Measuring the Effectiveness of an On-line School-to-work Transition Module

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Abstract—The paper proposes a framework to measure the effectiveness of an on-line module for school-to-work transition in a Technical and Vocational Education (TVE) system. The module was developed on the basis of educational outcomes (TVE objectives) and industrial companies’ requirements. It has been taught to a pilot group of Electrical and Electronic Engineering TVE students in Bahrain. The implementation phase was carried out during the school-based learning before the students joined the work placement program. The findings indicated that the pilot group’s performance in the school-based learning was better than the control group’s performance which was exposed to traditional teaching and learning methodology. The affective domain competencies can be taught and assessed more effectively with the on-line module. The framework proposed can evaluate the effectiveness of the on-line module in providing stake-holder’s requirements reasonably well.

II. EXISTING TVE SYSTEM

TVE started in Bahrain in 1937 when the first technical school was established for preparing craftsmen for public services as well as the petroleum industry, radio and television, refrigeration, and the automotive industry. TVE policy was to review specializations and programs continuously in order to make changes as per industry requirements. Therefore, specializations and programs were developed to be open-ended to enable modifications to be made and new competencies to be achieved. In 1996 an industry work placement program was established to expose the third (final) year students to real work environments, to benefit companies, and to make industry familiar with the qualifications and competencies of TVE graduates [3]. Figure 1 shows the existing TVE system. The transition year is the foundation year for new entrants to TVE. During this year a number of core subjects are taught, such as the Arabic language, mathematics, English, science, and basic mechanical and electrical engineering.

Also, the students join different mechanical and electrical practical sections to gain general knowledge and skills on the different engineering specializations. On the completion of year I, students may join either the
technical route or the applied route in year 2, according to their performance, personal interests and aptitude.

The technical route was structured in such a way as to enable the students to obtain sufficient professional and specialized competencies and skills, as well as general knowledge to enable them to continue their engineering studies or join the labor market.

On the other hand, the applied route was structured to enable the students to obtain sufficient professional and specialized skills and competencies in the field of practical applications, as well as to obtain the general knowledge which qualified them to join the labor market or go on to higher studies [3].

In year three, students join a work placement program related to their specialization for a period of four weeks. The program provides actual work experience for students and direct contact with the labor market. Also, students learn work ethics as well as improve their fundamental and interpersonal skills.

Figure 2 presents the outcome from a diagnostic study of the existing TVE system. The figure shows an adapted innovation matrix [4] consisting of four blocks that define requirements to meet current and future needs and expectations of the TVE system and the industrial companies/labor market in Bahrain.

![Figure 2. Diagnostic of TVE system](image)

In 2005, the Economic Development Board, the Ministry of Education, and the Ministry of Labor conducted a joint survey to analyze the destination of TVE graduates, and industrial requirements in Bahrain. The survey results indicated that only 12% of TVE graduates directly joined the labor market, 20% did not work or study and 68% joined further and higher education institutions. The industrial people claimed that the TVE system had not prepared their students for direct access to the labor market, as 50% of the industrial companies’ respondents stated that there was a skills gap between the needs of the industry and the skills that graduates acquired during their studies. The respondents mentioned that proficiency in English, practical experience, problem solving, work ethics, and team working were the skills most frequently lacking in new graduates [5].

III. TVE SYSTEM DEVELOPMENT INITIATIVES

It was clear that the attention should be given to improving the EECs in TVE and to integrate the appropriate technology in order to meet the modern industrial needs. Even though the development process is still under way and some pilot studies have been implemented, it is worth mentioning that evaluating the effectiveness of a phase may help to improve the existing EECs on a continuous basis. The next section presents some initiatives for improving the TVE system and measuring its effectiveness. The results may be used as a benchmark for future improvement.

A. The reform project

The reform project focused on providing students with the skills that industry needs, introducing the use of apprenticeships and experience in the workplace as part of a student’s education, and extending the range of courses so that the educational and career aspirations of all students are achieved [5].

Moreover, the education reform project focused on a set of innovative programs designed to improve all the three levels of the education system: school, vocational and higher education. These programs were developed following benchmarking of the Bahraini education system against other countries with excellent records in education, and following contributions from recognized global experts and more than 1,500 stake-holders. This education reform has been partially implemented for a number of students at TVE schools. The reform project focuses on:

- New teaching and learning methodologies.
- Adapting the practical classes at school to project-based lessons rather than individual practical exercises.
- Increasing the length of the work placement program; students spend more time in companies than before.
- Offering new secondary vocational education tracks as per labor market needs.
- Setting policy and standards for vocational education and training.

