Session III

Development of Educational and Training Curricula

Restructuring Educational Programs Through eLearning

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Introduction

Many institutions of higher education today are faced with the problem of using their existing human and capital resources and infrastructure to provide for an increasing number of learners seeking advanced educational opportunities. One way of addressing this problem is to restructure targeted educational programs within the institution that take advantage of the educational, access and cost benefits of eLearning. This session will provide examples of different methods for restructuring educational programs including:

- open electronic learning centers;
- anytime/anywhere online program offerings;
- interactive real-time mediated instruction;
- blended educational programs;
- content and credit-hour adjustment;
- time shifting;
- service learning opportunities.

eLearning Perspectives

It is helpful to view eLearning from a time and place perspective as depicted in Figure 1. Each component of the matrix has its own requirements with respect to instructional design, development, delivery, assessment, marketing, student and faculty support, availability human resources, technology, learning resources and of course costs. And each component or a combination of components can be used to restructure educational programs.

eLearning from a Time and Place Perspective

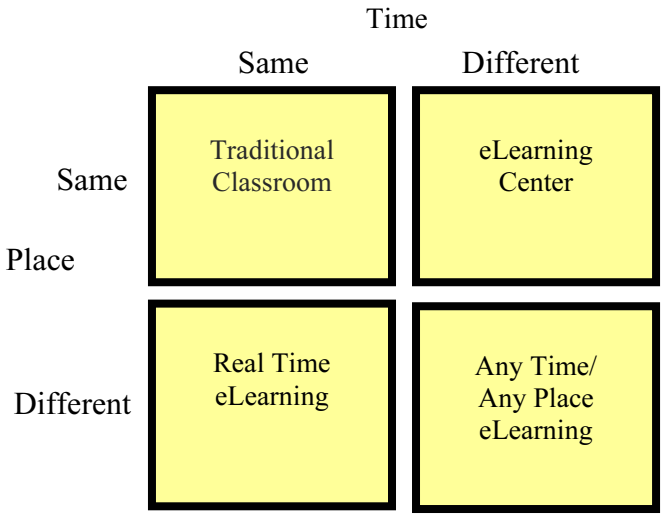

Fig. 1

Open Electronic Learning Centers

Open eLearning centers provide significant opportunities for institutions to leverage dedicated spaces for use by students at scheduled or independent times. The value of eLearning centers can best be seen in introductory courses or core curricula courses where a large number of students need access to the same instruction. Examples of such courses include math, history, language, and science. Students in these courses require a common set of introductory knowledge and skills from the students before they can take higher level and more complicated courses. Typically students in these courses are either grouped into one or two very large lecture-based sections, or they are spread apart into numerous smaller sections requiring many classrooms.

In an open eLearning center specific courseware is developed and/or purchased and delivered through interactive computer technologies. Faculty members define the course's learning goals and objectives in a modular format, plus important learning milestones each student must meet. Students can set their own schedules and learn at their own pace by interacting with the courseware. They receive immediate feedback on quizzes and problems and they explore alternative approaches to learning challenging material through instructional technology. While eLearning technologies play a major role in a student’s acquisition of knowledge, students also have the opportunity to interact one-on-one with faculty, tutors and other students. The focus is on mastering coursework and intended learning objectives in the most efficient manner possible. When students have demonstrated mastery of the coursework through formal assessment at the eLearning center, they may move on to another content module.

Enrollment in courses at an eLearning center is not based on standard university semester type terms, but instead on where each individual is in their educational program.

eLearning centers can be located within the university's campus or extended from the campus. Successful examples have included locations in shopping malls converted store fronts and specially designed or modified campus facilities. The size of an eLearning center can accommodate hundreds of students at a time or thirty students. The center hours can run similar to regular university hours or they can be open and staffed 24 hours a day. By creating a space that is independent of time substantial flexibility can be gained within an educational program that can be used to enhance the curriculum.

Anytime/Anywhere Online Program Offerings

One of the significant advantages of eLearning is its ability to transcend time and place. When courses and programs are placed online students no longer must travel to a university campus to obtain their education. The opportunity to educate individuals at a distance expands access to new knowledge and skills creating a more knowledgeable and highly skilled workforce and citizenry. Quality courseware, connectivity and support services remain two essential pre-requisites for the success of anytime/anywhere online programs.

The institutional costs of online course and program development can soon be overshadowed by benefits of space availability, or at least less overcrowding of classrooms and campuses. Online courses can also be used effectively for campus based students for many of the same reasons as students who are distant from the university. For the university flexibility in space is gained through online education, and flexibility of time is gained for the online student and faculty member.

Interactive Real-time Mediated Instruction

eLearning technologies have evolved from satellite delivered instruction to digital two-way voice, video, and data interactive web-based instruction over the commodity Internet. The advantages of interactive real-time mediated instruction are most visible when the level and/or type of content requires live interaction between the student and the instructor or the student and other students for the learning to be most effective. Interactive real-time mediated instruction typically requires set schedules whether they be for virtual classroom discussions, or virtual faculty office hours.

Blended Educational Programs

No one approach to teaching and learning works best, so it is no surprise that a blended approach to eLearning is frequently used by many universities. A blended approach allows faculty to leverage the best of each component in a time/place educational environment to create an engaging and meaning learning environment for students. Basic content information delivered the same each term and requiring no interaction between student and faculty does not require students to be present with the

faculty member to learn the material. In fact learning may be achieved more efficiently with students entering self-paced eLearning modules at their own individual level of knowledge or ability. Certain content that requires demonstration may best be held in live face-to-face sessions, while other content can be as easily, if not more safely, be learned through computer- based simulations. A classroom discussion or project may be less meaningful when the discussion is limited to traditional classmates, as opposed to student from another culture half-way around the world engaged in a similar problem discussion or project.

The advantages of blended educational programs to the student, faculty and institution are numerous. In addition to an enhanced educational experience, students and faculty can increase their teaching and learning flexibility and gain additional time for research and discovery. The institution again gains flexibility in facility utilization and the ability to increase institutional capacity as well as educational excellence.

Content and Credit-Hour Adjustment

Universities have typically been established along traditional structures of time and place. Content is typically identified to meet required learning goals and a standard level of credit is assigned or a standard amount of content is designated to be learned prior to taking a course mastery examination. By re-thinking content and credit-hour metrics an institution can gain increased space flexibility while maximizing human and physical resources. Breaking standard course content into smaller more easily managed modules allows students to bypass or test out of components of course content that they may already know. Their time and the time of the faculty member is better spent on learning content that the student did not know. The learning of new knowledge can thereby be accelerated.

Time Shifting

As with content and credit-hour adjustment, universities typically adhere to traditional schedules and calendars. By shifting the times of instruction within a day, a week, several months, or even a year flexibility can be obtained for the student, faculty member and institution. Executive MBA programs within the United States provide an excellent example of educational time shifting. Corporations often support their potential executives by providing them with the opportunity to obtain their MBA at company expense and partially on company time. In return the company manager agrees to complete much of the work on their own time through eLearning and weekend class sessions at specified locations. The entire process is accelerated resulting in the successful graduate obtaining an MBA in 12 -15 months instead of three years part-time. The company manager progresses more rapidly in his or her career goals, the company minimizes its educational investment time in the employee and can use the results of the employee's new knowledge and skills more quickly, and the university typically uses institutional facilities and resources at times of low need. These same concepts can be applied to basic undergraduate education.

Service Learning Opportunities

Learning goals and objectives can be achieved through a variety of ways. One way often used in corporate management training but less used in higher education is experiential learning. Experiential learning activity engages the student in the experiences of the content to be learned. Practicum in teacher training programs which require the student teach to teach the subject they seek certification in to the level of students they plan to teach under the direction of a master teacher and a practicum supervisor is an example of university-type experiential learning. Healthcare curriculums such as nursing also include experiential learning activities. While not every course can effectively integrate experiential learning, many can. Service learning provides opportunities for students to actively engage in work that benefits others while at the same time obtaining valuable new knowledge that achieves targeted course learning outcomes and benefits the student.

Conclusion

Restructuring educational programs through eLearning allows universities to address the challenges of higher education in the 21st century. In a rapidly changing global society where nanoseconds become the norm universities must look to alternative ways of doing business. eLearning provides universities with numerous options to meet today's challenges including: open electronic learning centers; anytime/anywhere online program offerings; interactive real-time mediated instruction; blended educational programs; content and credit-hour adjustment; time shifting; and, service learning opportunities.

Study Guide: An Important Tool for Curriculum Development

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ABSTRACT. Study guides can make a major contribution to learning. They are likened to a tutor sitting on the student's shoulder-available 24 hours a day to advise the students what they should be doing at any stage in their study.

Study guides are different from textbooks. Study guides have three roles in facilitating learning: (1) assisting in the management of student learning; (2) providing a focus for student activities relating to the learning; (3) providing information on the subject or topic of study. A study guide triangle model can be used to represent these different roles. Guides can be placed at different points in the triangle reflecting the relative emphasis on these three functions. The composition of a study guide will depend on its purpose.

Study guides may include an overview of the course, the expected learning outcomes, the prerequisites, the timetable, the learning strategies and opportunities, assessment information, staff contacts and personal comments from staff. The guide can be designed to encourage students to interact with the subject through questions, student activities and self-assessment exercises. The guide may be developed as a portfolio or record of students' information. Extracts from previously published content information or new information on the topic produced by the authors can be included in the guide.

Steps in preparing a guide can be considered under the following headings: (1) deciding on the function and format of the guide; (2) relating the study guide to the curriculum; (3) writing the guide. A well-written guide is a management tool that encourages both the teacher and the student to assume responsibility for learning.

Aims of this review

Study guide is becoming an integral part of any reformed curricula of both undergraduate and postgraduate education. It is a natural response to the explosion of information in every specialty of both science and literature. The aims of this review

are:

1. To emphasize on the importance of study guide as an important tool to develop our university curricula.
2. To guide people on the scientific steps to prepare their own study guide.

Introduction

Travel guides are an expanding area in publishing. Their popularity stems from traveler's needs to seek guidance or support when visiting a country or area, perhaps for the first time. Travelers recognize that, to maximize the often limited time at their disposal, they need to be pointed in the right direction to visit the attractions or sights of the most interest to them. A good travel guide can meet their needs. The guide will help them to get the maximum benefit from their visit and help them to understand and appreciate what they are seeing. Advice is usually contained in the guide relating to accommodation and the different forms of transport available at the destination and a relative cost. Information in the guide may be read in advance of the visit to prepare the traveler for the journey. Some travelers prefer to plan their own itinerary. In these circumstances, information in travel guide is invaluable. Just as a travel guide is a useful resource for the traveler, a study guide serves the same functions relative to student's studies.

By reviewing the articles and books that these searches yielded, we found recurrent themes that can be placed under the following headings:

- Definition of the study guide
- The importance of study guides
- The function of study guide
- Designing and preparation of a study guide
- Electronic Study guides
- Conclusion and Recommendations

Definition of the Study Guide

Laidlaw and Harden [1] defined a study guide as "an aid, usually in the form of printed notes, designed to assist students with their learning. It indicates what should be learned, how it can be learned, and how students can recognize if they have learned it". A study guide can be seen as a management tool, which allows the teacher to exercise his responsibilities while at the same time giving the student an important part to play in managing his own learning.

The study guide can be seen as a tutor sitting on the students' shoulder, available 24 hours a day to advise the students what they should be doing at any stage in their study [2] .A study guide is an aid, usually in the form of printed notes, but they may be presented electronically.

Harden [2] captured the idea well when he linked a study guide to traveler guide. The study guide is quite different from a textbook or a book of readings; these are intended to communicate information. While the study guide may also communicate information,

its primary purpose is to communicate teaching. For this reason, it is sometimes referred to as 'a tutorial in text" [3].

The Importance of Study Guides

Study guide is an essential student learning tool and can be seen as one response to a number of trends in curriculum development [2-5].

- ***A move to more independent learning***

The undergraduate curriculum cannot equip students with the knowledge and skills required for a life-time practice of any specialty. Students can learn more effectively working on their own rather than attending formal lecture courses[2]. There has been a move from teacher-centered approach where the student takes more responsibility for their own learning. Students need guidance and assistance with this approach and study guides have an important role to play.

- ***Increase availability of learning resource material***

There is a wealth of learning resources material around. Printed material in the form of textbooks or printed journals, audiovisual programs and more importantly the World Wide Web (WWW). On the other hand, information overload is well documented as a major problem facing education, with knowledge expanding at more than 14% per year, a figure predicted to rise to 40% per year [2]. There are increased expectations of training programs but the time available for their delivery is fixed. Students are expected to learn more but within the same period of time. The result is that they have to be selective in what they study and they need help to do this and study guide have an important role to play.

