

Ergonomic analysis of educational situations in the Algerian school

التحليل الأروغونومي للوضعيات التربوية في المدرسة الجزائرية

Houria Benayache^{1,*}, Hacina Belhay², Abla Boussaha³

¹ University of Annaba (Algeria), houria.benayache@univ-annaba.dz

² University of Annaba (Algeria), hassina.belhay@univ-annaba.dz

³ University of Annaba (Algeria), abla.zouini-boussaha@univ-annaba.dz

Received: 19/01/2023

Accepted: 11/05/2023

Published: 19/06/2023

Abstract:

Educational institutions are a fertile field for ergonomic applications through what the ergonomics offers in terms of solutions, not only, for wrong positions and designs, but also by studying the cognitive processes of the individual at work related to information capture, processing and storage. Also this includes studying all technical arrangements that lead to adapt and organize the work environment. Through this article, we discuss the importance of educational ergonomics in improving learning conditions, adapting the school environment and making it healthy and safe for both the student and the teacher. This comes with a focus on the ergonomic analysis of the reality of educational situations in Algerian school, which in their entirety are difficult situations, not adapted and donot provide a healthy work environment. Additionally, the article talks about the most important difficulties that prevent the real application of ergonomics in the Algerian school.

Key Words: Educational Ergonomics, Ergonomic Analysis, Educational Situations,

المخلص:

تعتبر المؤسسات التربوية مجالا خصبا للتطبيقات الأروغونومية من خلال ما تقدمه الأروغونوميا من حلول، ليس فقط للوضعيات والتصاميم الخاطئة وإنما كذلك من خلال دراسة العمليات المعرفية للفرد في العمل والتي تتعلق بالتقاط المعلومات ومعالجتها وتخزينها، ودراسة كل الترتيبات الفنية التي تؤدي إلى تكييف بيئة العمل وتنظيمه. من خلال هذا المقال نتطرق إلى أهمية الأروغونوميا التربوية في تحسين الوضعيات التعليمية وتكييف المحيط المدرسي وجعله آمنا ومريحا لكل من التلميذ والمعلم. هذا مع التركيز على التحليل الأروغونومي لواقع الوضعيات التربوية والتي تعتبر في مجملها وضعيات صعبة، غير مكيفة ولا توفر بيئة مدرسية سليمة. إضافة إلى الحديث عن أهم الصعوبات التي تحول دون التطبيق الفعلي للأروغونوميا التربوية في المدرسة الجزائرية.

الكلمات المفتاحية:

الأروغونوميا التربوية، التحليل الأروغونومي، الوضعيات التربوية.

The problem

Many studies show that work, despite the satisfactions and advantages it provides to the individual can be a causative factor for disease. Because every professional activity

*Benayache Houria.

contains a certain risk and these risks are everywhere, in industrial and service institutions, on the roads, ports and workshops, as well as in educational institutions on their various levels. On this basis, the problem of security and protection of individuals is among the problems faced by all organizations of all kinds. This is because the work environment may contain many risk factors that threaten the psychological, mental and physical health of individuals, and most of the risks are related to the interactions between the type of work, organizational environment and workers skills and competences. Ergonomics, of all kinds, has played a key role in providing organizational solutions to these various risks, through the vision, strategies and approaches it provides to reduce the problems which hinder the performance of workers and lead to occupational risks.

Ergonomics, through its main functions that revolve around the study of man in his relationship with his professional environment, and the collection and organization of knowledge in a way that makes it capable of achieving appropriate means of work, aims to achieve the greatest degree of worker comfort. This is by predicting risks, accidents, diseases and reducing fatigue related to muscular and mental work, creating good working conditions and aiming to achieve effectiveness for the organizations which is closely related to individual effectiveness.

Ergonomics is for a great importance that cannot be denied because of the services it provided to individuals and institutions. It is a scientific discipline that is currently applied to all types of human activities with the aim of designing tools, machines, means, equipment and work environment adapted to its users that allow achieving the greatest efficiency, security and comfort. The field of ergonomics expanded to include educational institutions, and are particularly concerned with the educational process by addressing the relationship between the main actors, namely the teacher-student, the tools and means, the equipment and the school environment. This is besides the social and temporal conditions in which the educational process takes place and where ergonomics allows to bring about harmony between human factors and the general context in order to improve academic positions.

Technological and social development and the need to raise the level of teacher's performance and the level of students' achievement, and improve the conditions surrounding the educational process in general led to the introduction of ergonomics concepts and applications into the educational field. Use of ergonomics help achieve compatibility between the educational process and learning processes and physical space represented in the school environment; and educational tools and equipment to achieve comfort and well-being for every teacher, student and the administrative staff as a whole, in order to achieve the ultimate purpose which is the development of educational system.

