UNESCO Institute for Information Technologies in Education

ICTs IN TVET

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THE UNESCO APPROACH

Major research projects by different international organizations concentrate on the "21st century competencies" in our knowledge economy driven by technology. The efforts aim at finding indicators, criteria, and benchmarks for international comparisons in order to assess the effects of Information and Communication Technologies (ICTs) in education.[1] Recent documents emphasize innovation strategies for education and training. Attention is given to skills and needs used by modern firms, working population, and also in the arts and science education.[2] In Technical and Vocational Education and Training (TVET) there is a tendency to emphasize the "learning by doing" approach.

UNESCO facilitates a collaborative access to existing free training courses and promotes open-licensed resources to contribute to the development of specific groups and local communities. The objective behind this platform is to empower trainers or/and trainees with free resources and with a structured and collaborative space to share their experience. In addition, UNESCO promotes the use of "open" training materials that are freely and openly accessible for trainers and self-learners to use and reuse for non-commercial purposes such as teaching, learning, and research.[3]

The 2001 UNESCO and International Labour Organization (ILO) Revised Recommendation concerning TVET defines technical and vocational education as "a comprehensive term referring to those 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 occupations in various sectors of economic and social life."

The Revised Recommendation understands technical and vocational education as:

- an integral part of general education;
- a means of preparing for occupational fields and for effective participation in the world of work;
- an aspect of lifelong learning and a preparation for responsible citizenship;
- an instrument for promoting environmentally sound sustainable development;
- a method of facilitating poverty alleviation.

It includes "aspects of education that are technical and vocational in nature, provided either in educational institutions or under their authority, by public authorities, the private sector or through other forms of organized education, formal or non-formal, aiming to ensure that all members of the community have access to the pathways of lifelong learning."[4]

Nowadays, with increasing frequency, those with higher vocational education find themselves in a job that requires thinking ability, responsibility, and leadership skills. They may not necessarily be in a traditional leadership position; however, in today's new 'stripped-down' organizations, leadership, responsibility, and authority are often widely distributed. Modern administrators, rather than being simply controllers and supervisors, are often also trainers, facilitators, and distributors of resources. They may take personal responsibility for providing leadership when necessary, but increasingly they also share it with or delegate it to others. Thus, all employees in the organization, but particularly the professional staff, are expected to be willing and able to accept responsibility and provide leadership in a team environment. They are expected to make themselves responsible for the continuous improvement of their own skills, to apply their know-how flexibly, and to be capable of working cooperatively – which, in turn, can generate new combinations of know-how; that is, collective competence.

The objective of this distribution of responsibilities and expectations is to systematize professional development with a stress on learning at work, where the concepts of innovative environment, creative tension, and developer network are exploited. In development projects there is an emphasis on empowerment, participatory leadership and management, and coping at work. Thus, what is being attempted is the creation of a work environment of lasting development, one where the basic values of human and social wellbeing are seen as the basis of economic growth.[5]

TVET AND ICTs IN THE KNOWLEDGE SOCIETIES AND THE SOCIAL AGE

The UNESCO World Report "Towards Knowledge Societies" (2005) noted that there is a general agreement on the expression "knowledge societies" but not on its content.[6] The rapid development of social media and new technology is associated with the Social Age.

Today, vocational education plays a crucial role in the social and economic development of a nation. The emphasis on specific objectives and tasks, however, varies from country to country. Accordingly, the organization and administration of vocational education is based on different models. It can be incorporated at the secondary or post-secondary level, and it can be combined with an apprenticeship or be followed up with further training. Increasingly, vocational education can be recognized in terms of prior learning and assigned with partial academic credit towards tertiary education. The skills and competences necessary can be acquired either in workplaces or in vocational schools, and most often a combination of both are used. Vocational education is usually overseen and/or regulated by the Ministry of Education, the Ministry of Labour, or by relevant sectoral Ministries.

Managing work in which responsibilities have been distributed to a high degree is a major challenge.[7] The communication between employees and their managers may be based only on virtual contacts. In short-term assignments and in mobile work it is difficult to update and upgrade one's competences. This would, however, be crucial to the future employability of knowledge workers. On the other hand, it is difficult for managers to support continuous learning of individual employees and to emphasize shared learning of all employees in the network of a team or an organization. There is a growing need for flexible structures and practices that facilitate lifelong learning. Learning at work and web-based social software have an increasingly important role in competence development.

The requirements of speed and possibilities of virtual work have emphasized the emergence of new business models, such as open source. Instead of strictly protecting the development work up to the launch of a product or service, the idea or project is openly discussed and collectively developed from an early stage on the Internet. Based on open source, anyone can contribute an idea or provide improvements to the project in order to benefit the total development. The development resources can thus be multiplied.

