And 2) Which are the most important factors producing the risk of visual fatigue among the ITCJ research professors as a result of reading electronic material on a VDT?. Later on, she (or he) asked the participants to write out on cards provided, three ideas that could respond to the first question. The guidelines were to write an idea on each card and to explain the idea in case it was not clear enough.

The cards were classified as follows: a member of the group was asked to read one of the cards which later was posted on the board. Then, the group was asked if anyone had written the same or a similar idea on the same subject. They read the cards and posted all the cards in columns. To make the classification of ideas easier, those that seemed confusing to the group were sustained by the participant who suggested the idea and which was subject to the group judgment. The classified cards were posted in columns and were read over in order to give each column a name according to the main idea which was being expressed. In this case, the names given were those of the factors.

To demonstrate the importance of the factors, the group was asked to suggest the procedures for ranging the information. Two procedures were suggested: The first one was to vote on the factors found and arrange them accordingly to their importance starting with the ones with the majority of votes. This procedure was rejected by the participants as they decided the second procedure was more practical.

The second procedure, accepted generally, was developed as follows: First, the thirteen factors obtained from the classification, were listed. Then, each participant ranged these factors by importance starting from 1 as the most important to 13, the least important. Later, a member of the group collected the data and filled out a table drawn on the board in which the information was organized scoring them according to the participants consensus had given to each factor and added them up, as directed by one of the participants. Finally, the scores were ranged starting with the highest in importance; thus, the factors were arranged, according to the knowledge and experience of the participants (fig. 1).

Figure1. Collecting and classification of data.

2.2 Data analysis and interpretation

In order to do the data analysis, the score variables given to the factors and the degree of variability among the responses were used. The ideal response was defined as the case in which all the participants agreed on the ranging and the gap between the ideal and real values. The values of the ideal responses and their gap are shown on table 1. Notice that the analysis was done with the results of only 11 of the 12 participants due to the fact that one of them had to abandon the session for personal reasons.

3. RESULTS

The importance given to the factors is shown graphically in figure 2; as observed, the factors are ranged according to their importance perceived by the group. Such arrangement is listed as follows: screen brightness, time of exposure, lighting, type of monitor, screen size, font type, test format, reader posture, font size, printing quality of text, colors used, human factors, and amicable software.

The first five factors are the most important, as assigned by the group of people assessed, who coincide in their responses, except for the first factor (screen brightness) scored differently by all concerned. If everybody had arranged brightness in the first place, the results would have been 11 points from 11 participants. However, it amounted to 32, which gap indicates that there were participants who did not give that much weight to brightness. Nevertheless, brightness was voted on as the most important factor.

Table 1.Analysis of data

	Participants													
Factor	1	2	3	4	5	6	7	8	9	10	11	Sum	Gap	Ideal
Screen brightness	0	2	4	5	1	1	10	2	4	2	1	32	21	11
Time of exposure	3	4	1	8	8	4	3	12	1	5	2	51	29	22
Lighting	4	3	5	4	2	3	8	8	9	11	3	60	27	33
Type of monitor	2	12	11	3	12	13	1	1	2	4	4	65	21	44
Screen size	7	13	6	3	6	10	7	6	3	3	5	68	13	55
Font type	13	5	7	1	3	5	5	13	5	7	6	70	4	66
Test format	11	7	9	7	5	7	6	3	12	1	7	75	2	77
Reader posture	9	1	10	9	7	8	4	4	6	13	9	80	8	88
Font size	8	6	8	6	4	6	9	7	11	8	8	81	18	99
Printing quality of text	10	8	3	12	12	2	2	10	8	10	11	88	22	110
Colors used	5	9	2	11	9	11	11	11	7	6	10	92	29	121
Human factors	6	11	12	13	13	9	2	5	10	12	12	105	27	132
Amicable software.	12	10	13	10	10	12	12	9	15	9	13	125	18	143

In relation to the variability of the responses, the score obtained from the ranged list was compared to that of ideal responses, in case everyone would agreed on the same response; this difference is the gap in “uniformity” through which we perceive that the assessment has been representative and its degree of representativeness. Notice the factors 1,2,3,4,10,11,12, y 13 display a greater gap and though these factors have been ranged so, the appraisal of the focal group should have been validated by a survey and ponder other variables such as age and occupation (fig.2.)

