



المؤتمر العلمي الثاني بعنوان  
مستقبل التعليم المهني والتقني بمدارس التعليم العام في فلسطين

**A Research Paper on:**

**Educational Ergonomics: Towards the Quality of the  
Technical and Vocational Education and Training (TVET) Environment  
in Light of the Challenges of the Third Millennium**



**Prepared by:**

**Dr. Sameh Khalil AL-Jabbour**

**PhD “Computer Security Systems”**

**Professional Development & Curriculum Unit Coordinator**

**UNRWA – Gaza**

**07-08/05/2018**

ورقة عمل مقدمة إلى/



الكلية الجامعية للعلوم والتكنولوجيا - خان يونس  
بالتعاون مع  
مديرية التربية والتعليم - خان يونس

المؤتمر العلمي الثاني بعنوان

مستقبل التعليم المهني والتقني بمدارس التعليم العام في فلسطين

بعنوان/

**Educational Ergonomics: Towards the Quality of the  
Technical and Vocational Education and Training (TVET) Environment  
in Light of the Challenges of the Third Millennium**

الأرغونوميا التربوية: نحو جودة بيئة التعليم والتدريب التقني والمهني  
في ضوء تحديات الألفية الثالثة

**إعداد/د. سامح خليل الجبور**



(سورة طه: 114)

## Contents

#	Subject	Page
1.	Abstract	6
2.	Introduction	8
3.	Technical and Vocational Education and Training (TVET)	8
4.	Benefits of TVET	9
5.	TVET Challenges in the Light of the Third Millennium	11
6.	Educational Ergonomics	13
7.	Objectives of Educational Ergonomics	14
8.	Educational Ergonomics: Design and Performance	14
9.	Recommendations	19
10.	References	20

# Learning by Doing



**(Learning should be relevant and practical,  
not just passive and theoretical)**

*By: John Dewey (American Philosopher)*



As the essence of the learning process is the individual (teacher and learner interaction), it is useful and necessary for **Ergonomic** to intervene for good design and correction to increase the effectiveness of education and to improve the outcomes of technical and vocational training.

This research paper attempts to highlight the importance and role of **Ergonomic** in the service of **TVET** and its development, based on the search for the harmonization of the educational process and the physical elements of that process. This is for the convenience of the teacher and the learner environment and to reach the maximum levels of effectiveness in the educational process and in its development.

**Keywords:** Education - Ergonomics – TVET – TVET Quality – 21<sup>st</sup> Skills – Third Millennium.

## Introduction

"The main challenge in the science of human learning; is to understand the requirements of educational design at all levels" (K.U. Smith and Smith, 1966, p. 478).

**Education** is the process of facilitating learning, or the acquisition of knowledge, skills, values, beliefs, and habits.

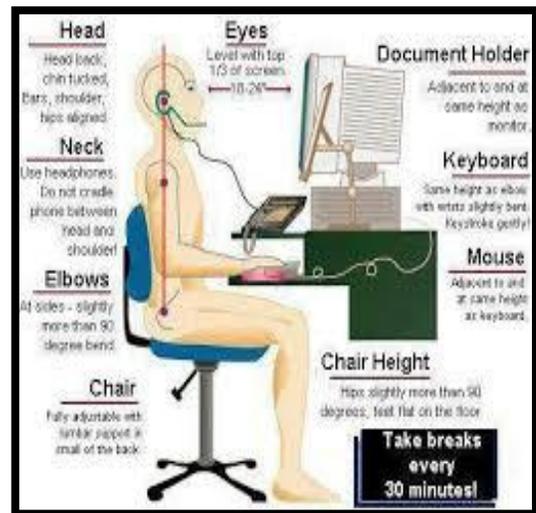
**Ergonomics** derives from two Greek words:

**ergon**, meaning work, and **nomoi**, meaning natural laws, to create a word that means the science of work and a person's relationship to that work.