- ***Curriculum change***

Generally, the curriculum of many specialties (e.g. medical curriculum) has become increasingly complex with integration and the introduction of new educational strategies such as problem-based learning, and teaching and learning in a variety of sites and contexts. Study guides help students to learn within an integrated curriculum and assist them to make the best use of the resources available [4].

In Saudi Arabia, probably in most developing countries, the undergraduate curriculum of many faculties & specialties is still traditional, teaching is discipline-based. Each discipline has a separate block of time. The student has to synthesize these separate blocks of knowledge for themselves. Now, however, there is intention to reform many curricula in many most of the undergraduate specialties. Therefore, we are moving towards a more complex curriculum where study guides are essential tool for student learning.

- ***Increased accountability and effectiveness in education***

Study guides help the students as well as the teachers to ensure that the learning process is as efficient as possible. The guide can also help the teacher to become more

realistic. Some teachers have unrealistic expectations of what can be learned by the students in a given time. By putting a time allocation on each learning activity it is possible for the teacher to have a clearer idea.

Study guide can help the teachers to communicate between themselves. This is important since many staff is now involved in teaching undergraduate students. The study guide will co-ordinate activities and prevent unnecessary duplication [6].

- ***Distance learning***

Distance learning is now a fast growing educational approach. The foundation of every good distance education course is the study guide, whether in an electronic version or the far more popular form of a printed handbook.

Functions of Study Guides

Harden introduced what is called "study guide triangle model" as shown in figure (1) [2]. The guide can be located along the boundaries or within the triangle as illustrated below.

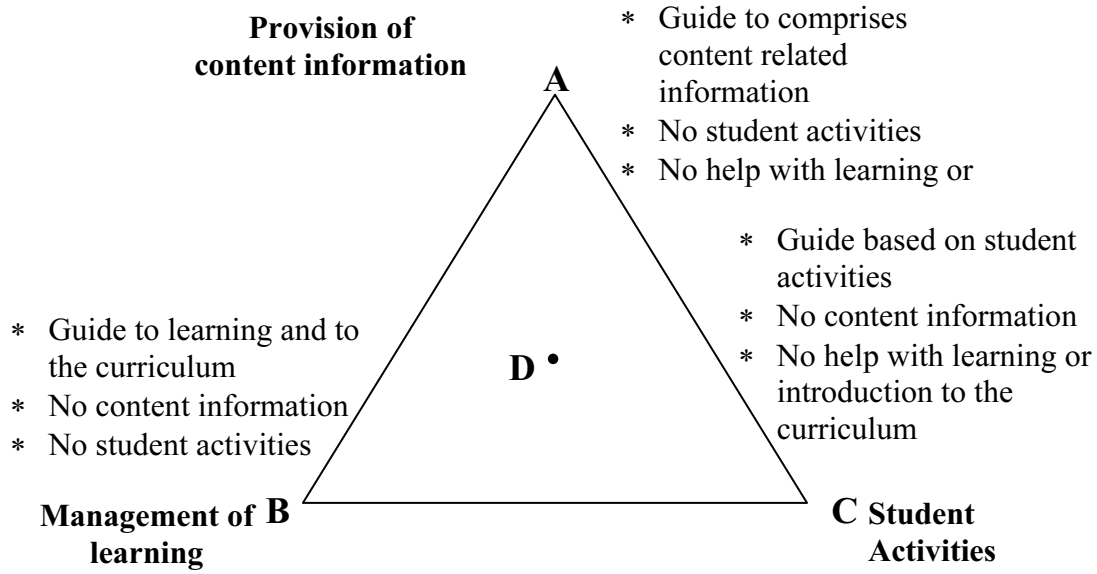

Fig. 1. The study guide triangle [2].

This model can be used to represent different functions or roles of the study guides. For example, some undergraduate teachers see the principal function of the study guide as the presentation of content materials, with the key facts emphasized, difficult concepts explained and illustrated, and new up-to-date facts provided. Generally, the type of information can be classified into the following two categories:

- Previously published information: quotations from other texts, an article from a journal and further references.
- New information: tips and comments from teacher, a glossary, key points on the topic being studied.

Some of undergraduate teacher may see the guide as a tool to manage students' learning, providing students with advice about the expected learning outcomes and how they can achieve these, and guiding students in their approach to their studies and in their use of the various learning resources. A third perspective of study guide is where emphasis lays with the students activities. In this perspective the guide will provide, for example, a set of questions to allow students to test their understanding of the text, small project, assignment, students' portfolio and record of achievement [2].

In practice, most guides provide a mixture of these functions in varying proportions. There is no rigid prescription with regard to the function and role of a study guide. The function depends on the purposes for which the guide is intended. Some of the study guide will provide information on the topic as indicated by A in Fig (1). Other study guide may assist students in managing their own learning, B in Fig (1). A third type is the guide provides a focus for educational activities relating to learning as indicated by C in Fig (1). However, most of the study guides are multidimensional where all three functions are emphasized in different proportions. Table 1 summarizes the main content of study guide.

Preparation of a Study Guide

There are several useful publications about the designing of the study guide [2-5], [7-9]. The time spent in the designing of a study guide is well rewarded. Students are likely to make very good use of a well designed guide but may not look to those which are not attractive and poorly repaired [4]. Harden [2] gives good practical steps in the preparation of a study guide. Here are the main steps:

- Use advance organizers. Their purpose is to prepare the students for new topics. They should take on board the background of the students and they need to know to continue successfully in their study.
- Make use of headings which help to provide a structure to your writing.
- Build in some pre-test and self assessment exercise but try to make them stimulating thinking and understanding not just factual recall.
- Incorporate some illustrations e.g. cartoons, pictures and figures. Bear in mind that illustrations can have different functions – the most important being to help your students better understand a piece of text. Illustration can break up the text and make it less dense to read.
- Keep sentences short and simple. This will help the student to read it and understand it easily. It is important to use familiar words especially in the developing country where the language of instruction is not the mother-tongue of most of the students
- Write in the active voice. Active voice is more easily understood.
- Adopt conversational style which is much more user friendly.

Table 1. Content of study guide, reproduced from (2).

A Information	
1	Reference to texts and journals
2	Quotations from text and journals
3	Complete text or articles
4	Longer extract from text
5	Complete texts or articles
6	Short comments on the topic
7	Short notes
8	Key or core information
9	More extended account of the topic
10	Glossary, definitions or list of terms used
B Management of learning	
1	Overview of topic or course
2	Learning outcomes
3	Prerequisites
4	Timetable
5	Learning strategies
6	Learning opportunities
7	Assessment
8	Staff contacts
9	Personal comments by authors
C Activities	
1	Interaction with lectures and resource material
2	Application of theory to clinical practice
3	Self-assessment exercises
4	Record of achievement or portfolio
5	Personal information bank
6	Student comments on the guide

- Attention to the layout and the typography of the study guide are very important issues. For instance, it is not advisable to use type smaller than 10 point; otherwise you are in danger of the material not being read. If line lengths are too short impair legibility.
- The guide should be divided in section on a clear scientific basis. This will help the reader to move forward and backward more easily.

- When it comes to the production phase. There are some important question that should be addressed:
    - How many copies of the study guide are required? This will help you to decide whether it is an in-house printing production or commercial production.
    - Is color really necessary or is it just to make the product look nice? The budget is important here.
    - What type of paper should be used? There is a wide range of papers available and you have to choose the reasonable type.
    - Are you planning to print on the sides of the paper? You need to think carefully about the capacity of the paper. There is nothing worse than an image from a previous page shining through as you struggle to read new information.

Electronic Study guides

To date, most study guides are printed on paper. Though a paper format can be convenient, electronic study guides are gaining their place as learning tools in the educational setting. Smyth [10] reported that the use of electronic study guide may have the following advantages:

- Electronic study guide, in common with printed guides, can indicate what should be learned, how it can be learned, and how students can recognize if they have learned it.
- The electronic format allows the students to make links between different sections of the guide. Moreover, student can make links between the guide and different useful sites on the web. For example, student looking at a course objective of heart sounds in cardiovascular system module can move almost instantly to the relevant annotated list of learning opportunities. These might include observation of a video-clip, visiting a web site, a description in a textbook on auscultation, clinical experience in the ward or at cardiac clinic. Using the electronic study guide students can review whether they have the necessary prerequisite. If in doubt, they can use the self-assessment component to test themselves and to have immediate feedback electronically. Of course all these procedures are possible with a printed study guides but not by the same quality and speed of electronic study guide.
- The electronic study guide offers students the opportunity to individualize the study guide to their own requirements. For example, they can add further information or links and relate it to their own studies. This personalized electronic information can develop and grow as the students' progress, through the whole and graduate study or may be even to postgraduate level. On the other hand, the printed study guide is less flexible in terms of updating, and may require the whole section to be added or changed.
- The electronic study guide can help the teacher and students to keep with explosion of information. It allows students to build in their own indexing and

retrieval system. They can make links to information in an electronic textbook, an electronic article, a useful web site or any other electronic material on the network. Though all these procedures are possible with printed guides, they are often cumbersome and seldom practical.

- The electronic study guide will motivate the students to improve their information technology (IT) skills. It motivates them to use word processor and the internet. Today, the IT course is an integral part of the undergraduate medical curriculum. When using an electronic study guide students can integrate the use of computer in the day-to-day activities.
- In electronic guides we can incorporate color, illustrations, photographs and video sequences. With this facility, photographs can be used to introduce the staff responsible for the course. The guide can show the layout of the library, practical laboratory or clinical unit where the student will be studying. More importantly, clinical problems or procedures can be introduced visually in the study guide.
- Excluding the initial investment in hardware (which may be shared and the hardware may have other uses), electronic study guide production and distribution cost may be less than the printed one.
- Generally, the electronic format of the study guide can be updated more easily than the printed format.
- The electronic guide allows the students to share resources and communicate easily with each other and with their tutors. It also allows communication between different medical colleges in the global electronic village [11].
- A study guide template may be prepared electronically to allow the teacher to use the template for designing a study guide for their own course. An electronic template will allow the teacher to produce a high quality with high flexibility.

Though the electronic study guide offers many advantages against printed study guide, a few disadvantages may be raised.

- The most obvious disadvantage is the necessity of the student and the staff to have access to a computer. However, the computer networks became an integral part of any faculty where students have access to the computers in a daily basis. For example, in King Abdul Aziz University there is an excellent computer network which is not used properly for education. Most of the students use the computer every day for E-mail, chatting and browsing of the web. Therefore, it is time to move the computer skills of our students to the write direction by using the electronic study guide.
- Another disadvantage is the necessity of the teachers to have good computer skills. This is real challenge to the use of electronic instructional materials in general. However, one of the main programs in staff development should be IT skills. The need of some familiarization with computers is not really a disadvantage but an advantage – it assists the staff to acquire confidence in this area. Using a ready made study guide template will play a big role in motivating

the staff to start using the computer to develop and update their own study guides.

During the development of electronic study guides, there are important issues to be considered [11-14]:

- The student's capabilities in the use of electronic media should be evaluated carefully. No matter how "attractive" our study guide is, its usefulness depends in part on the users' characteristics and their ability to navigate and use computers.
- The format and the platform of the electronic study guide should be used friendly by the students.
- The electronic study guide should be more attractive than the printed format. The electronic format shouldn't look like the printed one [15-19]. It should include video, sounds, graphics, illustrations, pictures, animations, texture and background that might change according to sections of the guide. However, too many attractive elements might distract the students from the main purpose of the guide [20-22].
- The electronic guide should include all information about the course. Once the student is sitting in front of a computer, it will be very irritating for him/her to have to look for extra information, which is not contained in the study guide.
- A clear instruction about the use of the software should be included. A help menu should be available to answer the common questions about the use of the software. A demo demonstration is a useful tool.
- It is time consuming to have to return to the main menu every time you have to finish with one section. Therefore, we have to be sure to include all necessary links in all pages of the electronic study guide.
- Students need to have access to the study guide from their home or worksite, and not just from inside the Campus, school or University facilities. In addition, student should have authorization to access the study guide from the very beginning of the course. A personalized login and password should be granted to each student registered for the course.
- A security locks on information is needed to avoid student modification of the guide.
- The electronic study guide should keep the track of the time and date when each student logs in. This will help the teachers to monitor, electronically, individuals and groups of students using the guide.
- Giving information by means of attachment should be avoided. It is too tedious to be asked to open up documents in the form of attachment to gain access to information and then return again to the core information of the guide.
- The electronic study guide should be updated and maintained periodically.
- In designing an electronic study guide, we should not get overexcited with high technology forgetting the basic principles of instructional design. The study guide should be designed on the papers before attempting to convert it to an electronic format.

- Designing an electronic study guide is time consuming and it needs a team work. Without a team including an expert software designer, the medical teacher may waste his time in the technical aspect of the software.