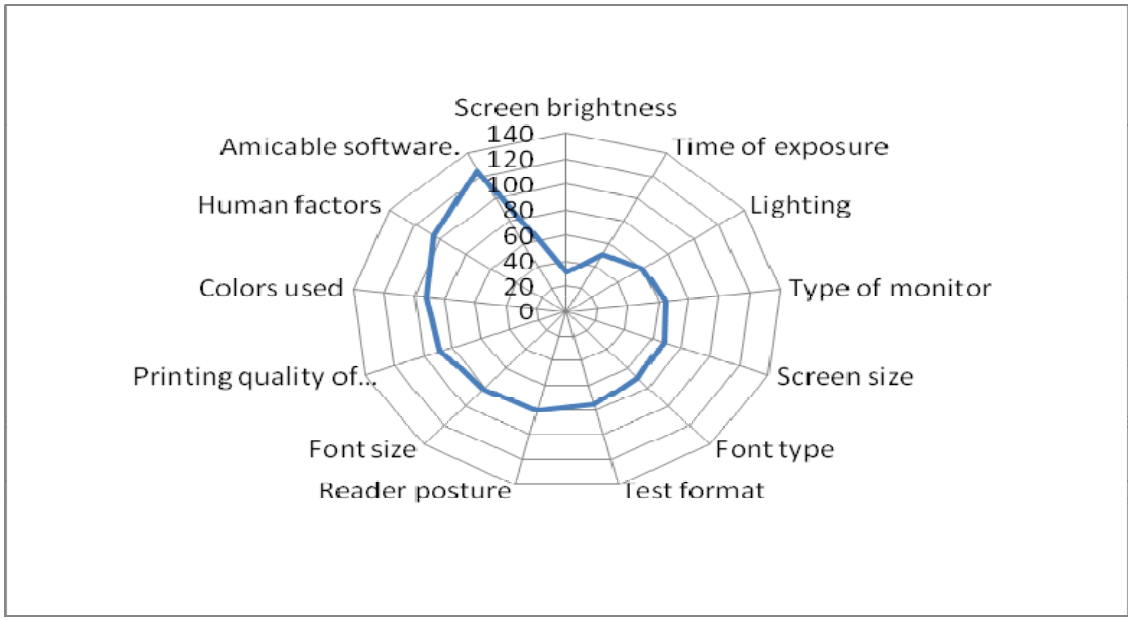

Figure 2. Factors ranked by importance

As shown in fig. 3, the focal group agreed on a valid arrangement, even though the rank of importance has the same behavior as that of the ideal case, the real scores obtained have the same trend: gaps on the arrangement diversion. This is due to two different situations: the first concerns the views of a PhD that differ from those of a Master or other people of different academic background, because of their habits and types of equipment they use for reading their electronic texts; the second, of no less importance, is the age.

3.1 Definition of the categories

To determine the categories it was decided to establish the first classification into two: controllable and uncontrollable factors; most of them (54%) were found controllable, that is, they can be adjusted to an operating level in such a way as to minimize the effect on asthenopia. The controllable factors were 1, 2, 3, 8, 11, 12 and 13, while the uncontrollable were 4, 5, 6, 7, 9 and 10 (fig. 4)

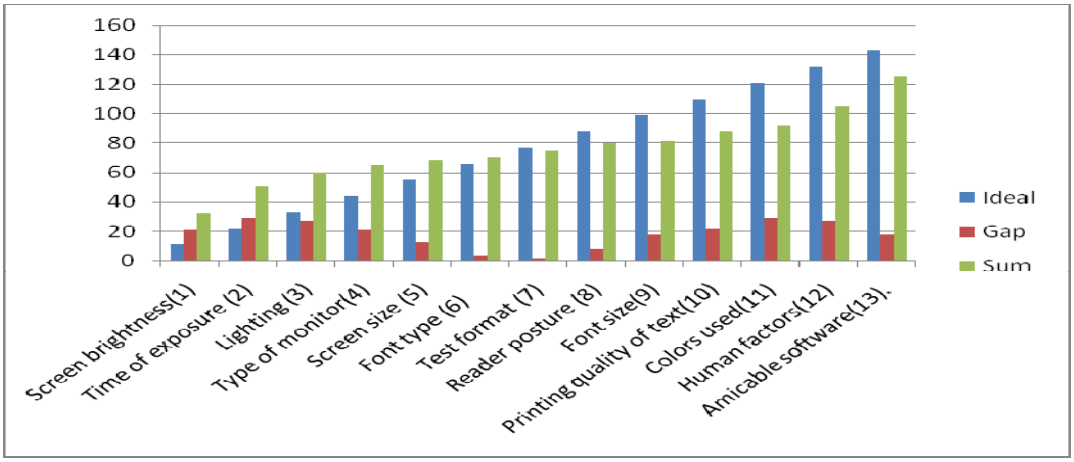

Figure 3 Uniformity of responses.