B. The on-line school-to-work transition module

The on-line school-to-work transition module has been developed to include up-to-date learning resources, innovative teaching and learning and assessment strategies, develop students’ competencies, and meet the industrial requirements. It is expected to make a major contribution to the improvement of the TVE system because it will challenge all students and teachers to recognize, make informed responses, and work comfortably with the diverse requirements that they encounter in the workplace.

The module also ensures that the TVE students receive the necessary training during school-based learning in work preparation skills required by the industry [2], before they join work placement program [6]. It contains different case studies for students to observe, apply, discuss, and analyze...
the various skills required by the industry. Each case study is firstly presented with a theoretical part for knowledge acquisition and attitude understanding (on-line learning and classroom interactions), and is then followed by the practical applications. Thus, the module includes both the theory and the practice resulting in better skills acquisition that is required by the labor market.

The module’s learning case studies were formulated by experts from the TVE system. The learning outcomes have been integrated to the case studies and the activities that students should understand and demonstrate during the work placement program. The outcomes include learning activities that are specifically related to the knowledge, skills, and attitude components presented in the new work preparation skills model [7].

In total the module incorporates the following features:
- Five learning case studies which include various technical and work environment competencies.
- Each case study is divided into on-line learning (using the multimedia laboratory) and practical applications (using the practical workshop).
- Soft and technical skills, based on the work preparation skills model.
- Supportive skills for students in the workplace, based on the work preparation skills model.
- Specific job-related competencies, based on the work preparation skills model.
- Each case study includes a number of learning activities which have been divided into various learning indicators.
- The learning activities have been developed on the three domains of Bloom: cognitive, affective, and psychomotor.
- Category of attitude being learned based on the attributes of Bloom’s learning theory for the affective domain.
- Teaching and learning strategy, based on the new teaching and learning guidelines for the school-to-work transition module [6].
- Student-based learning through team working, problem solving, independent learning activities, individual and group learning, etc.
- Assessment strategy based on both summative and formative assessment approaches for theoretical and practical assessments/exercises [8].

C. The pilot implementation

60 students specializing in electrical and electronic engineering were selected for the pilot implementation phase. They were divided into two groups: the first group was taught in the traditional learning environment without the school-to-work transition module (control group); and the second group was taught in a combined learning environment with the on-line school-to-work transition module.

In addition, 48 TVE teachers participated in a teachers’ development training workshop. For the second pilot group of students, five teachers were selected to teach in a combined learning environment. Two teachers (one teacher per 15 students) were assigned to deliver the on-line theoretical learning activities (using the multimedia laboratory). The remaining three teachers (one teacher per 10 students) were assigned to practical learning activities (using the practical workshop).

Before the implementation phase, two well known and widely used learning theories were identified: Bloom’s learning theory (for curriculum and assessment content development) and Kolb’s learning theory (for teaching and learning styles) [9] and [10]. Bloom’s theory was used to develop the learning content for the new module (school-to-work transition module). It has three learning domains, namely: cognitive (to structure activities and exercises which measure students’ knowledge); affective (to structure the learning activities and exercises that measure students’ attitude during the delivery of the module); and psychomotor (to structure the content of the technical and practical competencies learning activities) [9]. Kolb’s model and its learning styles are used for delivering knowledge, attitude skills and practical learning activities. This model helps in allocating the time for delivery of each learning activity as well as the proper sequencing of the delivery [10].

Figure 3 shows the details of both the learning theories which were integrated to provide effective guidelines for content development, teaching and learning, and assessment strategy. The guidelines ensured that the curriculum and assessment content included the following skills: cognitive, affective and psychomotor, as well as developing learning methods through observing, thinking, partitioning and acting modes [6]. During the implementation phase, TVE teachers should deliver the new module according to the following guidelines:
- The learning activities corresponding to the cognitive domain should be delivered using three approaches to learning style: assimilating (thinking – observing), accommodating (acting – partitioning), and converging (thinking – partitioning).
- The learning activities corresponding to the affective domain should be delivered using three approaches to learning style: diverging (acting – observing), converging (thinking – partitioning), and accommodating (acting – partitioning).
- The learning activities corresponding to the psychomotor domain should be delivered using three approaches to learning style: accommodating (acting – partitioning), diverging (acting – observing), and converging (thinking – partitioning).

The main focus was to provide an embedded pedagogical framework during the implementation phase. TVE teachers had the opportunity to choose suitable teaching and learning methods for the management of the learning activities. For instance, in a cognitive learning activity, there are ways of learning such as thinking-observing and thinking-partitioning. On the other hand, the guideline identifies different examples of teaching and learning methods that are appropriate for teachers to choose from. Also, the teaching and learning examples include various experiential learning
opportunities for students such as simulation of real work applications (using diagrams, hyperlinked text, video, pictures, interactive examples, virtual reality simulations and animations).