Conclusion and Recommendations

By reviewing the literature, we can conclude that study guide is becoming an integral part of any modern curriculum. Moreover, the growing number of both undergraduate and postgraduate students in our universities will disturb the student : staff ratio, and therefore will decrease the time allocated for each student from their teaching staff. This would certainly necessitate the presence of a study guide for our courses which would be able to answer most of the students' questions and queries throughout the course of study. Therefore we recommend:

1. Study guide should be part of any university course. Teaching staff should arrange to develop a study guide for all courses.
2. Practical workshops are necessary to help the staff to prepare their own study guide; therefore the universities (or faculties) are kindly requested to arrange for such workshops.
3. Just like a course portfolio, a study guide became a necessity to get an international accreditation especially in medical and health sciences faculties. Therefore, it is recommended to make a study guide a must for these faculties, so the process of accreditation would be easier.

As the major goal of the current paper is to raise awareness about the importance of study guide as an educational tool, the appearance of many future study guides for many courses would be an indication of fulfilling the paper main objectives.

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دليل الطالب للمنهج الدراسي: وسيلة مهمة لتطوير المناهج الدراسية

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المستخلص: إن دليل الطالب للمنهج الدراسي من أهم الأمور التي سوف تساهم بشكل كبير و فعال في تطوير المناهج الدراسية ومن ثم العملية التعليمية بشكل عام. لذا فإن هذا البحث يهدف إلى التأكيد على أهمية وجود دليل الطالب ضمن أي منهج دراسي جامعي حديث وهادف، كما يهدف البحث إلى عرض مختصر لكيفية إعداد دليل الطالب بحسب أهداف المناهج المختلفة. إن دليل الطالب يمكن تشبيهه بالمعلم أو الموجه المتواجد على أكتاف الطالب ٢٤ ساعة يوميا لينصح ويوجه الطالب بشكل دائم ومستمر في كافة مراحل الدراسة.

إن دليل الطالب يختلف كليا عن الكتاب المقرر حيث أنه يوجه الطالب بشكل خاص وتفصيلي عن ما يجب على الطالب أن يعرفه في كل مقرر دراسي. إن لدليل الطالب ثلاثة أدوار رئيسية تهدف إلى تطوير العملية التعليمية: (١) يساعد الطالب في إدارة وقته الخاص بالعملية التعليمية، (٢) يزود الطالب بما يجب أن يركز عليه من أولويات ومهام عمله في العملية التعليمية، (٣) يبين للطالب أبرز المعلومات والحقائق العلمية التي تعتبر مفاتيحًا للعملية التعليمية. كما أنه يمكن تمثيل هذه الأدوار الرئيسية بالمثلث الذي تحتوي كل زاوية فيه على أحد هذه الأدوار.

إن دليل الطالب للمنهج الدراسي يمكن أن يتكون من مقدمة عن المنهج الدراسي، الأهداف والمخرجات المتوقع من الطالب تعلمها في نهاية المنهج الدراسي، المتطلبات الدراسية لهذا المنهج الدراسي، الجدول الدراسي التفصيلي، الاستراتيجيات الخاصة بهذا المنهج الدراسي، طرق التقييم، طريقة الاتصال بمدرس المادة، و أي توجيهات أو نصائح إضافية يراها أستاذ المادة. كما أنه من المحبذ أن يحتوي الدليل على أسئلة وأنشطه يقوم بها الطالب بنفسه لتقييم مستواه في المادة بشكل دوري ومتكرر. كما أن دليل الطالب يمكن أن يطور ليصبح كملف المنهج الدراسي الذي يمكن أن يستخدمه الطالب ليسجل نشاطاته بشكل مستمر و فق المهام المحددة المعطاة في كل منهج دراسي.

إن خطوات تحضير دليل الطالب للمنهج الدراسي يمكن تلخيصها في النقاط التالية: (١) تحديد وظيفة وشكل الدليل، (٢) تقرير علاقة الدليل بالمنهج الدراسي، (٣) كتابة الدليل. كما يعتبر دليل الطالب المعد بشكل جيد من أهم الأدوات التنظيمية التي تشجع كلا من أستاذ المادة و الطالب وتحدد مسؤليتيهما بشكل واضح وفعال تجاه المنهج الدراسي ومن ثم العملية التعليمية.

Effective Learning Environments

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ABSTRACT. New developments in the science of learning raise important questions about the design of learning environments – questions that suggest the value of rethinking what is taught, how it is taught and how it is assessed.
The paper will discuss the importance of designing an effective learning environment that encompasses four interrelated teaching aspects, knowledge, learner, assess and community centered learning environment (see figure below) and the role of culture in such environments.
Knowledge centered is how students can need to work on themselves and organize their knowledge that is accessible in appropriate contexts.
Learned centered is when students make connection between their previous knowledge and their current knowledge. It's the study of how students construct new knowledge and how they interpret new information.
Assess centered is the need of training students to be able to assess themselves in the class thus improving their quality of thinking and learning.
Community centered is the values and norms that students possess which reflects the value of learning and how they interact receive feedback and learn.
The paper will present;

1. How people learn in general focusing on teacher-student relation in class.
2. Instructional styles and delivery methods which encourages interactive learning environments rather than passive learning environments.
3. Recommendations on how to achieve alignment between culture and each of the learning environments

Introduction

As a result of the research from the past 30 years, the views of effective learning have shifted from the benefits of drill and practice to a focus on students' understanding and application of knowledge. (How People Learn, 2000, page xi). Research on expertise in areas such as chess, history and science, demonstrates that the experts' ability to think

and solve problems depends strongly on a rich body of knowledge about the subject matter. (e.g. Chase and Simon, 1973, Chi et al., 1981; deGroot, 1965).
Excerpted from a presentation at NCREL's 1992, in Lisle, Illinois, John Dewey said, 'You cannot become a great teacher unless you are able to illustrate from the experience of your students what it is you want them to understand exactly'. Consequently, we need to speak the language of the students. We have to know something about their history. We've got to be able to illustrate it in a way that they understand it."
Teachers will need to put several aspects into account;

- Cultural differences can affect students' comfort level in working collaboratively instead of individually. Differences are also reflected in the background knowledge that students bring to a new learning situation (Moll, Tapia, & Whitmore, 1993).
- Students' conceptions of what it means to be intelligent can affect their performance. Students who think that intelligence is a fixed entity are more likely to be performance oriented as opposed to learning oriented; they want to look good rather than risk making mistakes while learning. These students are more likely to give up when tasks become difficult. In contrast, students who think that intelligence is malleable are more willing to struggle with challenging tasks and are more comfortable with risk (Dweck, 1989; Dweck & Legget, 1988).
- Attention should be given to each student's individual progress and develop appropriate tasks which further facilitate deeper understanding of the material. For instance, students can be presented with challenging material that they can manage; that is, the problems are demanding enough to maintain engagement, but not so difficult as to lead to discouragement. This approach demonstrates teachers' understanding of their students' knowledge, skill levels, and interests (Duckworth, 1987).

The paper will discuss how teachers can integrate culture when designing effective learning environments that optimize the characteristics of being, learner, knowledge, assessment and community centered.

The first section will talk about ways people learn in general, the second section will pinpoint the traditional means of learning and the third section will discuss how to go about designing an effective learning atmosphere for both teachers and students.

A) The Ways People Learn

Effective education strategies deliberately consider the various ways in which people learn and are evident in how well students draw on their existing knowledge and competencies as they master new skills and acquire new information. Given this, the development of effective strategies needs to be grounded in and informed by the research on teaching and learning.

The following three findings about how people learn are supported by solid research and have important implications for education practice:

(i) Students come to the classroom with preconceptions about how the world works

If students' initial understanding is not engaged, they may fail to grasp new concepts and information presented in the classroom, or they may learn the material for purposes of test taking but revert to their preconceptions outside the classroom. Prior understanding in students at any level can impede their ability to learn contradictory ideas unless they are given the chance to explore the errors in their initial beliefs.

Recommendations for Teachers

- Draw out their students' existing knowledge through classroom tasks and conditions that reveal students' thinking;
- Use preconception as the foundation for students to further understand the subject matter; and
- Use frequent formative assessments to make students' understandings apparent to themselves, their peers, and their teachers. These assessments are more useful in promoting learning with understanding than are tests measuring students' ability to repeat facts or demonstrate isolated skills.

Schools of education can promote teachers' ability to work with students' preconceptions by helping teachers to; 1) identify predictable preconceptions that make mastery of subject matter challenging, 2) recognize unpredictable preconceptions, and 3) help students to build on their preconceptions by challenging them and replacing them when appropriate.

(ii) To develop competence in an area of inquiry, students need a foundation of factual knowledge, an understanding of facts and ideas in the context of a conceptual framework, and the ability to organize them in ways that enable retrieval and application

Research comparing the performance of novices and experts, in addition to research on learning and transfer, demonstrates that experts draw on an extensive and richly structured information base. But accessing factual information is not enough. The key to expertise is the mastery of concepts that allows for specialized learning and enables the transformation of a set of facts into usable knowledge.

Experts organize information into meaningful patterns that facilitate eventual retrieval for problem solving. And unlike the simple acquisition of factual knowledge, thoroughly understanding concepts facilitates the transfer of learning to new problems.

Recommendations for Teachers

This finding suggests that in-depth coverage of fewer topics that enables learning of key concepts is preferable to broad and superficial coverage of subject-related topics. Teachers, consequently, need

- A substantial knowledge base in a variety of subjects,

- Familiarity with the processes of inquiry,
- An understanding of the relationship between information and the concepts that help organize information in a discipline, and
- A grasp of the processes in students' conceptual development.

Thus, assessment tools that measure both deep conceptual understanding and factual knowledge and are aligned with the above approaches to teaching must be systematically developed.

(iii) Strategies can be taught that allow students to monitor their understanding and progress in problem solving

Research on the performance of teachers reveals that they monitor their understanding carefully by; 1) making note of what additional information is needed, 2) deciding whether new information is consistent with what they already know; and 3) determining appropriate revisions in their understanding and then cognitive processes, if any, so that they advance their understanding.

This metacognitive approach functions as an internal dialogue to consider alternative solutions to problems and whether the one chosen will lead to the desired end. The strategies involved in this deliberate monitoring are part of a habit of mind or disposition of inquiry, and can be successfully taught in the context of subject matter. In teaching these strategies, teachers model both the monitoring questions and observations and facilitate classroom discussion with the ultimate goal of fostering independent monitoring and learning in their students.

Recommendations for Teachers

- Integrate teaching in metacognitive skills into the curriculum in a variety of subject areas, and
- Explicitly emphasize and model the internal inquiry process in order to enhance students' ability to learn independently.

B) Traditional Learning Environments

Some classrooms have traditional and, at times, inadequate classroom techniques that are not successful. Teachers may continue to use these techniques because; 1) many teachers learn autobiographically (Lortie, 1975) and in difficult situations may abandon their new teaching techniques and in favor of the techniques that were used to teach them, and 2) lack of professional support, a sense of professional community, and staff development opportunities makes it more difficult for teachers to learn and implement new techniques.

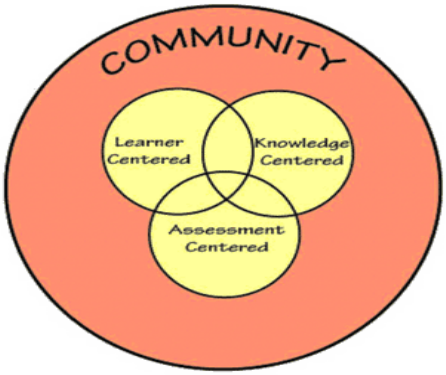
Classrooms that have focused on basic skills often present information in a fragmented and disconnected way. New cognitive research has shown that these approaches do not provide environments that will help students learn complex thinking skills;

- Fragmented skill development is less successful than skill development within a context of solving more complex problems.
- Fragmented knowledge is more difficult to connect to broader understandings of subject matter.
- To help students become engaged learners and increase student understanding, teachers should provide in-depth curricula and authentic instruction is one method that can be used in this situation.
- Teachers should emphasize understanding rather than coverage of factual information.
- In-depth projects that spend time looking at ideas or concepts will be more engaging.

C) The Four Cornerstones of Effective Learning

To create a successful active learning environment, both faculty and students must make adjustments to what has been their respective "traditional" role in the classroom. Traditional here refers to the fact that most students have spent the majority of their school career in passive learning environments in which faculty were disseminators of information, and students were required to memorize information or use specified algorithms to 'solve problems'.

For the instructor who is committed to promoting active learning, the challenge lies in helping students understand the necessity of becoming active colleagues in learning. This process can be facilitated if the curriculum includes exercises to direct students' attention to a number of issues that impact their learning.