In industrialized countries, educational systems have developed during the years to address specific social and economic challenges that emerged in the 20th century. The legal, political, and economic institutions that underlie vocational education and training, in particular, have evolved to answer the demands of industrialized mass-production. In many ways, the reality of TVET reflects the needs to optimize production in a historically unique setting, where boundary constraints are set by the limits of transportation capability, resource availability, access to knowledge, and coordination and information processing capacity. Information and communication technologies are now radically pushing those boundaries both in industrialized and developing countries.[8]

As a consequence, the demand for TVET and other forms of education and learning are changing. Educational systems are not independent of the rest of the society. When society changes, the educational system also changes. Although change in social institutions occurs slowly, eventually they respond to new social demands. To understand the changing nature of TVET and its future, one needs to sketch the larger historical setting where TVET exists today.

Technologies, vocations, skills, and the ways in which work is organized differ in agrarian, industrialized, and knowledge societies, but remain closely related. The currently emerging global knowledge society is unique in its capability to connect countries across geographical distances and economic levels of development. It brings us a qualitatively different world where vocations, organizations, skills, and knowledge acquire a new meaning. Development, in this context, does not necessarily mean, for example, that vocational and educational practices trickle down from the economically most advanced countries to the rest of the world. The best existing TVET systems in the economically developed countries represent the best answers to yesterday's socio-economic challenges. In principle, there is no reason why these systems would be necessarily beneficial in the emerging knowledge society. On the contrary, it is quite possible that TVET systems optimized for the "yesterday's world" can be dysfunctional in today's world. Similarly, it is important to consider the broader historical socio-economic situation where we now find ourselves.

Transforming boundaries

The current transformation also penetrates boundaries that emerged and were shaped by the forces of the previous techno-economic paradigm. One of the most important of these boundaries is the one that separated industrialized countries from developing countries. The global knowledge-based economy slices geographical regions in new ways, where national borders have decreasing relevance. Instead of geographical proximity or local availability of resources, the underlying organizing principle is based on global networks.[9] The distinction between developing countries and developed countries is therefore becoming increasingly misleading. This change can now readily be seen, for example, in countries such as South Korea, India, and China, where regional hubs connect with global production networks. A similar reorganization can also be seen in the leading industrialized countries, where geographic specialization is now essentially based on diversification in the context of global systems of production.

This means that the challenges of vocational education will be surprisingly similar in countries that vary widely in their current economic level of development. This, indeed, is one of the key differences between the Industrial Age and the Knowledge Age. The Industrial Age in many ways produced the distinction between developed and developing countries. It also carried with it a specific global division of labour where vocational categories in both developed and developing countries made sense. The present socio-economic transformation is now widely visible in developed countries and its effects spread at a speed never before seen in the human history. In the next few years, it will reach the most remote villages, potentially connecting them into the new global socio-economic system.

ENTREPRENEURSHIP

Closely connected with ICTs is **entrepreneurship** – a very important factor in both the global and local economies. Entrepreneurship has played an important role in economic growth, innovation, and competitiveness, and it may be the key to poverty alleviation over time.[10] Self-employment is an important mean of earning a living in low-income developing countries, because typically they lack formal-sector jobs in labour markets. Entrepreneurs who have their own businesses can control what they do in their working life, and they have the opportunity to shape their work environment and make an impact on their community.

Entrepreneurs need a wide range of skills – not just for selling their products, but also for developing their expertise, markets, and business. Entrepreneurial skills involve planning, decision-making, problem-solving, creativity, communication skills, among others. These skills are very useful for a working life, whether the worker is self-employed or not. Entrepreneurship is not an inherited personal feature; it encompasses a wide array of competences that include attitudes, knowledge, and skills.

In order to promote entrepreneurship among students, formal vocational education should be organized so that they stay in contact with a culture of entrepreneurship, ideally, in the framework of an educational institute or a school. However, in traditional educational institutes, many teachers lack initiative in terms of business and productivity, and rather work exclusively as academics. Basically, they are not entrepreneurs at heart. This sets a major challenge for TVET on how to equip young people with skills that enable them to build their own future and life as entrepreneurs.

