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ASPECTS OF COGNITIVE NEUROERGONOMICS AND HUMAN FACTORS IN THE OPERATORS OF ELECTRIC POWER CONTROL AND OPERATION CENTERS:
Case Study in Brazil

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Aims

- Evaluate cognitive Neuroergonomic Aspects in operators at the Electric Power Operation and Control Centers (EPOCC) and to measure cognitive metric variables with the use of electroencephalographic equipment.

INTRODUCTION

source: ANEEL, 2015.

- One of the major challenges that electric utilities companies increasingly face is related to the health and well-being of workers especially those directly related to the operation and maintenance of electrical power systems.
- In these power systems, a confusing Human Machine Interface (HMI) with an operator can result in misinterpretation and induce errors during decision making.
- There are still accidents and incidents caused mainly by high workload that may lead to fatigue and decreased attention and concentration

MATERIALS AND METHODS

- The methodology used a sample of operators of Control Centers with 32 operators in Northeastern Brazil

- Measures with a Eletroencefalogram (EEG) equipment EMOTIV Insight 5 Channel Mobile

- NASA-TLX method questionnaires were given to evaluate the ergonomics aspects and to obtain information on the following variables: MD (Mental Demand), RP (Requirement Physics), TR (Temporal Requirement), LA (Level of Achievement), LE (Level of Effort) and LF (Level of Frustration)

- Psychometric tests were performed, composed of letters and symbols where the respondent marks the required letter or symbol. This application was performed before the beginning of the shift and at the end of the workday.

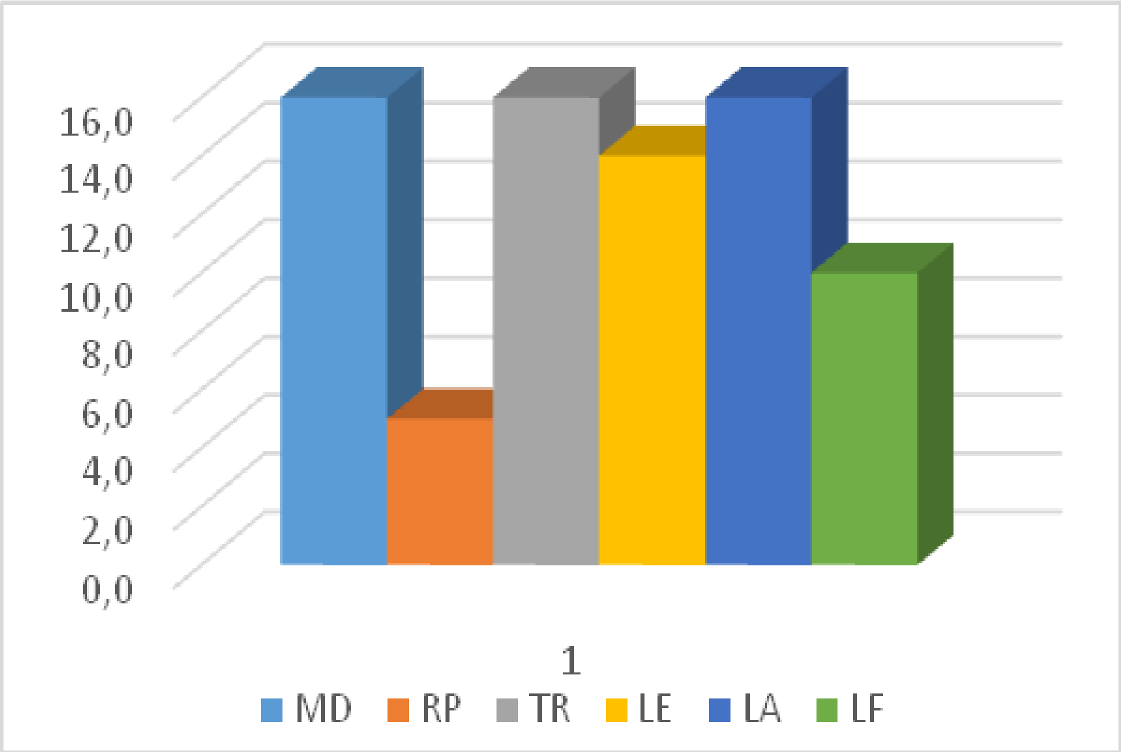
Eletroencefalogram (EEG) equipment EMOTIV Insight 5 Channel Mobile

- Eletroencefalogram (EEG) equipment measures the six cognitive variables:
- **INTEREST**: Measures how much you like or dislike something;
- **ENGAGEMENT**: measures how immersed you are in what you are doing or experiencing;
- **EXCITEMENT:** Measure of your mental stimulation;
- **STRESS MEASURES**: how comfortable you are with the current challenge you are facing;
- **RELAXATION**: Is your ability to switch off and reach a calm mental state;
- **FOCUS** is your ability to concentrate on one task and ignore distractions.

Eletroencefalogram (EEG) equipment EMOTIV Insight 5 Channel Mobile

RESULTS

NASA-TLX indicators for an absolute value scale between 1 and 20, where 1 represents the smallest value and 20 the largest.