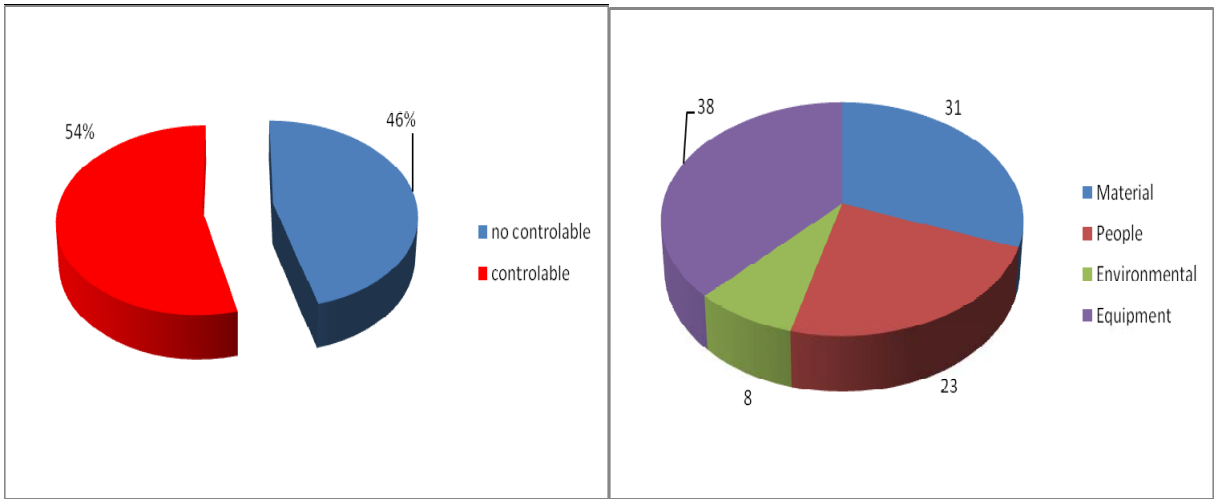

Figure 4. Categories for the factors that affect the asthenopia

A second classification permitted to obtain the categories according to their origin. These categories were due to equipment, material, environment and people. Most of the factors rise mainly from the equipment (38%), that is, the computer used, mainly its technical specifications and dimensions. Then, the material factor amounted to 31% due to the nature of the electronic reading, where very little can affect the printing of the scanned text or choice of the font type: these characteristics are already defined in the articles. The effects due to the people represent 23%; this means that even if they are just a few does not mean they are less important. An experimental design could measure the contribution of each factor to the visual fatigue, in case it's decided to model the process. Finally, very few factors are attributed to the environment (8 %.)

The resulting gap is an indicator that measures the participant agreement with certain arrangement; in our case there are not very important gaps, but our attention is drawn to the fact that the ranging was done with both very important factors and those which are not at all important. This unrelated feature could indicate a bias to be solved in future investigations whether by other instruments for collecting data, such as surveys or interviews at depth. The outcome obtained from the knowledge and experiences of the participants are the risk factors for asthenopia. Figure 6 shows their classification by range, drawn from the cultural domain of the focal group members.

