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WHY TURKEY NEEDS TO INTEGRATE VIRTUAL AND REMOTE LABORATORY TECHNOLOGY TO TECHNICAL VOCATIONAL SCHOOL OF HIGHER EDUCATION SYSTEM: A SITUATION ANALYSIS

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ABSTRACT

The emergences of new and advanced technologies have led to an increase in jobs that require more knowledgeable person in their field. In this context, vocational education tries to adapt itself to this new situation, because the industry demands well educated technicians with the ability to use new instruments, and devices. However, in Turkey the situation of the technical vocational school of higher education is not very optimistic. Although there are several problems in these educational institutions, there is an increasing demand to the technical vocational school of higher education because students can go to technical vocational school of higher education without a university entrance exam. This demand cannot be met, because of the lack of resources and staff available. In this situation virtual and remote laboratories will contribute to the development of technical vocational school of higher education in Turkey by filling absence of adequate staff and instruments.

I. INTRODUCTION

There is a great shift to the industrial economy to knowledge economy. Developed countries earn most of their income from "information and knowledge intense products" [1]. This technology based global economy changes the needs of the "worldwide labor market" [2]. The emergences of new and advanced technologies have led to an increase in jobs that require more knowledgeable person in their field. At this point technology literacy is getting necessity for both of the employers, and being a technology literate is a must for all educational level. Higher education is also significantly affected from the information and communication technologies. Scientific and technological developments are continuously changing course contents, and academic research interests of the higher education. Especially, internet causes dramatic changes in higher education. Vocational education tries to adapt itself to this new situation, because the industry demands well educated technicians with the ability to use new instruments, and devices.

Today, the situation of the technical vocational school of higher education is not very optimistic. As it was stated of the report of the Yükseköğretim Kurulu- YOK (The Council of Higher Education of the Republic of Turkey), there is a deep monetary, and staff problems [3]. That means the money spent on each student in higher education system should be increased, because money spent on each student in Turkish higher education is only 755 $. However, in North America it is 5936$, and in Europe 6585$ [3]. Also in the same report it was highlighted that the number of students per each academic staff technical vocational school of higher education level is 66. On the contrary, in US this number is 21, in Belgium 10, in Japan 9, and in Germany 5. These numbers briefly explain the problems of the technical vocational school of higher education. According to YOK report [3], main reasons of the current situation are: increasing number of students, the cost of each student is increasing about the topic of developing technologies, developing technologies needs more costly equipments, and the sources of the public are spent on more fundamental education and infrastructure problems.

Although there are several problems in these educational institutions, there is an increasing demand to the technical vocational school of higher education because of the given opportunity to the vocational high schools students. These students can go to technical vocational school of higher education without an exam like OSS (university entrance exam). Actually, the percentage of the technical vocational school of higher education in the total higher education programs is 29.5% [3]. Approximately, it covers one of the third of the current Turkish higher education system. Actually, this number is too below than the developed countries. For instance, the percentages in Taiwan (55 %), Swiss (47 %), and US (55 %) are very different from Turkey [3]. There is a great demand from the students to these schools, and the percentage of these schools in the Turkish higher education system is too below from the developed countries. In addition to these facts, in the "Ninth Five Year Development Plan" of Ministry of Education, there is a special interest to the vocational education. Because, industry needs a well educated workforce, this workforce is not only consist of white collars such as engineer, lawyer etc. Actually, because of the information and knowledge age, in the industry there is growing need to the technicians (blue collars) [1]. The more graduate of technical vocational school of higher education is needed in the market. Because of this demand, many new schools established in many different universities. Especially, Computer technologies and programming, industrial electronic, electronic communication, industrial automation are some wide spreading programs [3].

However, this demand cannot be met, because of the lack of resources and staff. In developed countries being an academician is a prestigious, and in these countries in order to be an academician in a technical vocational school of higher education one should have many necessities, such as at least 1 year experience in vocational schools [3]. In Turkiye, finding skilled staff for working in technical vocational school of higher education is impossible, because of the current

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situation of the Turkish higher education. For that reason, some universities prefer to establish e-learning programs for technical vocational school of higher education. These are Sakarya, Mersin and Cukurova Universities. These internet-based technical vocational schools of higher education educate tens of thousands of students every year.

In this situation virtual and remote laboratories will contribute to the development of technical vocational school of higher education in Turkiye by filling absence of adequate staff and instruments. Because in Turkiye the importance of vocational education has always been underestimated until recent year. Absence of staff and material has decreased the quality of education given on technical vocational school of higher education. For that reason, these institutions cannot be developed as desired. Adoption of this kind of tools will fill the some of the deficiencies of vocational education by integrating stable, reliable and good working instructional tool. In this research the main aim is to solve the problems of the technical vocational school of higher education by using such tools. It is obvious that, there is a great need to increase the effectiveness of these schools, because, the problems of these educational institutions are huge, and obvious. Similarly, European Union, Ministry of Education, and YOK emphasize the importance of vocational education in their reports. With the scope of e-learning EU intend to facilitate education with using technology and meet the needs of the information society. By integrating internet-based virtual laboratories or remote laboratories to the courses of the technical vocational school of higher education, both of them will be achieved. And moreover, this will provide a well designed learning experience for the students of these schools.

II. THEORETICAL REASONS

Virtual and remote laboratories are not the same thing. A virtual laboratory is a simulation of the real laboratory environment. On the other hand, a remote laboratory typically involves conducting a physical experiment from a remote location especially by using internet [4]. In internet based vocational education virtual laboratories are needed because it fills the gap between the theoretical information and practical hands-on exercises [5].