The entrepreneurial spirit is crucial in vocational education and training in both developed and developing countries. New and innovative programmes are yielding dividends for the future of students. How can traditional vocational education institutions foster in their students the entrepreneurial skills needed to succeed? The following examples illustrate how to creatively approach this issue:

Self-Sufficient Schools	Self-sufficient schools are the result of an innovative approach that combines entrepreneurship and vocational education. Not only they increase the relevance of learning; they also provide a training ground for students and a means of finance for the school through school-based businesses. While the students work on the production and sale of goods and services, the school develops in them an entrepreneurial culture, as well as emphasizes the tangible benefits of acquiring skills and knowledge and highlights cooperative forms of working. Self-sufficient schools have been implemented successfully in developing countries such as Benin in West Africa.[11]
School Enterprises	School enterprises are another similar approach promoted by UNEVOC.[12] School enterprises are established with the goal of fostering competences for self-employment as well as wage employment. School enterprises, combining learning with production, develop in students the skills required for launching and managing small-scale businesses, underlining the importance of visibility of future returns.

SKILLS ACQUISITION PROCESS

ICT literacy and numeracy are vital for TVET. "The health and safety of workers often depend upon their ability to read instructions (e.g., on fertiliser bags) and to make accurate calculations (e.g., of mixing ratios and application levels). The wider skills of scientific and social literacy are also important, for example, for equipment maintenance and repair, understanding technological change (scientific literacy), group work, dialogue and negotiation with colleagues and supervisors, gender and ethnic tolerance, and other skills needed to build harmonious relations in the workplace (social literacy). The application of such literacies to the world of work and active citizenship need to become core dimensions of vocational education if it is to respond to the imperatives of social sustainability."[13]

The usage of the terms '**skills**' and '**competences**' is inconsistent. Skill is sometimes seen as representing only lower-order attributes (e.g. keyboard skills), but most often as including also higher-order attributes (like thinking skills). Competence is often construed as the application of skills in specific contexts, but also as synonymous with skill.

Workers face two overlapping challenges. The first is to acquire the skills necessary to enter an increasingly digital and competitive job market, and the second is to continually improve those skills and learn new ones as a part of their lifelong learning. Many studies suggest that workers around the world are not able to sustain this pace, and it is widely believed that schools are failing to keep providing employees who are adequately prepared to exploit new knowledge and skills. Considering that the first skill to be acquired in the working life is **bridging information gaps**, there is a wide consensus that all workers should be able to:

- Master appropriate tools to gather information;
- Understand the context of that information;
- Shape and distribute information in ways that make it understandable and useful;
- Exchange ideas, opinions, questions and experiences.

The paradigm of learning in the corporate setting is rapidly shifting from skills development to capability management. The strongest factors driving this change are the ever-increasing need for faster innovation cycles and for abilities to support a strategic competency renewal.[14]

The new learning paradigm can be expressed as the **70-20-10 formula of learning**:

- 70% of workers' capabilities is built through on-the-job development and real-life experiences;
- 20% is built through coaching, assessments, and increased self-awareness;
- 10% is acquired through structured learning deliveries, such as instructor-led trainings and e-Learning.

Learners will soon realize that, once they adopt this formula, each day will be a learning day. The need to separately plan times for learning and for work will disappear; learning will be incorporated into the daily work routine. Basically, what this formula requires is developing the right mind set for learning rather than making choices between learning events and modes of delivery. There will always be room for skills-based competency development. Certain enabling skills will continue to be delivered in a classroom, not to mention those that are acquired via interactive leadership development, where discussions and networking play a major role. In a similar fashion, e-Learning is here to stay as an easily scalable and cost-efficient delivery channel for theoretical solutions.

As a new working culture emphasizes the importance of lifelong learning, corporations are beginning to provide workers with means to customize and direct their own learning experiences. There is still a long road to travel in terms of improving employment opportunities for individuals and expanding the innovative capabilities of companies; however, workers, employers and trainers are all becoming more responsible in trying to ensure the continuous development of the knowledge and skills acquired.

The traditional focus of vocational education on skills needed for manual work is being challenged by the mixture of competencies required in the workplace today. Many traditional forms of work are undergoing major changes, and as a result the division between manual and mental work is vanishing. Sustainable vocational education should concern and affect both manual and mental competencies.[15]

FROM E-LEARNING EXPERIENCES TOWARDS BLENDED LEARNING

In brief, the evolution of **ICT literacy** in different regions has developed in the following stages:

Stage 1: Building access and connectivity.

Stage 2: Introducing basic Internet use as well as more sophisticated and sustainable digital competences.