It is known that a person goes through different and important stages in his life, and the schooling stage is considered as critical stage that affects the future life of the individual, during which he gets the knowledge and information necessary to build a certain intellectual line. During this stage, the student uses certain educational equipments and if they are not designed in an appropriate way for his psychomotor development, this may lead to health problems that affect school achievement and his life in general. This is known too that in Algeria, talking about ergonomics in general and educational ergonomics in particular remains just academic research far from exploitation and application on the ground for several reasons. And through this proposition we will make an ergonomics diagnosis of educational situations in Algeria and identify the most important difficulties and obstacles that prevent the application of ergonomics in Algerian educational institutions by dissecting the reality of these institutions and the obstacles that prevent the design of institutions, programs, curricula and educational devices according to ergonomics' standards that ensure the effectiveness of the educational process and contribute to improve the quality of life for students, teachers and administrative staff.

1. The definition of Ergonomics :

Ergonomics is the scientific discipline that refers to the basic understanding of the interactions between individuals and the rest of the components of the system in such a way that the comfort, well-being and safety of individuals are at their best levels, and ensure the maximum effectiveness of the organization.

Ergonomics contributes to planification, design and evaluation of tasks, jobs, products, organizations, environments and professional systems by making them compatible with the needs, capacities and limitations of worker's capabilities. (Amigues, 2003, 5)

Ergonomics also designates: « that human specialization whose purpose is to find the best fit and harmony between the worker's needs and the constraints imposed by professional environment while ensuring effectiveness in the workplace by achieving the highest levels of efficiency, security and occupational safety.”(Coutarel2015p 11)

The international society of Ergonomics defines it, as “The scientific discipline concerned with understanding the interactions between individuals and the components of the system, and it is the application of theories, principles and methods in order to improve the well-being of workers and achieve the maximum efficiency of systems.”(Amigues2003p7)

The ergonomics foundation of the French language defines it as “adapting the work of man using scientific knowledge in order to design tools and devices that combine Usability, comfort, security and effectiveness” (Gillet, 1987, 19)

Ergonomics is the science that adapts work to the worker, and it is the science of the economy of effort, time and movements to achieve efficiency and satisfaction for the worker. It revolves around the study of psychological and physiological characteristics of the worker in his position to contribute to the design and evaluation of tasks, products, work methods and systems to make them compatible with the limits of the worker 'capabilities. A discipline includes all types of human activities, and is an approach that takes into account cognitive, social and organizational conditions. Ergonomics is concerned with the study of human being in his work environment, and denotes the sum of the knowledge associated with the individual and necessary in order to design professional equipment and use it in the most comfortable, safe and effective manner.

Some specialists divide ergonomics into two streams:

- * **Human factors ergonomics** : which is called The human machine too is the most widespread trend in the United States of America, and it is concerned with the physiological and mental characteristics of individuals in order to design machines and technical devices suitable for these characteristics based on some sciences such as physiology and engineering, which contribute to the design of seats, screens and working times that are most suitable for the human body .Whereas, psychology is relied upon by recognizing the personality traits of individuals, their abilities, skills and the limits of their capabilities, as well as through psychological and good preparation for them.
- * **Ergonomics of human activity**: it is the current spread in Europe, which considers ergonomics as an analysis of work situations through studying the task and the activity, and focusing on the various physical and mental activities carried out by the worker, with the aim of improving them, analyzing and discovering the various elements involved in completing the tasks by asking the following questions :who does what? And how does he do it? Can he do it in the best way? What are the purposes that can be reached through good design of work situations as well as work procedures? And what activities does the worker do while performing his tasks?

The main characteristics of ergonomics lies in the fact that it is of a multidisciplinary nature because it mobilizes knowledge related to psychology, physiology, medicine and engineering and its application to problems resulting from design errors, in order to achieve the main goal which is adapt the work environment for the worker, due to the inability of the person to use work tools efficiently in the event that they are not suitable for his abilities and characteristics.

Ergonomics recorded its first beginning in the military field, especially during the Second World War, when it recorded the largest losses in military vehicles, which were

caused by bad design and inappropriateness to the sensory and motor capabilities of its users. There, attention was paid to human factor, and the need to take into account the capabilities of the worker and his psychological aspects when designing devices and machines to achieve integration and adapt them. Then ergonomics spread to include all areas of life, and its applications were numerous in the civil field and became necessary in the design and development of air navigation systems, medical equipment and human-computer interaction systems especially in the design of communication interfaces, data processing and web design. To move ergonomics to interfere in the school field because of the need to make adjustments and changes in school environments and make them more efficient, effective and safe for students, teachers and administrative staff.