The framework was used as guidelines to evaluate the effectiveness of the content of the on-line school-to-work transition module.

D. The evaluation phase

Figure 4 presents an extended information quality framework [11]. It was used to evaluate the effectiveness of the on-line school-to-work transition module with respect to pedagogical and technological aspects.

The framework incorporates specific pedagogical and technological aspects as required by modern industry. The technological information quality dimensions are intrinsic information quality, contextual information quality, and accessibility information quality [12]. The pedagogical information quality dimensions are incorporated from existing quality frameworks [12] (interpretability, ease of understanding, representational consistency, and concise representation), as well as modern industrial needs (depth of knowledge, personal attributes, motivation, and integration of skills) [2]. In addition, one pedagogical quality dimension (interactivity) was added to accessibility information quality.

Users’ views questionnaire on the effectiveness of the on-line school-to-work transition module was distributed to various stakeholders including the pilot groups of TVE teachers and students. The aim was to receive information that is critical to the research results and to help in evaluating different views and perceptions about the effectiveness of the module.

With respect to the quality dimensions, respondents agreed that the pilot group’s performance in school-based learning (in a combined learning environment with the school-to-work transition module) was better than the other group’s with the traditional teaching and learning methodology. It was apparent that the module contains workplace proficiencies, prepares TVE students for work placement, provides effective teaching and learning methodologies, contains employability skills which meet modern industrial needs, and presents a cooperative learning environment. More specifically, the respondents agreed that the school-to-work transition module has the following features:

1- Believability: The module provides updated and believable information to meet modern industrial needs.

2- Accuracy: The module provides scientific and accurate content.

3- Objectivity: The module has impartial learning case studies.
4- Reputation: The module provides an effective quality model as a benchmark for producing future EECs.

5- Consistency: The module has consistent information which is not available in other learning modules.

6- Value added: The module adds value to engineering education courses.

7- Relevancy: The module contains relevant information to modern industrial needs.

8- Timeliness: The module contains up-to-date learning case studies.

9- Completeness: The module has information applicable to meeting TVE and industrial objectives.

10- Appropriate amount of information: The module contains an appropriate amount of information in a structured manner.

11- Verifiability: The module is flexible and information can be amended as required.

12- Interpretability: The module has clear and appropriate language, structure, and instructions.

13- Ease of understanding: The module arranges the information in a way that can be easily understood.

14- Representational consistency: The module is easy to use.

15- Concise representation: The available information is concise.

16- Depth of knowledge: The module has different learning activities and teaching and learning styles for knowledge acquisition and higher order thinking.

17- Personal attributes: The module considers individual differences and improves attitudes, values, and behaviors.

18- Motivation: The learning activities and learning styles attract students and motivate them to learn.

19- Integration of skills proficiencies: The module provides clear instructions for practical applications.

20- Accessibility: The module can be easily accessed on-line and/or in the multimedia laboratory.

21- Access security: The access security features are enabled to protect the content of the module.

22- Response time: The system responds effectively, enabling flexibility in browsing and moving from one learning activity to the next.

23- Availability: The information is available and can be accessed at any time.

24- Interactivity: The system has different interactivity features such as videos, animations, and a feedback system for corrections and extra information.

Figure 5 shows the contribution of the school-to-work transition module. Block 1 represents the existing TVE system in Bahrain that currently serves a number of industries, such as petroleum, electronic and telecommunication engineering, building services, mechanical engineering, and computer technology. The existing system meets some of the visible needs of the industry such as basic proficiencies and technical skills. Block 2 shows where the existing TVE system does not meet the needs of existing industries such as work ethics, affective domain competencies, and specific job related skills.

In designing and developing the contents of the module, the un-met visible needs of the current industries in Bahrain were considered such as the skills proficiencies presented in the proposed work preparation skills model [2]. Blocks 3 and 4 show that the new module has been introduced to new TVE specializations such as business studies, financial services, information technology, multimedia and tourism. This has helped it to serve other industries in the market which were not served by the existing TVE system. The new on-line module has ensured that the required competencies by modern industry were incorporated in the content and examined by extended information quality framework. In addition, the affective skills attitude which highly recommended by the industry was considered in the learning activities and added value to the new module.

IV. CONCLUSION

This paper identified the problems faced by TVE system in satisfying the industrial requirements. An on-line module was developed which has been implemented and its effect has been assessed through a careful pilot study. Then, a diagnostic quality information framework has been developed to benchmark the on-line module for future improvement.

It has been shown that the new on-line module is capable of bridging the gap between TVE and scopes the wider industrial requirements.

Figure 6 shows the expected TVE system performance improvement after completing the pilot implementation of the new module. Therefore, the new module has helped in contributing to the improvement of educational policy in Bahrain.
Figure 6. The expected performance improvement in the TVE system

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