Perspectives on Learning Environments.
Source: Bransford et al. (1998)

a) Learned centered refers to an environment which pays careful attention to the knowledge, skills, attitudes and beliefs that learners bring to the educational setting. It involves teaching practices that has been called "culturally responsive", "culturally compatible" and "culturally relevant". Can also be referred to "diagnostic teaching" (Bell et al. 1980) since teachers recognize the importance of building on the conceptual and cultural knowledge that students brings with them to class.

To integrate students' preconceptions about subject matter while it simultaneously promotes a better understanding of students, the following questions should be taken into account;

- What does the learner bring to the learning setting (prior knowledge) and how do they connect it with new knowledge?
- Does learners' belief affect how they interpret new information?
- Does current knowledge help or hamper learning?
- Are teachers aware of the learner's background and what steps do they undertake to effectively connect new ideas to their students' prior knowledge?

In such a learner-centered environment, faculty become facilitators of learning and students become active participants, engaging in a dialogue with their colleagues and with the instructor.

Four major aspects that teachers need to focus on in a learner-centered environment are students' interaction, communication, and building mental models.

To encourage **interaction** teachers can include activities like distributing cards to students and asking questions like "What is your student's job in this course?" and "What is the instructor's job in this course?" etc. From the answers, a discussion will be initiated between teachers and students, thus the teachers will be able to determine the students thinking and the student will be introduced to the types of interaction expected in an active learning environment. However, these exercises represent a first step. They are not sufficient to ensure continued student participation in the class room. By conducting these or similar exercises, faculty is, in effect, expressing a commitment to facilitate active learning within the classroom. They must recognize this commitment and act accordingly.

Students will continue to participate only as long as course or curricular activities fulfill the promise of providing an interactive environment that is learner-centered. It is important to recognize that examinations and other assessment tools fall into the category of course activities that must be consistent with the commitment to active learning. Examinations that only require recall of facts rather than application of factual information to new situations can undermine the instructor's attempt to maintain student participation in the classroom. The message received by students from inappropriate exams is that "performance in this class is determined in the same way as in classes where I just sit and listen, so why should I go through the work of testing my mental models?".

Another issue to consider is **communication.** The success of any interactive environment depends on the ability of the participants to communicate effectively. There is a growing diversity in first languages spoken by students and faculty. This, of course, raises a number of challenges related to establishing a common language in which to communicate. However, even within a common language, there can be diversity of interpretation that can lead to diversity in the mental models resulting from a conversation. The first step to effective verbal communication in the classroom is ensuring that students recognize that what they "hear" is not always what was said and that they must be willing to seek clarification whenever doubt occurs. Recognition of

this fact is critical because communication is one way that mental models are tested. Thus elective communication is essential if students and instructor are to reach a common understanding of the phenomena being discussed. Below is an example of bridging communication gaps:

Students of a biology department are shown a short video of an athletic performing. The class is then divided into groups of three to four students each, and the groups are directed to "Describe what kind of information you would seek if you wanted to understand what is going on in [the athlete's] body when he performs." The instruction is repeated, and the groups are given -10 min to complete the task. Before proceeding with a discussion of the video designed to emphasize the integrative nature of the basic sciences, each group is asked to describe the assigned task.

This exercise was used on several occasions in both student and faculty workshops. In one student workshop, six different descriptions of the task were elicited from eight groups of students. The responses ranged from "make a list of topics" to "design experiments and describe the kinds of measurements that you would make." Each student in the room heard the same words spoken at the same time. Each student heard the words two times. Yet, the groups interpreted the words differently. On each occasion that we have used this exercise, similar results were obtained, and members of the "class" were surprised by the diversity in meaning attributed to the directions.

The third important aspect is acknowledging the **mental model** of students. Few students realize that interpretation of nearly all information (i.e., their mental models) depends on past experience, and, because each member of the class has had different life experiences, each student integrates "new" information into a unique conceptual framework. Furthermore, these mental models are modified with the acquisition of new relevant data. Recognizing this fact helps students appreciate the need for discourse as they build and test mental models of physiological systems. This, in turn, leads to a greater willingness to participate in the type of discourse that characterizes an interactive (active) learning environment, example;

Students view a short videotaped segment showing a bird preening its feathers amid bleached logs and dune grass on a patch of sand. The sound track is that of an isolated ocean cove and includes the sound of waves and the sounds of gulls. The students were divided into groups and asked what they make up of the following video. A discussion ensues in which students are asked to explain how they arrived at their conclusions regarding the scene (i.e., their mental model of their observations) and what they would look for in a second viewing that might further confirm their conclusion (i.e., how they would test their mental model).

The scene is then shown again, only this time; the view broadens to reveal that the bird is part of a display in an aquarium. The ensuing discussion focuses on how the group would interpret the scene if they viewed it for a third time, that is, how their mental models of the scene have been modified in light of the most recent data.

This simple exercise generates considerable discussion about the factors that influence interpretation of what is seen and heard. Evidence will show that students' interpretation of language is not the only factor that plays an important role in the process of building mental models. Experience is also an important factor. Students report that they had not realized the diversity among classmates of mental models (interpretations) of a seemingly simple scene. In addition, they voice a new appreciation

for the need to communicate with colleagues and faculty (i.e., seek clarification) when dealing with new information and new situations.

In summary, by deciding to implement an active learning environment in the classroom, faculty enters into an implicit contract with students. Under the terms of that contract, the instructor becomes the "coach" whose responsibilities include helping students to understand why they should agree to "play the game" ensuring that course activities follow the "rules of the game" and reassuring students that, although "playing the game" is not as easy as being a spectator, the goal of understanding and applying information can only be reached by continuing to be an "active player".

b) Knowledge centered is how students can need to work on themselves and organize their knowledge that is accessible in appropriate contexts. Knowledge and learner centered instruction tends to overlap each other, so to distinguish between each concept the following questions should be addressed;

- How does this type of instruction help students use their current knowledge and skills to think and solve problems?
- How do we help students learn and understand new knowledge verses learning a set of disconnected facts and skills?
- How much information should students be exposed to in order not to result in developing disconnected facts or skills rather than connected knowledge?

Learning with understanding is important because it makes new learning easier (i.e., it supports the transfer of knowledge to different situations). Learning with understanding is also harder and more time-consuming than simply memorizing. Many curricula fail to support learning with understanding because they present an array of disconnected facts in a short period of time. Similarly, tests often reinforce memorizing rather than understanding. A knowledge-centered environment, however, provides the tools for in-depth study and assesses students' understanding rather than their knowledge of disconnected facts. Furthermore, it incorporates the teaching of metacognitive strategies that facilitate future learning.

While students' interest or engagement in a task is important, it does not guarantee that students will acquire the various types of knowledge that will support new learning. Knowledge-centered environments, therefore, consider other factors besides engagement as the primary index of successful teaching (Prawaf, Remillard, Putnam, & Heaton, 1992). "These environments also recognize that there are important differences between tasks and projects that "encourage hands-on doing and those that encourage doing with understanding" (*How People Learn: Bridging Research and Practice,* 1999, p. 21). According to Greeno (1991), the knowledge-centered environment emphasizes the latter.

Writing help students clarify, defend, develop, and explain their thinking and communicate their ideas to others. Reading helps students to make connections between prior knowledge and knew knowledge.

Assignment were students are asked to read a chapter and analyze it, is considered one best technique to gain understanding were the student will address new

issues and think about it. Several actions will take place during this process. First the student will gather all the facts and link it to previous experience or prior knowledge to understand the concept at hand. Sometimes even reading the facts twice can give alternative thoughts. Then writing down the analysis via linking these facts will organize ones thought and make a linkage between the facts at hand.

Group work helps students collaboratively build new ideas that take alternative perspectives into account. There are many forms of group work, which can include activities like reading and analyzing papers or chapters, or a group project, or a problem at hand that requires scientific solutions or even coaching assignments where one student coaches another student thus enhancing teaching skills. Through group work communication, collaboration, interpersonal skills are developed and these are lifelong learning skills which are important learning objectives.

c) Assessment centered is the need of training students to be able to assess themselves in the class thus improving their quality of thinking and learning. Teachers and students need to deal with the questions below to improve their teaching and learning skills respectively;

- Is feedback fundamental to learning?
- Do students need opportunities for formative assessment that allow for revision and improvement of the quality of their thinking and understanding?
- If the learning goal is to enhance understanding and applicability of knowledge, is it sufficient to provide assessments that focus primarily on memorizing facts and formulas or not?

Formative assessments help both teachers and students monitor progress. Equally important, they permit teachers to; (1) grasp their students' preconceptions, (2) understand where each student is along the continuum from informal to formal thinking, and (3) design curriculum and instruction accordingly.

Another important characteristic of formative assessments is their learner-friendliness. Rather than requiring students to quickly memorize information for a quiz which will result in a grade that ranks them with respect to their classmates, these assessments provide students with opportunities to revise and improve their thinking (Vye et al., 1998), help them see their own progress over the course of weeks or months, and assist teachers in identifying potential problems in students' critical literacy and comprehension that may need to be remedied.

Activities where teachers ask students to write their reflections (includes personal thoughts, activities carried out, collection of fact) at the end of each class session can be an assessment activity where the teachers become aware of what the student had gained from the day activities and information received. Students will then receive feedback from the teacher on what they have written thus helping the student to be aware of the areas in which improvement needs to be made.

Other activities are quizzes where two students work together in coaching each other to solve the quizzes. This helps the students also realize whether they have learnt and understood the lectures.

Assessment also includes teachers evaluation forms which students can fill in occasionally, questions can include, what information or activity was beneficial, what part of the curriculum needs improvement, what other activities need to be included in the lecture etc. The teacher will then determine whether the instructional methods and information provided are benefiting the students and according improve the areas of weakness.

d) Community centered is the values and norms that students possess which reflects the value of learning and how they interact to receive feedback and learn. Culture adaptability is an important issue when studying in a multicultural learning setting so to achieve such a setting, questions like below should be considered;

- Does the learning environment promote a sense of community?
- Are most activities outside of school based in community settings, teams etc?
- Does community interaction allow more opportunity for motivation, interaction, and feedback?

Since learning is influenced in fundamental ways by its context, promoting student achievement via their community requires the development of norms for the classroom, and the outside world that both support and inform core learning values.

In some classrooms, the norms may require that students build their own information base; others may encourage academic risk taking and provide opportunities for students to make mistakes, obtain feedback, and revise their thinking. Educational norms must also support students' comfort in revealing their preconceptions about a subject, their questions, and their progress toward understanding new conceptual constructs related to the subject.

Similarly, teachers must design classroom activities and help students to promote the kind of intellectual camaraderie and attitudes toward learning that build a sense of community. These activities may take the form of students solving problems together by building on each other's knowledge, asking questions to clarify explanations, and suggesting differing solutions (Brown & Campione, 1994). Thus, the research indicates that cooperation and argumentation in problem solving enhance cognitive development and are factors in promoting student achievement (Evans, 1989; Goldman, 1994; Habermas, 1990; Kuhn, 1991; Moshman, 1995a; 1995b; Newstead & Evans, 1995; Salmon & Zeitz, 1995; Youniss & Damon, 1992).

Lave & Wegner (1991) found that a community-centered approach also supports teachers' efforts to establish a community of learners among themselves. Such a community encourages questioning and can become a model for creating new ideas that builds on the contributions of individual members. Community membership can produce in teachers a sense of excitement and ownership of new ideas to apply to theory and practice which they can transfer to teaching and learning in their classroom.

All the activities mentioned above adopt community-based initiatives since students and teachers are all from different culture, social, educational background so there will be always exchange of knowledge, ideas and beliefs which makes learning a very interactive activity for both parties. The most important thing is for students and teachers to be cultural sensitive of others so a cultural orientation session at the beginning of the first lecture will help bridge the culture barrier built from prior experience.

A key aspect is the idea of aligning goals for learning with what is taught, how it is taught and how it is assessed. Without this alignment it is difficult to know what is being learned. Students might be learning valuable information but one cannot tell unless there is an alignment between what they are learning and the assessment of that learning. Similarly students maybe learning things that others don't value unless curricula and assessments are aligned with the broad learning goals of communities (Lehrer and Shumow, 1997). In conclusion all the above factors mutually overlap and influence each other so teachers need to promote coordination among activities to design effective learning environments for the students.

Development of an Undergraduate Curriculum in Mechatronics Engineering

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ABSTRACT. As machines and devices with intelligence and multi-functions have become common expectation by customers, the need for engineers with multi-disciplinary knowledge and skills by industries has become more urgent than ever. The exciting field of mechatronics-increasingly recognized as a contemporary, integrative design methodology is serving as a vehicle to engage and stimulate the interest of many engineering students in hands-on, interdisciplinary, collaborative learning. Mechatronics combines mechanical, electrical, electronic and software engineering in the design, development and control of complex products. Although products have long included all four components, traditional design methods viewed them as separate, independently realized aspects of the design. Mechatronics emphasizes global optimization by integrating these four components of the design process.