2. The definition of Educational Ergonomics :

Before addressing the definition of the concept, it should be noted that the first to use the term of educational or school ergonomics is **Anne Lancry-Hoestland** in **1977**. She is considered one of the pioneers of educational ergonomics, which puts the student at the center of its approach without forgetting the teacher, the administrative staff and school environment as a whole where the student is viewed as a worker in the workshop, performing certain tasks within a specific practical context and within a specific physical environment. Also, she confirmed that ergonomics standards can be transformed and adapted to the educational environment. (Interview of Michel Pottier with Anne Lancry-Hoestland on April 04, 2003)

Educational ergonomics refers to everything related to hygiene, security, conditions of life and well-being in the school, based on the analysis of real educational situations and learning processes in all their cognitive, social, health and the formation of specialties in the field of education. (Danvers2003p242)

It is also known as: “the analysis of the pedagogical situations with the aim of improving the welfare and the performance of individuals who interact with the elements of a particular educational situation in order to accomplish the educational tasks.”(Martinez&Boutin2008 p128)

The concept refers to the multiple tasks that the teacher performs and the students are subject to, and analyze them so that all aspects of the educational task are known. The focus of the educational task analysis is on:

- ✓ Definition of the educational task and its various characteristics.
- ✓ Determination of task benefits and objectives.
- ✓ Determination of the individuals to whom it is directed.
- ✓ Determination of the educational equipment needed to accomplish the task.
- ✓ Identification of the people involved in the task.

- ✓ Determination of times of completion of educational tasks.

Evaluation of the duration of tasks.

- ✓ Determination of the location of educational tasks: class, laboratory, library.....etc.

Through the different definitions of educational ergonomics, we can confirm that interests are focused on:

- ✓ Design of school spaces and buildings.
- ✓ Design of communication's methods.
- ✓ Improving the physical conditions surrounding the learning process.
- ✓ Improving the design of the mobility spaces whether between classrooms and rows.
- ✓ Preparing classrooms and designing learning situations.

Educational ergonomics, specifically aims to achieve the satisfaction of the student, the teacher and the administrative staff, and to increase the motivation and enthusiasm to accomplish learning tasks, reduce errors and raise the levels of safety and security at work, build individuals and improve meaningful participatory activities. (Devolve, 2012, 16)

According to some experts, including Porcher, there are two levels of intervention in educational ergonomics :

- ✓ A specific level of design such as the design of educational aids, methods, pedagogical pillars and school tools. It is especially related to improving the physical conditions surrounding the school and every thing related to the types of paint, the colors of the classrooms, the noise, the type of the lightingetc.
- ✓ A second level includes students, teachers and the administration and deals with the general conditions of quality of life, and the social and economic environment, the diet and sleepy system and rest periods....etc.

Porcher, also points out that educational ergonomics is based on psychological and individual differences among students and teachers in their capacities, talents and experiences, the degree of intelligence, as well as the limits of student's abilities (comprehension and attention capabilities). These factors must interact with each other to form the appropriate space for the educational process based on a better understanding of behavior and the achievement of working conditions that closely match the basic needs of the student and teacher. It is also interested in researching the concepts of mental and physical fatigue and professional stress. (Montagner, 1983, 201)

The greatest concern for educational ergonomics is to find the best balance and fit between the human actors with its various aspects (biological, psychological and social)

and the general context of the learning process. In addition, that the ultimate goal is to be reached is that

“Every student enjoys while learning, and every teacher enjoys when he teach, and that the educational environment is a place for fun not for pain”. (Comenius XXVIIeme siècle)(Picard, 2013, 45).

3. Educational Ergonomics Goals :

The goals of educational ergonomics are multiple, depending on the different areas of its interventions, and are related to the teacher, the student, the other staffs and the school environment as a whole. N, Devolve summarized them as following:

- a) The scientific study of the conditions of educational work, especially the design of the interface (man-machine) in the educational field, so that the ergonom can design and evaluate educational tasks.
- b) Designing technological methods and devices related to communication processes, educational products, environment and systems, and making them compatible with the educational needs, competencies and psychological limits of the users (teacher-learner)
- c) Adapting working conditions to the physical and mental capabilities of the learner and adapting them to the competencies to be achieved.
- d) Adapting educational work methods to the physical dimensions of the teacher and the learner.
- e) Correcting work positions, especially those that caused a professional disease or work accident.
- f) Reconfigure work positions to adapt them to some special situations such as disability, or if the set goals were not achieved.