The **International Ergonomics Association** has adopted this technical definition: **Ergonomics** (or human factors) is the scientific discipline concerned with the understanding of interactions among humans and other elements of a system, and the profession that applies theory, principles, data and methods to design in order to optimize human well-being and overall system performance. **Ergonomics** is the science of making things comfy. However for simplicity, **Ergonomics** makes things comfortable and efficient. Efficiency is quite simply making something easier to do. Efficiency comes in many forms however.

## Technical and Vocational Education and Training (TVET)

Developed countries are interested in TVET, which is the path to progress, development and prosperity. **TVET** in Palestine is a special feature. In Gaza Strip, there are a number of technical and professional institutions which provides the society annually with the number of technicians and professionals who are in need for different economic activities. **TVET** is the



cornerstone for preparing qualified national cadres to implement development plans.

According to the definition by **UNESCO**, and the International Labour Organization (ILO), **TVET** refers to “aspects of the educational process involving, in addition to general education, the study of technologies and related sciences, and the acquisition of practical skills, attitudes, understanding and knowledge relating to occupants in various sectors of economic and social life” (UNESCO and ILO, 2001).



**TVET Quality:** **TVET** is often seen as "last choice education" because of a lack of quality. High-quality **TVET**, on the other hand, leads to a higher status and improved attractiveness of **TVET**.

**Third Millennium** in contemporary history, the third millennium is a period of time that started on January 1, 2001, and will end on December 31, 3000 of the Gregorian calendar.

### **Benefits of TVET**

The **TVET** is particularly an innovative application field of educational economic “Costs-Benefit-Quality”-research. Two main categories can be identified for benefits of **TVET**:

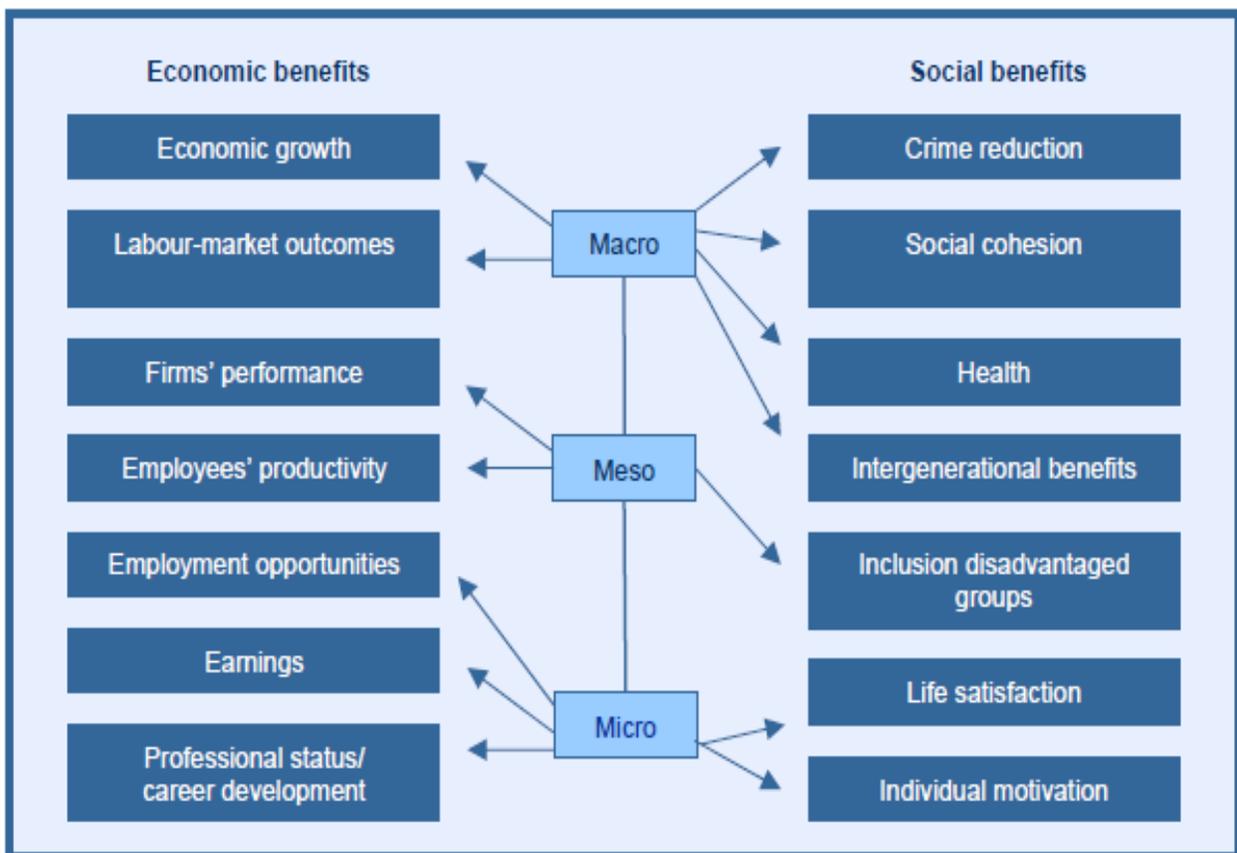
## 1. Economic Benefits.