The typical knowledgebase for the optimal design and operation of Mechatronics and smart systems comprises of system modeling and analysis, decision and control theory, sensors and signal conditioning, actuators and power electronics, hardware interfacing, rapid control prototyping, and embedded computing. The relevant technology applications of mechatronics include medical, defense, manufacturing, robotics, automotive, and distributed systems and smart consumer products. Graduates of this program will have extensive skills in integrating engineering with software development, particularly relating to multi-disciplinary projects, and will have developed experience in working on team projects. They will also have well-developed oral, written and graphical communication skills.

Mchatronics education in higher educational institutions in the Kingdom of Saudi Arabia is primarily confined to distinct courses in controls and computer-integrated manufacturing systems offered at the undergraduate level. This situation is clearly in contrast to what has happened in Japan, other Asian Pacific countries, USA, and some European countries in which distinct mechatronics engineering departments have been in existence for years. This paper presents the proposal for the development of a new curriculum track on “mechatronics engineering” in addition to the existing

track in “thermofluid-design”. The motivation for mechatronics curriculum development, proposed curriculum, and challenging issues are highlighted.

1. Introduction

"Mechatronics" is a branch of engineering that deals with combined mechanical, electronic, control and software systems. The elements of mechatronics systems include sensors, actuators, microcontrollers (or microprocessors) and real-time control software. One of the features which distinguishes mechatronic systems or products from earlier electromechanical systems or products is the replacement of some mechanical functions with electronic and software ones. This results in much greater flexibility of both design and operation. Another feature is increased speed and precision of performance. A third is the ability to conduct automated data collection and reporting. In addition, advanced mechatronics systems now have the ability to implement distributed control in complex systems.

Mechatronics technology has continued to advance rapidly. These advances are concerned largely with precision, speed, durability, miniaturization, flexibility, safety, power consumption, intelligence and cost. This is the result of the swift progress in all of the components and technologies of mechatronics systems, including actuators, sensors, microcontrollers and software as well as materials science, fuzzy logic, lasers, communications, kinematics, machine vision and virtual reality.

Mechatronics technology has been developed over the last three decades. In the 1970s, mechatronics was concerned mainly with servo technology for use in such products such as automatic focus cameras, automatic door openers and vending machines. During the 1980s it became commonplace to add microcontrollers to mechanical systems in order to further improve their performance, reduce size and cut costs. High growth applications during that decade included computer disk drives, numerically controlled machine tools, industrial robots, automobile engines and antilock braking systems. A feature of the 1990s was the growing incorporation of communications technology, thus making possible systems which could be connected in large networks. The critical advantages of these products and processes arise from their exploitation of real-time computation to create intelligent electro-mechanical systems.

An important trend throughout the short history of mechatronics has been the continued miniaturization of components and systems. In fact, some systems have become so small that they can be built into a single silicon chip (inclusive of sensor, actuator and control circuitry) using advanced semiconductor production processes.

In spite of the rapid progress that has been made and the emergence of whole new classes of products, not everyone is convinced that "mechatronics" should be considered as a distinct new field of engineering. This is because mechatronics is an evolutionary rather than a revolutionary development. It is just a natural progression to incorporate sensors, microcontrollers and other advanced electronic components into mechanical products now that they have become so inexpensive and small that they can be put into even the cheapest and tiniest of products.

However, the future of "mechatronics" is very bright. This is because advances continue to be made in all of the components and technologies used in such systems and because no slowdown is in sight for this progress. The result will be a continued improvement in the performance of mechatronics systems and a further growth in the number of applications.

The strength of a mechatronics solution, as opposed to a traditional solution, stems from the synergistic combination of the capabilities represented by the parent fields of mechanics, electronics, control and software. Education of mechatronics engineers requires that they gain depth knowledge of all four disciplines that will allow them to perform that synthesis. Nowadays, a growing number of mechanical engineering programs are recognizing the need to educate their students not only in the "facts" of mechanical engineering and their applications, but also about the application of software and electronics in design solutions (i.e., mechatronics).

2. Mechatronics and Design

As shown in Figure 1, mechatronics is the synergistic combination of mechanical engineering, electronics, control systems, and computers. The integration of these areas through the design process is the key element in mechatronics. Synergism and integration in design set a mechatronic system apart from a traditional, multidisciplinary system. Mechatronics is the blending of mechanical design/analysis; computer software/hardware systems; advanced modeling/control techniques; design/use of electric subsystems; computer vision and image processing; and virtualization and virtual environments. In order to design and manufacture quality precision consumer products in a timely manner, the present day mechanical engineer must posses both the analytical and practical knowledge in many different areas. The ability to design and implement analog and digital control systems, with their associated sensors, actuators, and electronics, is an essential skill of every mechanical engineer, as everything today needs controls. Knowledge of mechatronics helps an engineer generate more and better concepts, and trigger new ideas, and facilitates communication with team members in other disciplines. Creating new solutions to problems and developing these ideas into concepts is what design is all about.

The essential characteristic of a mechatronics engineer and the key to success in mechatronics is a balance between two sets of skills:

(i) modeling (physical and mathematical), analysis, and control design of dynamic physical systems

(ii) experimental validation of models and analysis and understanding the key issues in hardware implementation of designs

Figure 2 illustrates the procedure for a dynamic system investigation. Here the physical system can be an actual device or system that one needs to understand and possibly improve, or it can represent a concept being evaluated in the design process. The integration of electrical and mechanical measurements and the ability to observe their dynamic relationships provides the students with valuable insights into the mechatronics components and systems.

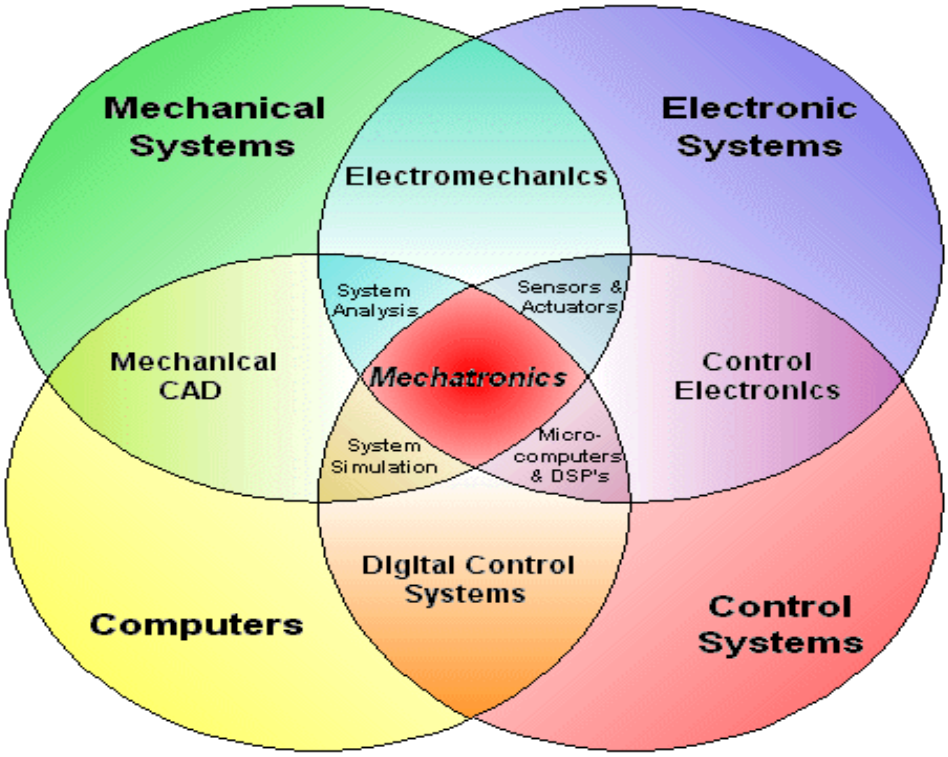

Fig.1. The multi-disciplinary nature of mechatronics.

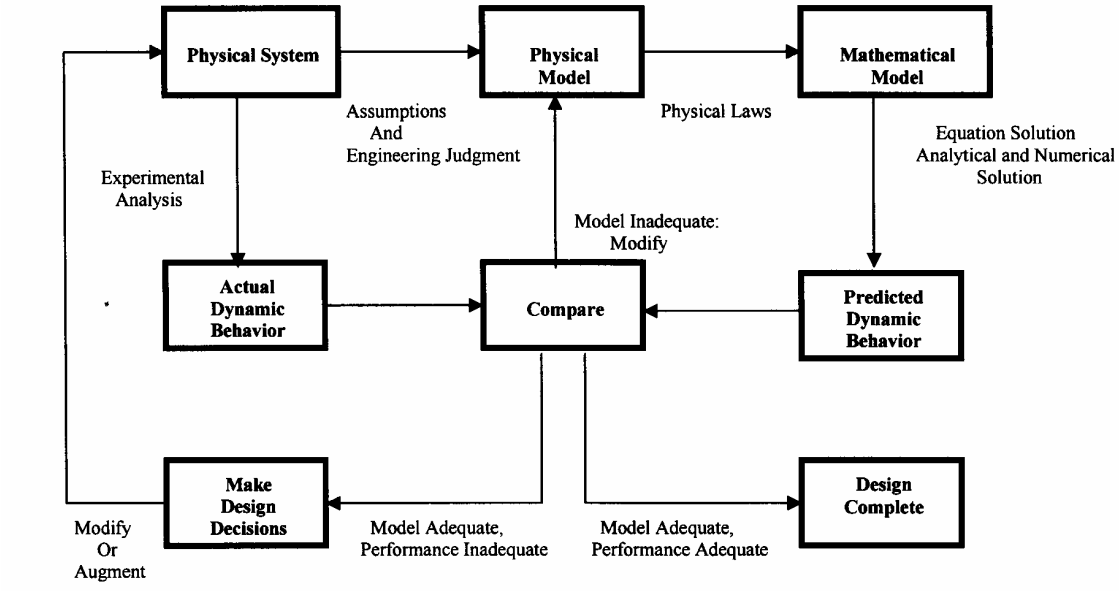

Fig. 2. Analysis/experimental cycle.

When students perform a complete dynamic system investigation of a mechatronic system, they develop modeling / analysis skills and obtain knowledge of and experience with a wide variety of analog and digital sensors and actuators that will be indispensable as mechatronic design engineers in future years.

3. Mechatronics and Engineering Education

The term "mechatronics" was initially used in the late 1960s at Yaskawa Electric Company Ltd (Japan) in reference to the application of electronic control of the company's electric motors, [1]. The term "mechatronics" has also been widely used in continental Europe for many years. Although it has been slow to gain acceptance as a distinct field of study and practice in the US and UK, its growing acceptance worldwide is evidenced by the rising number of undergraduate and postgraduate university courses now being offered. Today, a mechatronics department is found in most of the universities all over the world, [1]. Some other universities also offer a special program in mechatronics associated with either mechanical or system engineering departments. For example the University of Utah in USA [2] offers a Mechatronics Certificate from mechanical engineering department when any student in the college of engineering (or related sciences) passes the required classes and 14 semester hours of courses from a given list of approved elective courses , and by completing an approved mechatronics project. The Faculty of Engineering at the University of Victoria (Canada) [3] is offering a new Option in Mechatronics and Embedded Systems open to students from the three departments in the Faculty of Engineering: Mechanical, Computer Science, Computer and Electrical Engineering. Other universities have an independent mechatronics department with its own administration council, staff members labs, courses, and offer a B. Sc. Degree in mechatronics. Among these universities are: North Carolina state university (USA) [4] , Polytechnique university Brooklyn (USA) [5], New Castle University (England) [6] , Scholl of Engineering , Swinburne University , Australia [7], Faculty of engineering, Tilim University , Turkey [8], and Faculty of engineering , Ain Shams University , Egypt [9] . Reference [1] has provided a survey of mechatronics educational programs offered by academic institutions around the world.

The two approaches of either establishment of mechatronics department or having a special program in mechatronics associated with an engineering department have shown their validity and effectiveness , however establishing an independent department is not easy as there are so many constrains and limitations either technically or even at the administration and organization level .

4. Mechanical Engineering Department

The Faculty of Engineering at King Saud University first introduced the Bachelor of Mechanical Engineering course in 1382 H (1962 G). Over the years, the syllabus and curriculum has been revised several times to meet the needs and the changes that occurred in the mechanical engineering industry. In each curriculum development, the overall philosophy was to provide an educational environment in which aspiring engineers would develop a sound grasp of engineering principles and their limitations,

based on a thorough understanding of the underlying physical behaviors and laws; to combine technical competence with common sense, enabling them to gain in-depth specialist knowledge to develop problem solving and conceptual skills; and an ability to apply such skills to solve real design and decision problems. The emphasis of the courses is on the development of generic skills and a through grounding in engineering principles and their applications.