To achieve these goals, educational ergonomics confirms that there are some indicators that guarantee a healthy and safe school environment, including:

- ✓ Good preparation of overall building spaces in the school.
- ✓ Taking care of green spaces inside the school.
- ✓ Preparing classrooms, laboratories, libraries, gymnasiums and restaurants with the necessary equipment with an ergonomic design.
- ✓ The side roads in the school must be suitable include the general specifications and appropriate physical conditions.
- ✓ Create an hygiene and healthy work environment that encourages learning and competition.
- ✓ Rapid response to developments, changes, and constantly restructuring tasks with optimal use of technological means and organization of experiences.

4. Ergonomics Analysis Of Educational Situations in Algeria :

The primary goal of ergonomics is to achieve security, health and professional safety for individuals, based on the principle of respect for the human being at work. And ergonomic intervention in the professional educational environment takes into account the working conditions that the school has, in terms of its location architecture, means and equipment which negatively affect its users due to its non-conformity with ergonomic scientific standards .If we look at the Algerian educational reality, in all its stages, from primary to university level, we notice that the situation is alarming and that the reality is almost tragic because most teachers suffer from exhaustion, fatigue and stress. While we find that the educational staff and principals are closed on themselves, their only concern is to complete the programs without disturbances. And students suffer from educational, psychological and social difficulties that hinder them in completing their academic studies, and affect school achievement processes. Therefore, we cannot ignore these circumstances that require rapid intervention in order to change or modify them. A quick look at the professional education environment in Algeria makes us note the following:

4.1. Construction ENGINEERING :

The engineering design of most educational institutions is b, as some of the Architectural, engineering, health and aesthetic requirements are not respected in their implantation, which increases the alienation of students and puts pressure on teachers and administrators.

4.1.1. In terms of locations :

Most of the institutions are built either within residential communities and close to transportation stations and highways, which impedes communication operations inside school, or are built on slopes and on lands that suffer from slipping, which exposes them to the danger of collapse or next to valleys, which exposes them to the risk of flooding.

As for the classrooms, which have a direct impact on the achievement process and on psychological and physical health, most of them are narrow rooms, poorly designed especially in terms of:

- Designing and arranging school furniture inside the classroom, such as lockers, desks and blackboards....etc.
- Poor design of the rows and the space between them.
- Inappropriate paint colors affect attention and perception processes.
- The lack of ergonomics design furniture in the classrooms such as cylindrical standard tables (tables with wheels) and swivel chairs whose height can be adjusted according to the height of the students.

- *The lack of air-conditioned rooms for teachers, especially in times of rest, to prepare lessons, forcing them to complete them at home, which affect the private life of the teacher and increases his/her fatigue and exhaustion.

4.1.2. Physical conditions:

We note that many educational institutions are next to public services, residential communities and main or side roads which are classified as sound polluted areas, causing a lot of noise .It is known that the intensity of the noise affects both the transmitter and the receiver (teacher- student) and hinders the communication process as well as affects the senses of hearing and causes professional diseases in the long term.

- Many institutions also suffer from poor lighting and frequent electricity cuts, especially in the winter, and the intensity of lighting in the rest of the seasons with the almost total absence of curtains on the windows, knowing that the sun's rays always block and prevent students from seeing.
- The lack of heating in many institutions especially elementary schools in many remote areas, which leads to a feeling of extreme cold that affects the educational achievement of students and the performance of teachers.
- Students standing for long periods in the school yards, waiting for the classrooms to become vacant, which exposes them to the sun in the summer and to the bitter cold in the winter.
- The terrible overcrowding of students in classrooms due to the poor infrastructure of educational institutions not only affects communication, attention and perception but also impedes the learning process.
- Lack of interest in green spaces inside the school building, which allow students to feel psychologically comfortable, and develop a culture of preserving the environment and surroundings.

4.1.3. School programs and teaching means:

Considering that ergonomics is concerned with the design of educational programs, the observer of the reality of the situation in our educational institutions is sure of the intensity of the educational program in all phases, which exhausts both the teacher and the student, and makes the teacher live in a constant obsession about how to finish the program without taking into account the methods of learning and the individual differences between students levels of comprehension. In addition to all this, most of educational programs are intensive that rely on filling in information and do not correspond to the student's mental abilities.