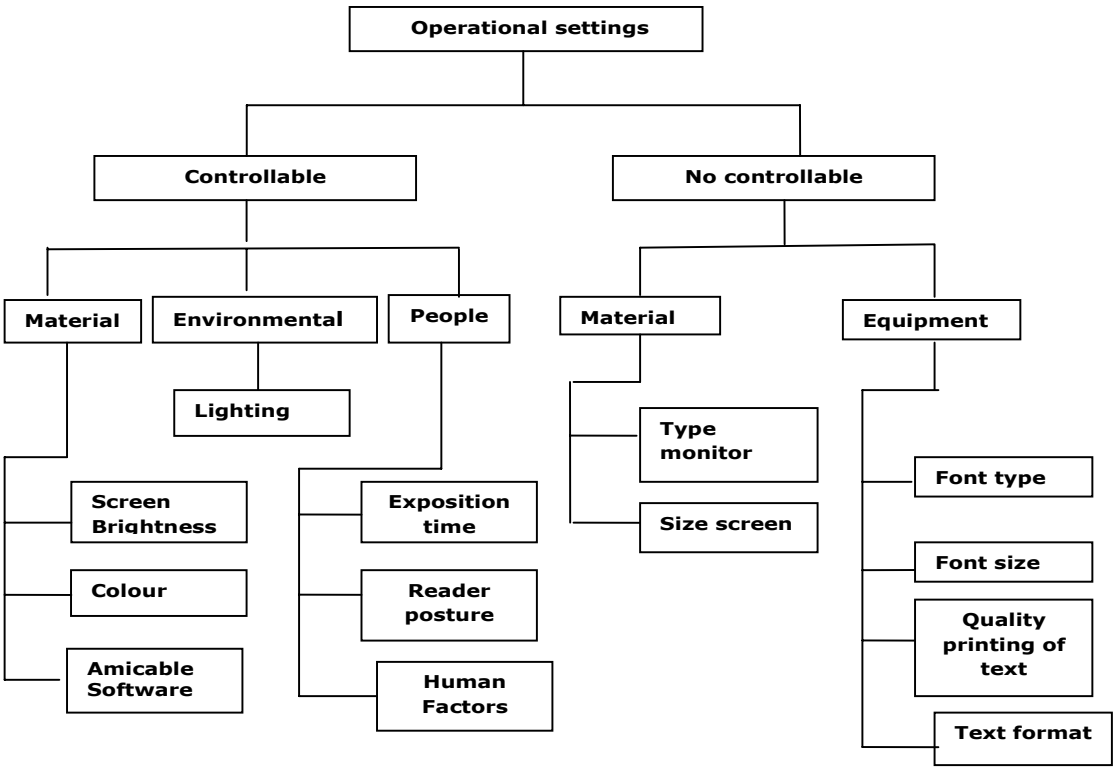

Figure 6. Categorization of asthenopia factors

4. DISCUSSION

Some previous studies mention that lighting has been one of the most important factors affecting asthenopia on workers at their working places by using visual screens (Lin, Hwang, Jeng y Liao, 2008; Sheedy, Smith and Hayes, 2005). Likewise, some investigators have discussed lighting effects on legibility and the effect of font size under a lighted environment or different light sources (Wang and Chen, 2003; Anshel, 2007). Thereby, lighting can diminish legibility because of an undesirable glare (Kim and Koga, 2004; Lin at al, 20008; Sanders and McCormick, 1993.) In this sense, the results obtained by the focal group

coincide with the lighting, screen brightness or glare factors, and for readability with its text format, font type and size.

One of the main factors that affects asthenopia is time exposure. In this sense, Knave et al (1985) quoted by Howarth and Bullimore in Wilson and Corlett (2005) have reported that a group of people exposed to more than five-hour period of working with visual screens shows major symptoms of visual discomfort, drawn from a study of cases and controls. The consensus of the group coincides with the American Association of Optometry who declares that one of the causes the Computer Vision Syndrome occurs because the visual requirement of the task exceeds the individual´s capacity to perform comfortably. Therefore, those people who use the computer two or more continued hours per day are prone to a greater risk of developing this visual problem. (AOA, 1995.)

The group also coincides in the color factor. In this regard, investigators mention that the inappropriate use of color could result in a poor performance and as a high cause of visual discomfort (Wang and Chen, 2003; Mathews, 1987). The worker posture is a factor widely studied and related to the musculoskeletal disorders (Turville, Psihoglios, Ulmer and Mirka, 1998.)

Even though asthenopia originates from the reading with VDT, it is considered to be of a multiple factors nature. Not all the identified and classified factors by the focal group were based on literature. Such is the case of the human factors, which particularly in this context seem vague and uncertain. The quality of text printing could likewise cause confusion since it applies to printed material on paper and not to an electronic reading. While the amicable software is an important factor in software and web page design.

So, in this work the factors that cause asthenopia are classified based on the experience of the participants which coincide greatly with international literature. More so, it shows the use of the focal group technique for explaining an ergonomic problem related to labor health which information can be used by research professors to prevent it.

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