The practice of mechanical engineering has changed and is changing dramatically. The rapid technology advancements taking place in today's world, the ever changing socio-economic scenarios as well as the demand on the Professional Mechanical Engineer to take a leadership role in the design team serve to strengthen further the necessity for the mechanical engineering curriculum to be perpetually improved and updated.

5. Motivation for Mechatronics Curriculum Development

Engineers involved in the development of Mechatronic systems must be competent in multiple disciplines and must also have the teamwork skills to work effectively within a multi-disciplinary team. Engineers possessing these skills are in high demand, [10 and 11]. In response to this demand, the authors are proposing a plan to offer a new track in Mechatronics open to students from the Mechanical Engineering department. Graduates of this Option will possess the theoretical and practical skills to enter the workforce as Mechatronics Engineers.

The plan for establishing a distinct curriculum track on Mechatronics Engineering in the Mechanical Engineering Program at KSU was first initiated in 2000. The following factors have motivated the faculty to introduce such a track:

1. To respond to the high demand for the development of machines and devices with intelligence and multi-functions to serve an affluent society. Such products urgently need engineers with multi-disciplinary knowledge and skills. Consequently, the faculty is proposing to prepare the ME program for the recent trend of offering interdisciplinary engineering education to its students.
2. To provide necessary human resource supply to the high technology industry (design, use and maintain) in this era of globalization and establishment of multi-national companies. Surveying of the local industries has shown that (1) control is still the domain of the specialist; (2) very few practicing engineers perform any kind of physical and mathematical modeling; (3) mathematics is a subject that is not viewed as enhancing one's engineering skills but as an obstacle to avoid; very few engineers have the balance between analysis and hardware essential for success in Mechatronics.
3. To set-up a national model for an inter-engineering disciplinary program on the emerging mechatronic technology. The four major engineering disciplines of mechanical, electrical, control, and computer engineering involved in mechatronic technology are shown in Figure 1. A curriculum of mechatronics at the BS level is thus considered to be an excellent educational opportunity

for undergraduate mechanical engineering students. The experience that will be gained in such development would thus serve as a model for other institutions in the nation to follow.

4. To strengthen the department. Mechatronics is closely related to the "control, manufacturing and design" specialty, which happened to be the strength of the department.

6. Aims and Objectives of the Mechatronics Track

The track aims to develop in students:

a. A mastery of the basic scientific principles underlying mechatronics.
b. A sound knowledge of engineering, computer science and software engineering.
c. A thorough understanding of engineering methods and the ability to apply them competently and where appropriate, with originality and resourcefulness.
d. An understanding of the principles of management and the financial aspects of engineering.
e. Communication skills so that students can present their ideas clearly by verbal, written and graphical means.
f. Self-educative skills and flexibility of mind so that students are prepared for a world of accelerating technological change.
g. The skills necessary for working in a team on a large scale project.
h. An understanding of the process of high tech product development.
i. Skills in the object-oriented approach to systems analysis, design and implementation.
j. The communication and management skills required to successfully manage product development projects.
k. An understanding of social, legal and ethical issues confronting the engineering professional.
l. Ability to master the entire design process from concept to manufacturing
m. Ability to use the knowledge resources of other people and the particular blend of technologies which provide the most optimal design solution
n. Leader in the initiation and integration of design
o. Interdisciplinary knowledge of various techniques

7. The Proposed Curriculum

The curriculum for mechatronics as given by different universities and institutes shows a wide spectrum of varieties when considering the application part. On the other hand, most of the proposed curricula agree on some basic courses to be integrated with the mechanical engineering core courses to complete the curriculum needed to give a certificate in Mechatronics. The application part may be covered with presetting orientation in the associated labs, in courses with small projects, and the final graduation project. This approach of developing the curriculum is more suitable if the Mechatronics become an option for the mechanical engineering student. These basic courses are already available from electrical and computer departments, however some

modifications may be needed in the teaching approach to orient them in the favor of Mechatronics Certificate Requirements.

The objective of this development is to set up a new curriculum track (option) on "mechatronic engineering" in addition to the existing track in "thermofluid-design". Undergraduate engineering education at KSU consists of two phases: an interdisciplinary core curriculum, with instructors from various departments, followed by the disciplinary curriculum implemented by an individual department.

According to the stipulation by the Accreditation Board of Engineering and Technology (ABET), each BS degree program should have curriculum tracks which consist of a capstone and a number of elective courses. The capstone course (project) synthesizes the knowledge and skills taught in these designated elective courses with an emphasis on system design in the area of specialization. The structures of the current and proposed curricula of the Mechanical Engineering Department are illustrated in Figure 3. Academic units associated with each group of courses are indicated beside the groups. After completing courses in the Lower and Upper Division, the students are required to complete their BSME degree requirements by selecting one of the two tracks.

Five new specific courses with their associated laboratories were identified. Description of these five new courses is given in Appendix I. In these courses, emphasis is placed on physical understanding rather than on mathematical formalities. The key mechatronic areas of study covered in these courses are:

- Mechatronic system design principles
- Modeling, analysis, and control of dynamic physical systems
- Selection and interfacing of sensors, actuators, and microcontrollers
- Analog and digital control electronics
- Real-time programming for control

Throughout the coverage, the focus will be kept on the role of these key mechatronic areas of study in the overall design process and how these key areas are integrated into a successful mechatronic system design. A premium will be placed on interactive learning through:

- student-team formation in the lectures and the discussion of design-related issues
- hands-on laboratory exercises, both in class and lab, involving industrial, off-the-shelf hardware
- computer-aided design involving the latest electronics simulation and control-design software, e.g., MATLAB, Electronics Workbench
- the encouragement of critical thinking throughout the courses

8. Expected Encountered Issues

At the beginning of launching the project, several issues may be encountered. Some of these issues are unique for this project, but many others appear to be generic for courses of multidisciplinary nature.

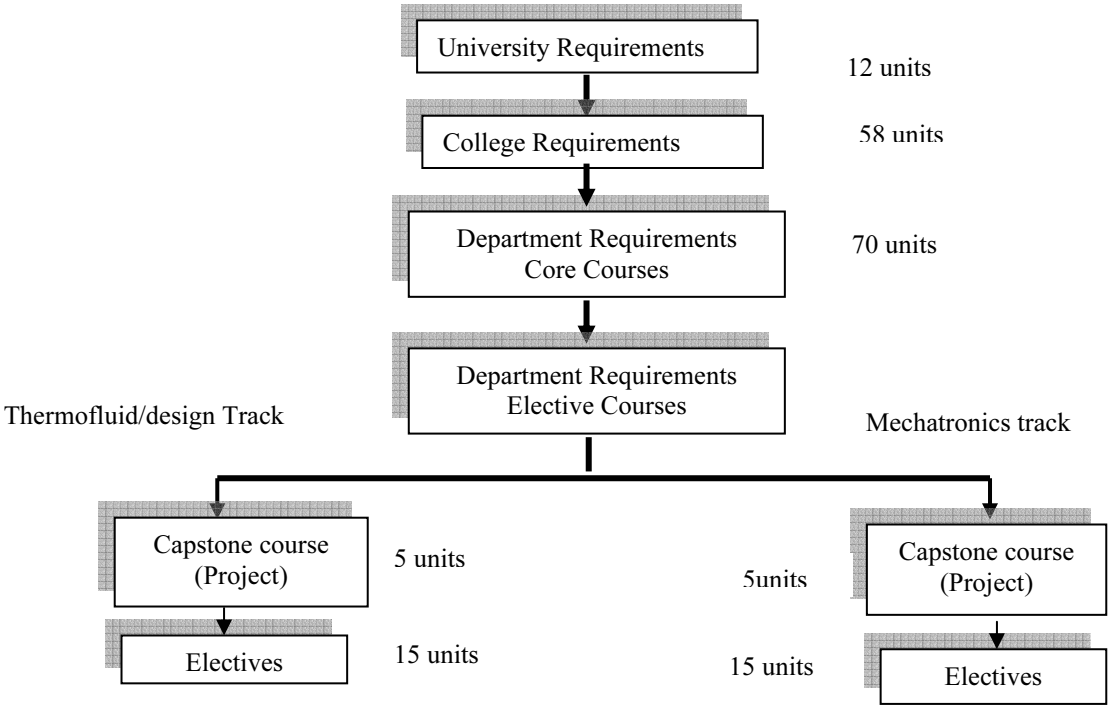

Fig. 3. Curriculum structure.

1. Student's awareness. Very few students of mechanical engineering program have heard about mechatronics. An intensive recruiting effort will be launched before offering such project. There will be seminars on mechatronics subject delivered to the students of the department by interested faculty and experts from selected local high tech industry.
2. Team teaching. Mechatronic curriculum is multi-disciplinary. As such, an interdisciplinary team is necessary to develop and implement such curriculum. Inter-departmental cooperation is thus the key to success for any such effort.
3. ABET accreditation. It is of interest of the institutions offering such program and seeking accreditation for the ABET to establish a special committee to develop evaluation criteria for the new multi-disciplinary Mechatronics Engineering degree program.

9. Concluding Remarks

There is a need for mechatronics engineers, and mechanical engineers should be familiar with mechatronics technology. Mechanical engineering professors teaching design must teach an integrated approach to design – mechanical, electronic, controls, and computers – and so must become proficient in these areas.

The essential characteristic of a mechatronics engineer and the key to success in mechatronics is a balance between two sets of skills: modeling / analysis skills and experimentation / hardware implementation skills.

Through modern mechatronics engineering, new avenues of thinking and design can greatly enhance the utility, performance and efficiency of modern machinery.

An inter-disciplinary team is necessary to develop and implement such multi-disciplinary curriculum. Consequently, inter-departmental cooperation is the key to the success for any such effort.

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APPENDIX I

New Mechatronics Courses

1- ME 462 Fundamentals of Mechatronics Engineering 4(3,1,2)

Dynamic system modeling, instrumentation, actuators, and computer--based data collection; Application of modeling, sensors, and actuators to feedback control systems. Microcontrollers are used to implement control systems in laboratory projects. Term project.

2- ME 463 Microprocessors and Microcontrollers 2(2,1,0)

Fundamentals of Microprocessors, Basic structure and operation, assembly language and programming, macro-assembler and simulator, selection guide for a microprocessor, Digital control using microprocessor, applications in industry. Introduction to microcontrollers.

3- ME 465 Analog and Digital Interfacing with Microprocessors and Microcontrollers 3(2,1,2)

Fundamentals of digital-to-analog (D/A) and analog-to-digital (A/D) circuits, relays, stepper motors interfacing, and digital switches. Interfacing digital and analog circuits

to computers and micro-controllers. Term project.

4- ME 466 Control of Electric Motors 2(2,1,0)
Principles of operation, mathematical models, and control techniques for electric motors. Types of motors include brush DC motors, stepper motors, brushless DC motors, synchronous motors and induction motors. Topics covered: steady-state and dynamic characteristics, torque limits and field weakening operation, characteristics under voltage and current sources, open-loop and closed-loop control of position and velocity, and field-oriented operation for AC motors. Laboratory included.

5-ME 467 Advanced Electronics 4(3,1,2)
Basic components and introductory integrated-circuit electronics. Operational amplifiers, timers ,analog signal processing circuits semiconductor power switches Noise and noise reduction. Transmission lines. Laboratory includes use of PCs in data collection and analysis, and in process control; advanced digital control techniques, interfacing to real-world equipment; sophisticated 32-bit processors used; Standard buses, serial and parallel, available development boards and tools, hardware and software treated. Laboratory included. Term project.

It is to be noted here that a basic electrical and electronic course is already given for all mechanical engineering students; therefore this course is not included in the above description.