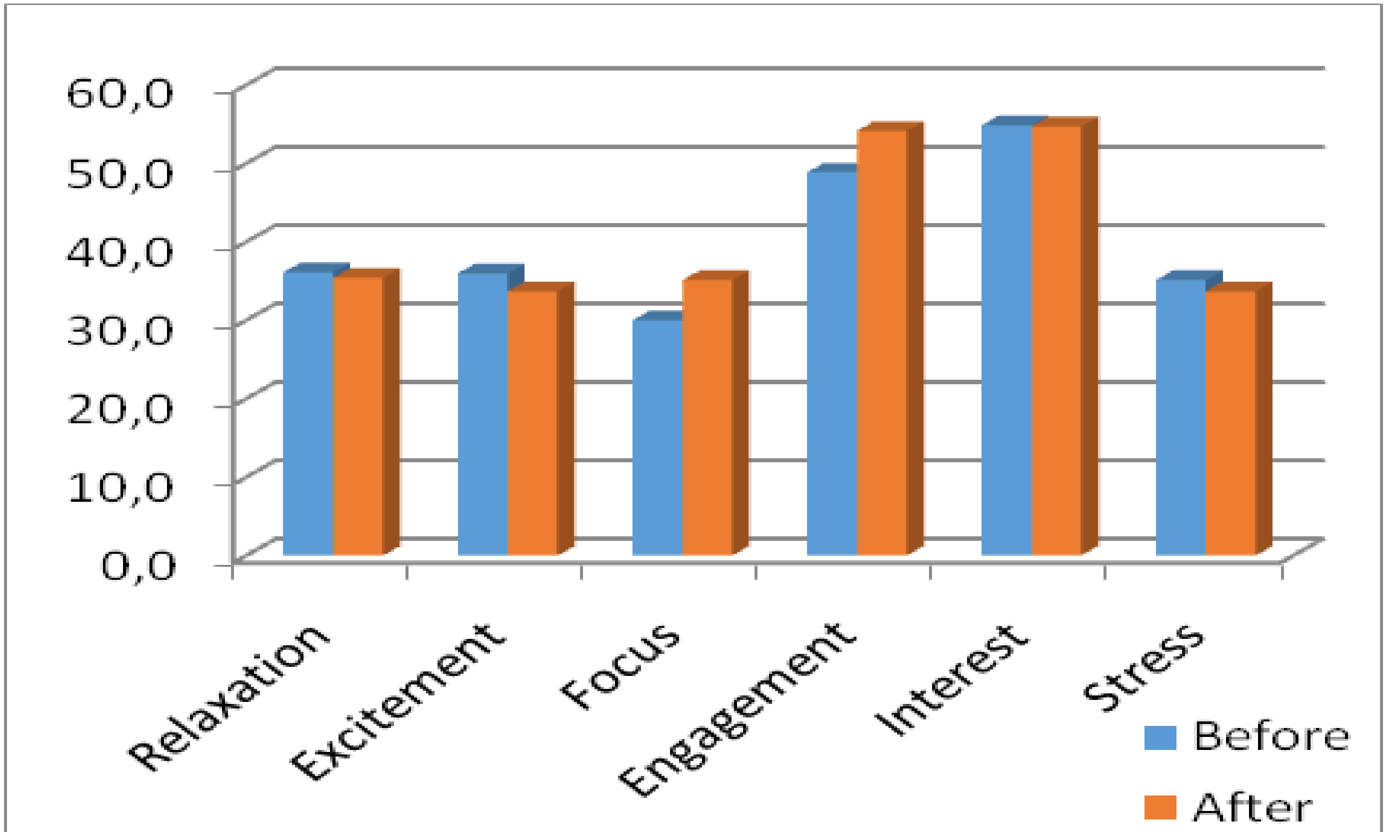


NASA-TLX subjective assessment tools:

MD (Mental Demand)
RP (Requirement Physics)
TR (Temporal Requirement)
LA (Level of Achievement),
LE (Level of Effort)
LF (Level of Frustration).

RESULTS

Cognitive metric data measured by the Emotiv 5 EEG. Value measured before the beginning of the workday and after the six-hour shift, in the scale 1 to 100.



DISCUSSION AND CONCLUSIONS

- Operator perception data has some very high values. The variables Mental Demand (MD) and Temporal Requirement (ET) and level of Effort (LE) have high amplitudes of 16, 16 and 14 on a scale from 1 to 20. This characterizes a type of work with difficult, complex tasks, requiring a lot of mental effort to reach the goal.

- There was an increase in the average value measured of the Focus and Engagement before the beginning of the workday and after the six-hour shift. From the data there was a 17% increase in Focus level and 11% in Engagement level. It is normally expected that after the work shift due to tiredness there will be a reduction in Focus and Engagement. However, this increase can be explained due to the characteristics of this type of work where operators are very concentrated throughout the shift.

- There was also a 4% reduction in the absolute level of the Stress variable measured before the start of the workday and after the six-hour shift.

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