As for the educational means or aids, we can confirm that they do not follow the development at the world level nor its technologies, as they are still traditional and simple . Many institutions suffer from poor working conditions, as most of them do not

have modern means of work such as tablets, with an almost total absence of educational supports such as Data-Show and demonstration tools. We also note the absence of some means like printers and computers, which leads teachers to go outside the institution to accomplish their work, and this is considered a waste of time and effort. In addition to all of that, the poor equipment of laboratories and workshops with modern health means.

4.1.4. The Student:

He is considered the focus of the educational process, and therefore its effectiveness is centered around the circumstances surrounding him/her. We observed generally that:

- Not maintaining a single rhythm school hours and changing it every week leads to an impact on the adaptation processes and suffering from sleep disturbances.
- The weight of the school bag that exceeds the standards that guarantee physical health and that causes back pain to student and the appearance of deformities to their spines.
- Not respecting the anthropometric conditions and measuring the body dimensions of the Algerian child when designing tables and chairs.
- Wrong sitting positions for students.
- Not respecting the rest time with no places for it, and proper healthy nutrition which increases the depletion of mental and physical energy. (The Japanese experience provides chairs for sleeping and relaxing during school hours). In addition to the lack of places to practice hobbies such as sports ground, art classes, vocational workshop...etc., in most educational institutions.

5. Difficulties in applying educational ergonomics in Algeria:

The most important difficulties that impede the application of educational ergonomics in Algeria can be summarized as follows:

- ✓ The absence of political intention to use ergonomics in all areas and fields, because the presence of the element of political will open horizons for thinking about adopting ergonomic work methods.
- ✓ Ergonomic intervention is weak, if not non-existent, in the professional and educational reality, as most of the existing academic studies focus on the anthropometric dimensions of bodies, tables and chairs and the weight of school bag and their negative effects.
- ✓ There are no specialists in Algeria, which is due to several reasons, the most important one is the cost of ergonomic training, which is very expensive.

- ✓ Resistance to everything new: although no one can deny the role of ergonomics, there is resistance against every ergonomics intervention that would change the general context of the educational process.

Conclusion:

If we take into account the necessity to apply ergonomic approaches to the conditions of life and work in Algerian educational institutions, it is necessary to focus on the importance and place that must be given to ergonomics in the educational institutions as a whole. Therefore, thinking should focus on re-creating school spaces, and asking the following questions: what is the optimal design for buildings and classrooms? What is the optimal design and arrangement of school furniture? What kind of pedagogical means and supports are most suitable for the Algerian student, which make him different, distinguished and creative?

These questions make us think more about the conditions and methods that allow designing school spaces that help attract the attention of students and teachers, and provide them with comfort, well-being and security, and improve their efficiency. And so we must talk about:

- ✓ The spatial space that the student occupies through his schooling period and the rest that must be provided in order to reach the greatest possible effectiveness.
- ✓ Reconsider the architectural side of the building, especially in the primary stages through :
- ✓ Adopting new patterns in construction in terms of building quality, design methods and adopting horizontal construction of classrooms interspersed with green spaces.
- ✓ The need to keep the school space away from streets, roads and noise.
- ✓ Providing hygiene means, especially, water and taking care of the cleanliness of places, while providing health coverage and social assistance to follow up on difficult cases.
- ✓ Pay attention to the colors of tables, chairs and desks which must be in the contrast to the colors of the walls.

References:

- Amigue R, 2003, pour une approche économique de l'activité enseignant, skhole, hors-série.
- Bernard Gillet, 1989, Le psychologue et l'ergonome, Ed, EAP, France
- Coutarel F, 2015, enquête sur les conditions de travail auprès des professeurs d'éducation physique et sportive et perspective d'action, in perspectives interdisciplinaires sur le travail et la sante, PISTES

Danvers Francis, 2003, 500 mots –clefs pour l'éducation et la formation tout au long de la vie, PUF

Devolve Nicole, 2005, Tous les élèves peuvent apprendre, approche psychologique et ergonomique des apprentissages scolaire, Ed, Hachette

Devolve Nicole, 2012, Réussite pour tous, Overblog.

Devolve Nicole, 2016, L'ergonomie peut-elle être au service du monde de travail, science conférence, Ed de Boeck.

Martinez Jan-Paul, Boutin Gerald, 2008, La prévention de l'école scolaire, Ed, PUQ

MontagnerH, 1983, Les rythmes de l'enfant et de l'adolescent, les jeunes en mal de temps et d'espace, Ed, Stock, Paris

Michel Pottier with Anne LancryHoestland, Interview On April 04, 2003, Ergonomic Society of french language, <https://Ergonomics-Self-org> On November 25, 2022 At 13,00 PM.

Picard D, Marc E, 2013, L'école de Palo Alto, Que-sais-je ?, PUF, Paris