Stage 3: Developing trust, confidence, and multiplatform use. Using social media for problem-solving, cooperation, and community building.
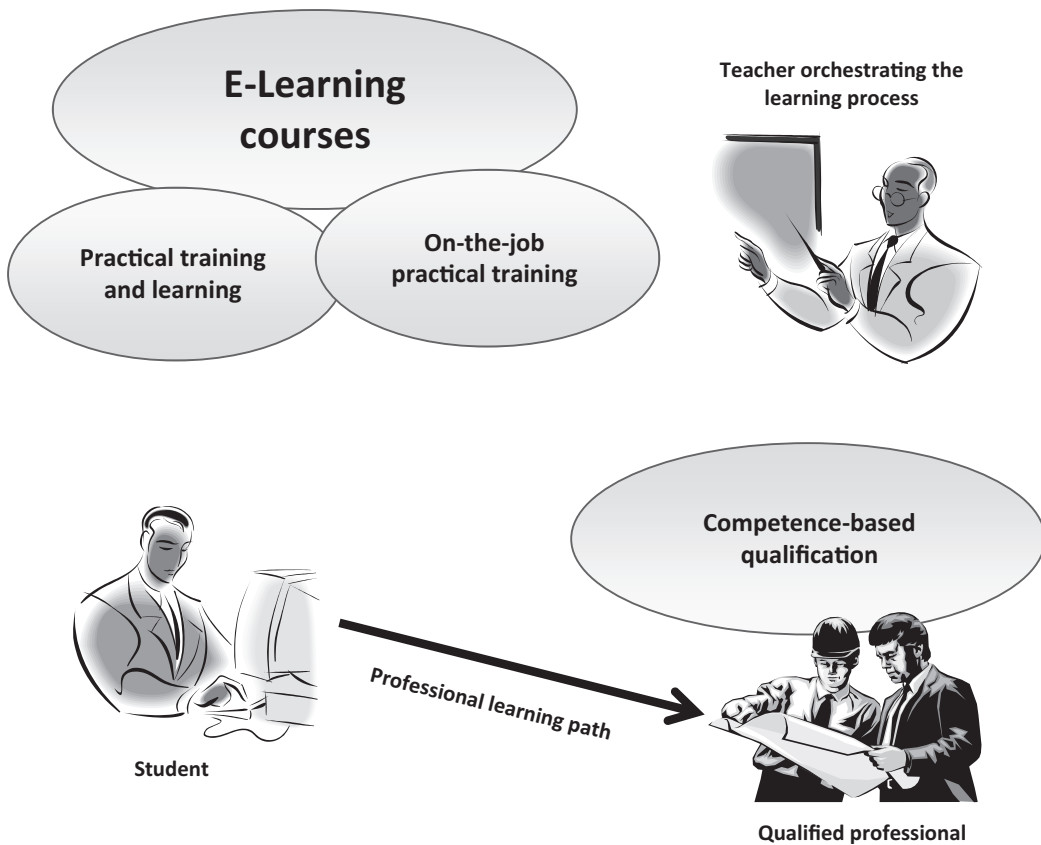
Practical approach to promoting the use of ICTs in TVET (based on the work of Tapio Varis and Petri Lounaskorpi, University of Tampere, Finland).[16]

The world of work is facing similar challenges everywhere on the globe. New possibilities of using ICTs in education and training will improve workers' chances to get vocational qualifications. The development of the educational structure will also bring changes: the need of face-to-face training can be reduced, the training material can be reused numerous times, and it can also be updated easily. Formal vocational education is becoming more integrated into everyday working life. Vocational qualifications are nowadays increasingly measured by competence tests. Also, competence-based qualifications have a great role in the in-service training of employees.

These innovative structures need new development projects for implementation. The infrastructure of vocational education institutes and schools also needs to be updated. New facilities and equipment ought to enable online education, international co-operative education, and also online training and competence testing. Implementation of vocational qualification and competence-testing systems, as well as developing international co-operation in the framework of new educational models, need project funding from international sources. Also, teacher in-service training can be created and developed on project basis.

Small, medium, and micro enterprises (SMME) ought to be connected to this development work of the vocational education system. The need for in-service training of employees is rising. For example, for many licenses given by the government or the international community, one needs to be qualified in a profession. The training required would give ample benefits to SMMEs, so they ought to be willing to pay for it, but updating the employees skills to the level needed could also be part of the cooperation between vocational education and industry.

SUMMARY AND RECOMMENDATIONS

Recent trends in ICTs and TVET put emphasis on the innovation strategy for education and training. Attention is given to skills and needs used by modern firms, working population, and also in arts and science education. In TVET there is a tendency to highlight the "learning by doing" approach. Today, managing work in which responsibilities have been distributed to a high degree among the network of workers is a major challenge. Communication between employees and their managers may be based only on virtual contacts. As a consequence, the demand for TVET is increasing, and education and learning are adopting new forms. The challenges of vocational education are quite similar in countries that vary widely in their current economic level of development. Entrepreneurship, which is closely connected with ICTs, is a very important factor in both the global and local economies.