## 2. Social Benefits.

Both categories can be analyzed on three different levels:

1. The **Micro** level (the benefits for individuals);
2. The **Meso** level (benefits for enterprises/groups);
3. The **Macro** level (benefits for society as a whole).

Figure (1) gives examples of **TVET** benefits according to the dimensions (**Economic and Social**) and the level of analysis (**Micro, Meso and Macro**).



**Figure (1): TVET Benefits**

(Reference: [http://www.cedefop.europa.eu/EN/Files/5510\\_en.pdf](http://www.cedefop.europa.eu/EN/Files/5510_en.pdf))

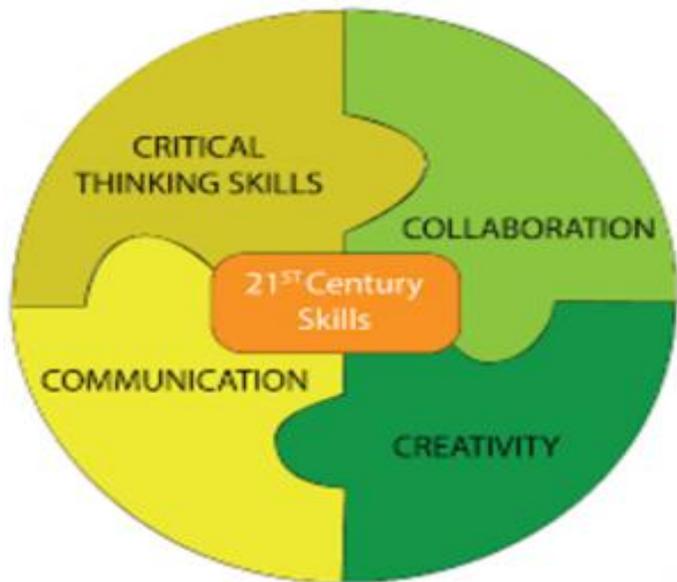
The European Quality Assurance for Vocational and Training has developed a list of indicators to assess the quality of **TVET** systems. The indicators are:

1. Relevance of quality assurance systems for **TVET** providers
2. Investment in training of teachers and trainers
3. Participation rate in **TVET** programs
4. Completion rate in **TVET** programs
5. Placement rate in **TVET** programs
6. Proportion of **TVET** program completers who are placed either in the labor market, further education or training (including university).
7. Percentage of **TVET** program completers who are employed after the end of training.
8. Utilization of acquired skills at the workplace.
9. Unemployment rate.
10. Prevalence of vulnerable group.

### **TVET Challenges in the Light of the Third Millennium**

We are in an age where knowledge is not only a tool, but it is a goal, imposing new requirements and changing the roles of teacher and learner, alike to prepare a generation capable of dealing with globalization and leveraging knowledge in the

face of future challenges. This is a challenge to educational systems, so some of them went to try to identify the requirements of the 21<sup>st</sup> century and identify the skills necessary for students to be able to live and work in this life.