تطوير برنامج هندسة الميكاترونيات لمرحلة البكالوريوس

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قسم الهندسة الميكانيكية

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المستخلص: نظرا للطلب المتزايد من جانب مستخدمي المعدات الميكانيكية على تزويدها بالعديد من الوظائف الذكية والتي تجعلها أكثر كفاءة ويسرا في الاستخدام فقد أصبحت هناك ضرورة ملحة لاستحداث تخصص هندسي جديد يلبى هذه الحاجة . ولقد أصبح علم الميكاترونيات الآن من المجالات الواعدة لتحقيق تصميم متكامل يجمع الوظائف الميكانيكية المطورة والمعتادة حيث يمثل لمهندسي التصميم المدخل الأساسي لتعلم طرق تصميم وبناء المعدات الذكية . ويجمع علم الميكاترونيات علوم هندسة الميكانيكا والإلكترونيات والكهرباء وبرامج الحاسوب من أجل التصميم والتطوير والتحكم في المعدات الميكانيكية المعقدة . وبالرغم من احتواء المعدات على البعض أو كل من هذه الأجزاء فإن طبيعة الدراسة الحالية بكليات الهندسة تتناولها بصورة مستقلة ومنفصلة دون النظر لأهمية استيعاب الطالب لأهمية ربط هذه العلوم مع بعضها للوصول إلى التصميم الأمثل . ويعد الإلمام بالعلوم الهندسية الأساسية مثل تحليل ونمذجة الأنظمة – نظرية التحكم واتخاذ القرار – الحساسات وتكييف الإشارات – إلكترونيات القدرة ووحدات التنفيذ – دوائر الاتصال بالحاسب – الأنظمة المدمجة والنماذج الأولية للتحكم السريع من المواد الأساسية لعلم الميكاترونيات . وعلى الجانب التطبيقي للميكاترونيات نجد مجالات مثل الطب – التسليح – التصنيع – السيارات – والمعدات الذكية الأخرى .

ويهدف برنامج خريجي تخصص الميكترونيات إلى إمداد الطالب بالمهارات اللازمة لتحقيق التكامل بين العلوم السابق ذكرها لتطوير معدات أو أجزاء منها لخدمة التطبيقات المذكورة بل وربما استحداث تطبيقات أخرى . كذلك تكوين الخبرة اللازمة للعمل مع فريق من المهندسين في المجالات الهندسية المختلفة كالكهرباء والنظم والكيمياء ...الخ ويشمل هذا أيضا تطوير مهارات الاتصال والمناقشة وإعداد التقارير وعرضها .

والمحتوى الحالي لمقررات الميكترونيات في جميع كليات ومعاهد الهندسة بالمملكة العربية السعودية لا يتعدى بعض المقررات المنفصلة دون وجود عوامل ربط بينها لتحقيق الأهداف المرجوة من هذا التخصص ، في حين نجد أن العديد من الجامعات الأمريكية والأوربية والأسيوية بدأت منذ أكثر من عقدين في تفعيل برامج متكاملة بحيث أصبح لديها الآن أقسامًا مستقلة تغطى هذا المجال الحيوي .

وسوف نتناول من خلال هذه الورقة مقومات البدء في استحداث هذا التخصص بالجامعات السعودية والوضع الحالي ، كذلك سوف نعرض نموذجًا هيكليًا للمقررات المطلوب دراستها مع إعطاء نبذة مبسطة عن كل مقرر وعلاقته ببعض التطبيقات الحالية.

Service-Learning at King Abdul Aziz University: A Successful Implementation in a Web Authoring Course for Women

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ABSTRACT. In service-learning, students integrate what they learn in the classroom through community service. This paper describes service-learning in a higher-level web authoring computer science course taught to women at the King Abdul Aziz University (KAAU), Jeddah, Saudi Arabia. The paper describes how service-learning is carried out as part of the course completion requirements. Students in this course are required to build a Web Site that serves an entity in the society. The paper also describes a successful partnership between the Computer Science (CS) Department and The Savola Group, a major conglomerate in Saudi Arabia that decided to support the service-learning initiative as part of its Corporate Social Responsibility (CSR) program. Although the partnership is still recent, the initial indicators and results of the first implementation during the previous semester seems encouraging and reflects the success of the concept and its valuable benefit to the students and to the community at large.

Keywords. Human-Computer Interface, Service-Learning, Web Design, Community Service, Curriculum.

1. Service Learning

Service-learning in the Disciplines, as defined by the US National and Community Service Trust Act of 1993, is:

"A method under which students learn and develop through thoughtfully organized service that: is conducted in and meets the needs of a community and is coordinated with an institution of higher education, and with the community; helps foster civic responsibility; is integrated into and enhances the academic curriculum of the students enrolled; and includes structured time for students to reflect on the service experience."

The term service-learning was coined in 1967 to describe the educational practices

and theory of integrating classroom concepts with a related community service experience. Honnet and Poulsen summarize the benefits of service-learning by "Service, combined with learning, adds value to each and transforms both" [1, 2].

Many faculty members across disciplines in various countries apply service-learning to connect the academic learning in the classroom to projects in the community.

In service-learning, experiential learning in the form of fieldwork combined with academic study takes place under the supervision of an appropriate faculty member. In a typical service-learning formal setup, a student must contract with a client, a faculty member, and a service-learning program coordinator, if available, to arrange for how the service-learning will take place. Although in most cases service-learning implies learning through providing a traditional service to the community, according to the National Service Learning Clearinghouse, the definition of service-learning is still evolving [3].

2. Benefits of Service Learning

Students in applied fields benefit enormously from experiential learning in which projects with external clients are completed. Learning to create products and services without a connection to those who will use the products and services provides a limited view of the production process. In dealing with real life issues such as accuracy, completeness and clarity of requirements, soundness of design, product usability, thoroughness of testing, and understandability and comprehensiveness of consumer acceptance - the students gain enormous insight. Service-learning is a type of active learning in which students are required to conduct an activity, as apposed to passive learning in which learners are required to read or look at pictures. In active learning produces a 70-90% retention rate of learnt material while passive learning only produces a 10-30% retention rate [4]. While projects are time consuming, students acquire more accurate and complete pictures of development lifecycles than they could without the projects.

A report by Eyler *et al.* [5] summarized the findings of service-learning research in higher education over the years [1993-2000]. The report documents both personal and social effects on students. Personal outcomes reported include positive effects on student personal development in areas such as personal efficacy, personal identity, spiritual growth, and moral development. Also reported are positive effects on interpersonal development skills, the ability to work well with others, leadership and communication skills. The summary also states that service-learning contributes to career development. Social outcomes reported include reducing stereotypes and facilitating cultural and racial understanding. Service-learning was also found to enhance social responsibility, citizenship skills and commitment to service.

Furthermore, researchers found service-learning to have a positive impact on students' academic learning. Not only does service-learning improve students' ability to apply what they have learned in "the real world", it also has an impact on academic outcomes such as demonstrated complexity of understanding, problem analysis, critical

thinking, and cognitive development.

Students engaged in service-learning report stronger faculty relationships than those who are not involved in service-learning. They also have higher chances of graduation. When becoming involved in service-learning, student satisfaction with college is improved. [5]

By involving students in real projects, the students are empowered with a sense that they can make a difference. Furthermore, by involving them in community service students are empowered with a sense that they can improve the society and get a sense of civic duty that will last a lifetime.

The Eyler report also states that research found communities to report satisfaction with student participation in service-learning activities, as it was found beneficial to communities through the useful services students provide. Moreover, communities report enhanced university relations through service-learning programs.

For faculty members, overseeing real world collaborations provides them with a valuable tool that enables students to connect what they are learning in the classroom to actual experiences working in the community. In addition, faculty members overseeing such projects are able to stay current in their fields and to forge closer ties with the industry, which in turn helps improve the understanding of the job market, thereby increasing the relevancy of the topic taught to the real world demands.

For the educational institutes, such collaboration will produce more and better internships for students and jobs for graduates, a need that continues to increase in importance. In several model institutes of good practices in service-learning, collaborating faculty members receive stipends from the hiring agencies to encourage their active participation in the program. Furthermore, tangible benefits to the institutes are increased visibility and positive publicity that leads to more funding [6] and better jobs for graduates.

For clients, receiving services from students provides fresh current insights on new methods and practices. Furthermore, clients will benefit from having a say on what talents and skills are needed in new graduates as they will influence curriculum to better meet their current demands. Moreover, clients will receive high quality services as service-learning will be graded by faculty and supervised by high quality expertise for low costs.

3. Computer Science and Service Learning

Colleges and universities report institutional commitment to service-learning curriculum. Furthermore, colleges and universities report availability of service-learning programs. However, it is unfortunate that only a few colleges and universities require service-learning in their academic core [1].

Service-learning is not very visible in the Computer Science education community, although faculty and students could gain great benefits from the integration of service-learning practice and theory into curricula [1]. Sanderson calls for Computer Science faculty involved in service-learning to develop, apply and disseminate effective frameworks for integrating service-learning into the undergraduate CS curricula.

3.1 *HCI and Service-Learning*

As technology evolves, so does the area of Human Computer Interaction (HCI). In a CHI 2002 Panel: Pinning a Tail on a Moving Donkey, Lazar *et al*. assert that the area of HCI education must continuously evolve to meet the ever-changing needs of users. The Panel claims that the limits of user-centered design are currently being challenged by collaborative and distributed systems, such as web sites and hand held devices, and that more user participation in design is needed. The Panel also argues that traditional HCI testing methods require make-overs to ensure they are relevant to user needs. Thus, the concept of 'user-centeredness' for students must be put into practice with combinations of work-place visits, internships and experiences of different kinds of usability testing [6]. Based on the above, service-learning in web design can produce great benefits to students.

4. The KAAU CS Department Service-Learning Initiative

4.1 *The CS 483: Web Authoring Course*

The CS 483 course is a three credit hour upper division course taught at the women's CS department at King Abdul Aziz University (KAAU) in Jeddah, Saudi Arabia. Students enrolled in the course learn and practice the complete cycle of web development, from gathering user requirement to deployment of sites on the www to user testing. Students study different programming languages, HCI basics and usability standards as part of the course. Students in groups of 2-6 members choose a client in the community that is in need of a web site during the first two weeks of the course. The groups apply all what they learn in class to build user-friendly and useful web sites that meet their clients' needs. The number of students in each group is contingent upon the instructor's approval which is based on matching the scope of the project to the number of members. At the end of the semester, each group is expected to have a complete professional web site, that serves the needs of the client, up and running.

4.2 *Examples of web sites built in the spring of 2004*

The projects developed during the spring 2004 semester serve a wide range of customers, both for profit and not for profit organizations. The clients included the Mental Health Hospital of Jeddah, A.R. Khalil's Museum of Art, The Science & Technology Center, three philanthropic associations: (Nabe' Al-Wed Charity, Sanabil Al-Khair Charity, and Jameyat Tahfeeth Al-Quran), four different departments at King Abdul Aziz University, The KAAU Immunology Lab at the Medical Center, two CS course instructors, The KAAU Accreditation Unit, an on-line Tutorial for Arabic Sign Language for a center for disability, an elementary school, three small businesses, and five subdivisions of The Savola Group: a major food conglomerate in Saudi Arabia.

5. The CS Department/Savola Partnership

According to The Savola Group's mission statement, The Group "is now one of the Kingdom's leading industrial companies. The Group actively works toward

enhancing and widening its Corporate Citizenship role based on its «Balanced Way» corporate culture. Part of the «Balanced Way» is Savola's commitment to the "taqwa" or Conscientiousness value which includes the Group's responsibility to the community at large. Savola takes an active role in social, environmental, and community concerns. The Group engages in activities that serve the community such as Saudization, education funding and empowering women." [7]

With that in mind, the instructor of the Web Development course approached The Savola Group in request of sponsoring the Service-Learning initiative. The Group welcomed the idea and accepted the proposal set by the KAAU CS Department.

As part of its Corporate Social Responsibility and its commitment to the community, The Savola Group decided to support the KAAU CS Department Service-Learning Program and to embrace it. The Group signed a one-year contract with the CS Department to sponsor students to build web sites that are needed by the Group or by the community.

5.1 *The Partnership Framework*

The KAAU CS Department and The Savola Group setup a framework through which the Group would support the service-learning initiative.

Both parties agreed that any enrolled student in the CS 483 course can voluntarily choose Savola as their web site client for their course project and that the web site requirements set by Savola, should directly relate to the material being taught while at the same time benefiting the Savola Group or any community entity Savola recommends. In successful service-learning the service experience should be related to classroom concepts and should focus on learning and not on service [4, 8] .

The Savola Group as part of its contract with the CS Department provides the course instructor a generous agreed-upon monetary grant every semester to be used to improve the CS 483 course for subsequent semesters. The Group also contracts the course instructor as a part time consultant to oversee the projects and provides a grant to hire an administrative assistant to help the instructor. Research reports lack of resources and lack of faculty reward as barriers to service-learning [5]. This is non-existent in this framework. On the contrary, with the agreed-upon support, The Savola Group encourages faculty members to actively participate in service-learning.

The Group also assigns a female coordinator who works for the Group as a point of contact for the students whose culture would prohibit them from working with male clients and to help answer all students' questions.

The students will work in groups of two-six members each, depending on the scope of the site. The groups will compete together while building the sites. The members will be required to go through a complete development life cycle from the stages of gathering user requirements to the stage of implementation and user testing.