Jonassen [6] defines computer-based cognitive tools as mindtools and categorize those tools with respect to his views. It is possible to use tools as a cognitive tool in web-based learning environment. However, when computers serve as cognitive tools, the most effective way to use computer is "learning with computer". By this way, computers are used as a facilitator to think in meaningful ways and require using applications to represents what users or students know [6].

In the article of Mayer [7] he tries to clarify instructional design principles of constructivist learning from textbooks, lectures, and multimedia environments, and he offers a model. The components of this model are selecting relevant information, organizing incoming information, and integrating incoming information. According to Mayer [7], in constructivist learning theory knowledge is constructed by the learner. Learner use both incoming information and prior knowledge from long term memory. When the goal is to encourage the learner to become cognitively involved in learning, instruction should be designed to help the reader to identify useful information, understand how that material fits together, and see how material relates to prior knowledge. This is really good evidence of the relevance of computers as a cognitive tool. Moreover as a cognitive tool, in reference [6] Jonassen explains two major uses of computers. These are interpretive and expressive visualization tools. Interpretive tools help learners view and manipulate visuals. Interpretive tools are used to clarify difficult-to-understand text and abstract concepts. On the other hand expressive visualization helps learners to visually convey meaning in order to communicate a set of beliefs. Actually this tool makes computers an efficient tool to clarify scientific understanding. This clarification can be based on a theory called "cognitive load theory". With respect to this theory, learner has a limited processing capacity [8]. Cognitive tools as a visualization tools might be a cure for this problem by supporting memory processes, facilitating schema construction, assisting schema automation, and using information hiding.

That is the reason why many institutions try to integrate technology to their existing facilities. One of them is European Union (EU). In the special meeting of European Union (EU) determine "Lisbon Strategies" to compete in the global information society in March 2000 [9]. The policy of the EU [9]:

- Education should be redesign with learner centered approaches.
- Using new technologies in education should be broadened.
- Individual teaching learning strategies should be highlighted.

With the impact of the information and telecommunication technologies, and the adoption process to the EU, Ministry of Education is planning to empower vocational education and modernize vocational education [9].

In order to accomplish these aims virtual and remote laboratory facilities will be a useful media, because virtual and cyber education is getting more and more popular day by day. Vocational education adapts itself to this new situation. Because, the industry demands well educated technicians with the ability to use new technology laboratories, and devices. However, giving quality education with using new technological devices is very expensive. Integration of internet to current educational settings will be a proper solution to meet the needs. For that reason, in this research virtual laboratory will be integrated to the traditional course, and in order to facilitate the virtual laboratory with respect to interaction and collaboration needs, several tools will be used. Because, as it was emphasized on the report of United Nations Educational, Scientific and Cultural Organization (UNESCO) [10], virtual laboratory concept includes "Collaboratory", "Virtual Workgroup", and "Distance Collaboration Group". Therefore, the educational needs of the students deeply changed with the light of the developing technologies. As it was cited by the National Aenautics and

Space Administration (NASA) learning technologies report, Trilling and Hood emphasis "21st Century, Knowledge Age skills" [11]. In this age mastering on reading, writing, and arithmetic (3Rs) do not meet the needs of the information age. "21st Century, Knowledge Age skills" should be empowered with 7Cs beyond 3Rs. Seven clusters of 21st Century skills are: critical thinking-and-doing, creativity, collaboration, cross-cultural understanding, communication, computing, and career and learning self-reliance

In order to establish these skills NASA learning technologies determine some attributes of educational applications. These attributes are project-based, interactive learning, hands-on component, students working together, access to scientist/engineer mentors, compelling information that is national and state standards-based, state-of-the-art, animation/videogame quality, intuitive and robust, and no cost.

With the light of these information NASA Learning Technologies supports five different projects, and one of them is a virtual laboratory project. In the virtual laboratory project of NASA provides students and educators with virtual but realistic software implementations of sophisticated scientific instruments commonly used by NASA scientists and engineers [11]. Moreover, UNESCO also gives great emphasis on virtual laboratories. According to UNESCO report [10], virtual laboratory defined as an electronic workspace for distance collaboration and experimentation in research or other creative activity, to generate and deliver results using distributed information and communication technologies.

In fact, social constructivism is a valuable approach to teaching-learning and it proposes that learning is a constructive and social process. Therefore, learning environments like virtual and remote laboratory should be facilitated with some conversation tools. With the impact of Internet and communication technologies (ICT), there is a growing interest on computer mediated communication (CMC) and learning groups based on CMC. Actually, computer and CMC are generally used for supporting individual learning, but it can also be used for group works. Actually, computer and CMC are generally used for supporting individual learning, but it can also be used for group works. As it was cited by Romiszowski and Mason (2005), some research results show some gains of CMC such as more satisfied with the web course, ability to study at one's own convenience, opportunity to gain experience about internet, faster assignment return, more immediate feedback, increased interaction with tutor and students, and extending learning experience beyond tutorials

Nonetheless, the aim of designing virtual laboratory is not replacing the traditional laboratories. According to Roberts [4], virtual laboratories can be a feasible alternative to traditional laboratories, and are most effective when used in conjunction with a traditional laboratory. Integration of internet to current educational settings will be a proper solution to meet the needs of the vocational education. In internet-based vocational education, virtual laboratories are needed because it fills the gap between the theoretical information and practical hands-on exercises [5]. By this way, aims of the YÖK and Ministry of Education will be more applicable related to vocational education by providing learning experiences that have not been possible before.

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