**Figure (2): 21<sup>st</sup> Century Skills**

(Reference :<https://scnforyou.com/can-swipe-best-em/>)

**21<sup>st</sup> century skills** are "the set of skills needed to succeed and work in the 21<sup>st</sup> century such as learning and innovation skills, information and communication culture, technology, and life and work skills".

In the light of learning skills in the 21<sup>st</sup> century, **TVET** thus equips people not only with vocational skills, but with a broad range of knowledge, skills and attitudes that are now recognized as indispensable for meaningful participation in work and life. Examples of the benefits include self-awareness and self-esteem, and strengthened interpersonal, citizenship, communication and entrepreneurial skills.

Based on the analysis of prominent policy areas, UNESCO is addressing six **TVET** persisting challenges:

1. **Promoting skills for youth employment.**
2. **Ensuring access: TVET for all.**
3. **Improving the image and quality of TVET.**
4. **Financing TVET.**
5. **Strengthening innovation and research.**
6. **Advancing sustainable development.**

❖ In order to promote skills for **TVET** youth and improve the image and quality of **TVET**, within a comfortable and sustainable environment to strengthen innovation, **Educational Ergonomics** should be considered.

### **Educational Ergonomics**

Is defined as that field of human factors/**Ergonomic** science concerned with the interaction of educational performance and educational design. The premise of educational **Ergonomics** is that student performance to a substantial degree is context specific specialized in relation to specific design factors and that **Ergonomic** interventions directed at design improvements therefore can benefit education.

## Objectives of Educational Ergonomics

The general objectives of **TVET** schools **Ergonomics** are:

1. **To improve the place,**
2. **To improve conditions,**
3. **To improve means of education.**

The objectives on which the **Ergonomics** are based are:

1. Physical and psychological comfort.
2. Avoiding occupational diseases.
3. The security and safety of teachers and learners.
4. Effective education and educational performance.

## Educational Ergonomics: Design and Performance

The Educational **Ergonomics** for **TVET** schools vary to include:

### 1. **Human Inputs:**

Human inputs include students, teachers and the school administration.

### 2. **Physical Inputs:**

Physical inputs are many and varied, including the design of the school and the classroom with its various facilities.

Educational system design factors that may influence student learning:

1. Academic Program.
2. Classroom and Building Ergonomics.
3. Class Design.
4. Organizational Design & Management of the Educational System.
5. Teaching Factors.
6. Personal Factors.
7. Community & Family Factors.

Design of the Educational Process refers to physical designs of instructional materials, environments, and technologies (e.g., classroom implements and equipment, textbooks, audio-visual materials and systems, work stations, computer hardware and software, school classrooms and buildings), to designs of different skills, tasks, classes of knowledge, and curricula targeted for learning, to social and interpersonal designs of the interactions of participants in the system with one another (e.g., student-teacher-staff-management relationships), and to the design, management, and administration of jobs, supervisory relationships, organizations, policies, and programs of educational systems, as well as to the designs of communities in which education occurs.

The education **TVET** environment is an intellectual system and practical practices that includes inputs, processes and procedures to create situations in which teaching and learning can take place in a constructive and effective manner. When

this happens, there is a system in the learning environment. This work can only come about if we use modern systems to correct and design everything that is materialistic in the educational process and in his relations with the design and engineering of human work.

- Educational **Ergonomics** is concerned with all modes and levels of interaction between educational performance and educational design.

This research paper represents an effort to establish an inter-disciplinary field of research toward total educational effectiveness. The traditional educational delivery lacks any systems perspective and precision.

- ✓ The application of **Ergonomics** to education has received only limited attention.
- ✓ A system analysis has identified **FIVE** components for educational

**Ergonomics:**

- (1) **Learning Ergonomics,**
- (2) **Instructional Ergonomics,**
- (3) **Ergonomics of Educational Facilities,**
- (4) **Ergonomics of Educational Equipment,**
- (5) **Ergonomics of Educational Environment.**

A brief for each of the above components, as following:

### **(1) Learning Ergonomics**

Learning **Ergonomics** explores such areas as educational skills of handwriting, reading, drawing, instrument manipulation, class scheduling and school scheduling, research in examinations, management of learning activities, and grading systems.