The nature of TVET in the emerging global Knowledge Society can be classified in knowledge work, service work, and technical work. New skills and competences in different fields can be acquired both in small modules and lifelong learning environments by using open educational resources (OER) and through cooperation with the industry and SMMEs. Instead of being limited to traditional testing, skills can be evaluated through product demonstrations and performances. The division between manual and mental work is vanishing as many traditional forms of work undergo major changes, and therefore a sustainable vocational education should develop both manual and mental competences. UNESCO's work should determine general key competences and identify other special competences needed in different fields of TVET.

Existing free training courses and open-licensed resources should include constantly updated modules for lifelong learning in TVET.

E-Learning applications seem useful and cost-effective, but will easily become counter-productive unless local and cultural elements are integrated into the learning process. The most promising in utilizing ICTs in TVET is a blended-learning environment where the course manager holds adequate didactic and ICT competences. The basic pedagogical principles should give key importance to motivation, activation, concretization, variations, individualization, and cooperation.

REFERENCES

1   Scheuermann, F., Pedró, F., eds. (2009). Assessing the effects of ICT in education. European Union/OECD.

2   Vincent-Lancrin, S. (2011). Senior Analyst, OECD Centre for Educational Research and Development. Public lecture in Helsinki, September 2011.

3   http://opentraining.unesco-ci.org/cgi-bin/page.cgi?g=;d=1

4   http://www.unevoc.unesco.org/pubsdir.php?akt=id&st=&id=2002_001&lg=es

5   INFOSOC (2006). Efficiency and vitality in future Finland. The Information Society Council´s Report 2006, Kukkila.

6   UNESCO (2005). Towards Knowledge Societies. UNESCO Publishing, Paris, 2005.

7   FinnSight 2015. (2006). The Outlook for Science Technology and Society. The Academy of Finland & TEKES, 2006.

8   Tuomi, I. (2002). Networks of Innovation: Change and Meaning in the Age of the Internet. Oxford: Oxford University Press.

9   Castells, M. (1996). The Rise of the Network Society. Oxford: Blackwell Publishers.

10   Landes, D. (1998). The Wealth and Poverty of Nations. New York: Norton.

11   Kafka, N., Stephenson, J. (2006). Self-Sufficient Schools: Fostering Entrepreneurship to Finance Sustainable Education. Paper for presentation at the APEID Conference "Learning Together for Tomorrow: Education for Sustainable Development", Bangkok, December 2006.

12   Singh, M. (1998). School Enterprises Combining Vocational Learning with Production. UNESCO-UNEVOC International Centre.

13   UNEVOC (2006). Orienting Technical and Vocational Education and Training for Sustainable Development. Discussion paper 1. UNESCO-UNEVOC International Centre for Technical and Vocational Education and Training. Bonn, Germany. Available at http: //www.unevoc.unesco.org/publications/

14   Salminen, M. K. (2005). Learning goes mobile. Paper presented at the e-Learning Conference, Brussels, 19-20 May 2005.

15   UNEVOC (2006). Orienting Technical and Vocational Education and Training for Sustainable Development. Discussion paper 1. UNESCO-UNEVOC International Centre for Technical and Vocational Education and Training. Bonn, Germany. Available at http: //www.unevoc.unesco.org/publications/

16   Varis, T., Lounaskorpi, P. (2011). Education in the 21st century: New literacies and eLearning competencies, The UAE Journal of Education Technology and eLearning 2011, UAE.

ICTs can be utilized in all fields and professions today. Consequently, ICTs are integrated in TVET and professional education at all levels. UNESCO stresses some general points in the use of ICTs in education. First, ICTs are only a part of a continuum of technologies, starting with chalk and books, all of which can support and enrich learning. Second, ICTs, as any other set of tools, must be considered as such, and therefore used and adapted to serve educational goals. Third, many ethical and legal issues affect the widespread use of ICTs in education, such as ownership of knowledge, the increasing treatment of education as a commodity, and the globalization of education in relation to cultural diversity (http://portal.unesco.org/ci/en/ev.php-URL_ID=2929&URL_DO=DO_TOPIC&URL_SECTION=201.html). The present policy brief will suggest policy measures on strengthening and further development of TVET through ICT-based solutions, taking into consideration international experience and contemporary socio-economic situation and needs of the Knowledge Society.

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