The instructor of the course will oversee the complete life cycle and supervise the quality of the product. At the end of the semester, all participating students will receive an award of recognition in the form of a diploma. However, 2 groups will be selected to receive 1st and 2nd place awards in the form of plaques, and monetary awards for all

their members. All other groups, no matter how many, who submit sites that will actually be used by Savola or a community entity will qualify for 3rd place awards. Each 3rd place member will also receive a plaque and a smaller monetary award.

Evaluation criteria: Evaluation of the different projects will be based on the judgment of the course instructor and whether or not the web site served its intended goal as reported by the evaluation of Savola members.

5.2 *A First Implementation of the Framework*

During the first implementation of the partnership between Savola and the CS Department, 24 students out of the 103 students enrolled in the class volunteered to participate. Savola provided five different projects to the students. The projects were to build sites for the following different Savola owned entities: Savola Careers, Herfy: A fast food chain owned by Savola, Savola Packaging Systems (SPS), United Sugar Company (USC), Saudi Arabian Glass Company (SAGCO).

Fig. 1. The Savola Career Web Site.

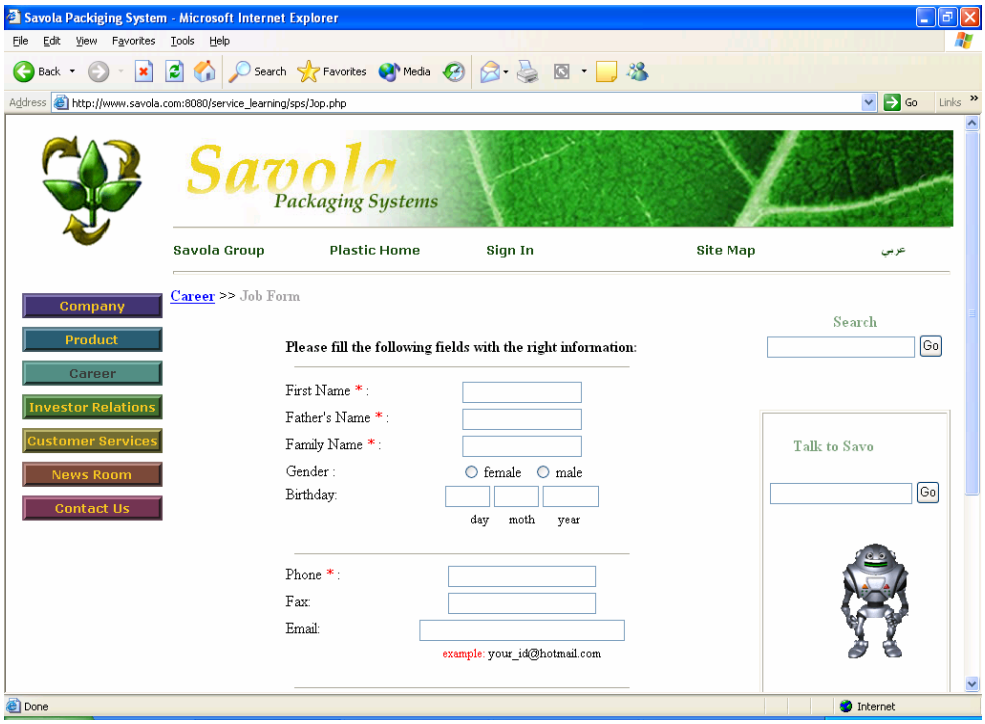

Fig. 2. The SPS Web Site showing SAVO the robot.

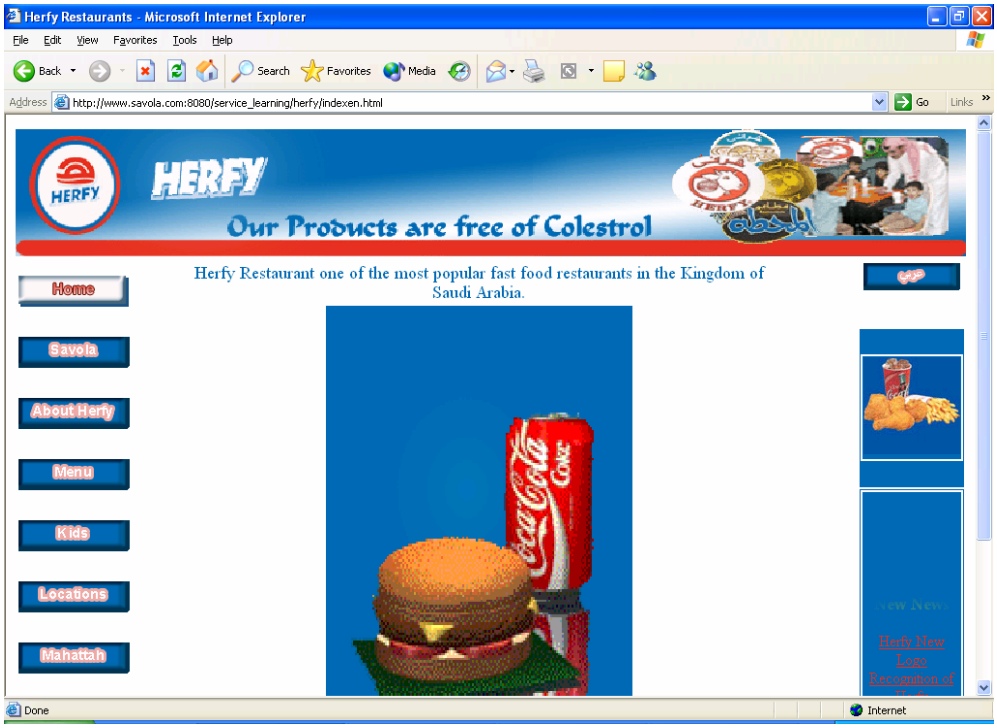

Fig. 3. The Herfy Web Site.

The participants produced very high quality web sites that qualified all of them for 1st, 2nd and 3rd places. The Savola Career group and the SPS group were both chosen as 1st place winners. The Savola Career group provided excellent competitor analysis, quality content, and online form processing. These were the group's main competitive advantages. The SPS group integrated what they studied in their AI course into the CS 483 course and so added an intelligent agent that provided online help to users. The Agent was a robot, the group named him SAVO short for Savola, which would accept questions from visitors and provide online answers. The group also provided online tools that would enable any non-technical person to update news and archive old articles, as Savola had a need to have a non-technical person update its news. The Herfy and USC groups qualified for second place. The Herfy group built two versions of the site (in Arabic and in English). The sites were very complete and the designs were very user friendly and usable. The USC group, although composed of 2 members only, provided animated images of the sugar refining processes, detailed maps, guest books, feedback forms, and many other features. The SAGCO group was granted 3rd place for producing a complete web site, but with a few minor problems in compliance with usability standards.

The Savola Group complied with all its agreed requirements and added a generous surprise ceremony in which the students were honored and given their awards.

5.3 *Student Evaluation*

After completing the projects, and before notifying the students of their placements, they were asked to evaluate their experience through a short survey in which their opinions were solicited about what they gained out of the experience, the obstacles they faced, how to improve the program, the awards, the coordinator contribution, and whether they will recommend participation in the program to others in the future.

Students reported several benefits gained from their participation in the program such as improving communication skills, applying what was learnt in class in real projects, competitor analysis, problem solving, learning from others, understanding one's rights and responsibilities, and time management. Interestingly, all students (100%) reported working in a group and dealing with a real client as the major benefits of the program. On the other hand, all students (100%) also reported data gathering as the major obstacle. This was due to many reasons. In some instances, it was difficult for some of the female students to visit male only work places to gather the needed information and the students had to depend on the coordinator to supply them with most of the information. The female coordinator faced the same problem. In others, the clients did not take the students seriously enough when they knew it was a class-related project thinking the end product will be of low quality and would never be used. And in some cases, the client did not really know what they needed on their web site. Similar obstacles for the same reasons have been reported in other service-learning in web development settings [9].

All students, with the exception of one, were also satisfied with the services and

help provided by The Savola Group coordinator. All students reported that the award was suitable. Suggestions for other awards were to provide fieldtrips to the Savola's industrial sites, letters of recommendations, job placements, and participation in the personal development training that The Savola Academy provides.

In evaluating the overall value of the program, students were given a likert scale of 5 choices ranging from the program being very unuseful to being very useful and were asked to rate it. All students reported the program as either very useful (75%) or useful (25%). When asked whether they will recommend the program to others, all students (100%) answered "yes", showing a positive reaction to the program.

5.4 *Coordinator Evaluation*

The Savola Coordinator was also given a chance to provide feedback on the program. The Coordinator provided similar feedback about the skills and benefits of the program as reported by the students. The Coordinator explained that the major obstacle she faces was the fact that she was unable to always provide the needed data to the students, thus some students always complained to her about the lack of needed data. The Coordinator recommends that the students be responsible in the future to seek their needed data directly from the clients without the need to go through her, as it was difficult for her to coordinate with five different clients. In order to further improve the effectiveness of the program, the Coordinator suggests the program be publicized in the community to gain support and to enable people to reap the benefits. The Coordinator also suggests applying the program in other CS courses such as Database Management and Software Engineering and in other disciplines such as Management, Marketing, Home Economics and Statistics.

5.5 *Results of the First Implementation of the KAAU Service-Learning Effort*

After completion of the course, and as a result of the successful application of the service-learning during the past semester, four female students were immediately contracted by The Savola Group to work on different web-based systems. The Savola Group also decided to take the service-learning initiative to a further level by negotiating similar contracts with the KAAU Dept. of Transportation in the College of Engineering to support students to research solutions for traffic bottlenecks in the city of Jeddah and with the KAAU Marketing Department to conduct market research.

Furthermore, the Jeddah Chamber of Commerce and Industry (JCCI) is currently considering to contract with KAAU using the same framework to support the service-learning initiative. The JCCI is also considering similar relations with the Department of Graphic Design at another local women's college, as it is not offered at KAAU. The JCCI will contract the Graphic Design major students to work on publications for the JCCI.

The Savola Group, encouraged by the high quality student work and results of the first implementation, supported 2 more projects that support the community, one was to build a system web site for the First Science Teacher Symposium sponsored by the Ministry of Education and another was a web-based system for Al-Sayiddah Khadijah

Center at the JCCI which provides support and services for Saudi business women.

6. Online Resources on Service Learning

- Campus Compact http://www.compact.org/faculty

  "Campus Compact is a national coalition of more than 900 college and university presidents committed to the civic purposes of higher education. To support this civic mission, Campus Compact promotes community service that develops students' citizenship skills and values, encourages partnerships between campuses and communities, and assists faculty who seek to integrate public and community engagement into their teaching and research."
- American Association for Higher Education Disciplinary Resources on Service-Learning http://aahe.org/service/
- American National Service-Learning Clearinghouse http://www.servicelearning.org/higher_ed/index.html
- The American Summary Report: http://www.compact.org/resource/aag.pdf

  At A Glance: What We Know about The Effects of Service-Learning on College Students, Faculty, Institutions and Communities, 1993-2000: Third Edition.[5] "At A Glance" summarizes the findings of service-learning research in higher education over the past few years and includes an annotated bibliography. It is designed to provide a quick overview of where we are in the field today and a map to the literature.

7. Acknowledgments

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التعلم من خلال خدمة المجتمع في جامعة الملك عبدالعزيز: تجربة ناجحة في مادة بناء مواقع الشبكة العنكبوتية في قسم الطالبات

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المستخلص: التعلم من خلال خدمة المجتمع مبدأ يتيح للطالب فرصة تطبيق ما تعلمه في الصف الدراسي من خلال الخدمة الاجتماعية. وتتناول هذه الورقة تجربة تطبيق برنامج التعلم من خلال خدمة المجتمع في إحدى المواد المتقدمة في قسم الحاسب الآلي في شطر الطالبات بجامعة الملك عبدالعزيز بجدة، المملكة العربية السعودية. المادة التي تم تطبيق هذا المبدأ فيها هي مادة بناء مواقع الشبكة العنكبوتية التي تدرس لطالبات السنة الرابعة. وتعتبر خدمة المجتمع إحدى متطلبات المادة، حيث تقوم الطالبات ببناء موقع إلكتروني يخدم جهة معينة في المجتمع. كما تصف الورقة نموذجا لتعاون قائم في مجال التعلم من خلال خدمة المجتمع بين قسم الحاسب الآلي ومجموعة صافولا، إحدى الشركات المساهمة الكبرى في الشرق الأوسط؛ حيث تدعم مجموعة صافولا البرنامج كجزء من برنامجها المسمى "مسؤوليات الشركة الاجتماعية". وبالرغم من حداثة هذا التعاون، فإن المؤشرات الابتدائية والنتائج التي ظهرت بعد التطبيق الأول في الفصل الدراسي السابق تبدو مشجعة وتعكس نجاح التجربة والفائدة الكبيرة التي تعود على الطالبات والمجتمع، بإذن الله.