### **(2) Instructional Ergonomics**

The instructional **Ergonomics** covers textbook design, teaching devices, instruction techniques, classroom conducts, lecture preparation, and educational T.V.

### **(3) Ergonomics of Educational Facilities**

**Ergonomics** of educational facilities concerns educational furniture, laboratory and library Ergonomics, classroom and office design, and equipment allocation.

### **(4) Ergonomics of Educational Equipment**

**Ergonomics** of education equipment investigates needs analysis, C/D design, allocation of equipment, performance analyses, and its safety and construction.

## **(5) Ergonomics of Educational Environment**

**Ergonomics** of educational environment includes such things as illumination, colour, noise, space utilization, and allocation of equipment.

## Recommendations

1. **Ergonomic** contributes effectively to TVET schools.
2. The educational **Ergonomics** in **TVET** schools is a scientific area that takes into account the educational achievement, health and safety of teachers and learners, and the comfort of all individuals, as well as the effective interaction between individuals, the tools they use and the environment in which they are located.
3. The school building should be designed in all its components so as to respond to the:
  - a. Functional objectives of the school,
  - b. Method of education and training therein,
  - c. Types of educational, professional and recreational activities in which it is practiced.
4. The educational **Ergonomics** and the learning environment in TVET schools, through which instructors exercise their tasks (conditions of education and training as well as work tools) also, affect the size of their efforts, their sense of value, their role in the educational process, their understanding of the profession they are learning and student achievement.
5. The researcher recommends more studies and research, because of the importance of educational **Ergonomics** and its multiple applications in the educational environment of TVET schools.

## References

1. القرآن الكريم
2. <http://www.cst-kh.edu.ps/ar/index.php>
3. <http://www.cst-kh.edu.ps/ar/index.php/second-scientific-conference>
4. [https://en.wikipedia.org/wiki/TVET\\_\(Technical\\_and\\_Vocational\\_Education\\_and\\_Training\)](https://en.wikipedia.org/wiki/TVET_(Technical_and_Vocational_Education_and_Training))
5. <http://www.unesco.org/new/en/newdelhi/areas-of-action/education/technical-vocational-education-and-training-tvet/>
6. [https://www.researchgate.net/publication/245319490\\_On\\_Educational\\_Ergonomics](https://www.researchgate.net/publication/245319490_On_Educational_Ergonomics)
7. [https://www.afdb.org/fileadmin/uploads/afdb/Documents/Generic-Documents/005\\_03\\_EN\\_What\\_is\\_Technical\\_and\\_Vocational\\_Education\\_and\\_Training\\_\(TVET\).pdf](https://www.afdb.org/fileadmin/uploads/afdb/Documents/Generic-Documents/005_03_EN_What_is_Technical_and_Vocational_Education_and_Training_(TVET).pdf)
8. [http://www.cedefop.europa.eu/EN/Files/5510\\_en.pdf](http://www.cedefop.europa.eu/EN/Files/5510_en.pdf)
9. [http://www.unevoc.unesco.org/tvetipedia.php?&tx\\_drwiki\\_pi1%5Bkeyword%5D=Quality%20assurance%20in%20TVET](http://www.unevoc.unesco.org/tvetipedia.php?&tx_drwiki_pi1%5Bkeyword%5D=Quality%20assurance%20in%20TVET)
10. [https://link.springer.com/chapter/10.1007/978-3-642-54224-4\\_8](https://link.springer.com/chapter/10.1007/978-3-642-54224-4_8)
11. <https://en.wikipedia.org/wiki/Education>
12. [https://en.wikipedia.org/wiki/3rd\\_millennium](https://en.wikipedia.org/wiki/3rd_millennium)
13. : [http://www.cedefop.europa.eu/EN/Files/5510\\_en.pdf](http://www.cedefop.europa.eu/EN/Files/5510_en.pdf)
14. : <https://scnforyou.com/can-swipe-best-em/>