Creating a Knowledge Database for Lectures of Faculty Members, Proposed E-Module for Isra University

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Abstract—Higher education in Jordan is currently expanding as new universities open and compete for offering the best learning experience. Many universities face accreditation challenges, hence, they attend to recruit lecturers who may not have a solid teaching experience. Experienced lecturers tend to have high turnover rate, which cause knowledge loss. To prevent such loss, this research presents a knowledge repository framework. This framework will serve as a reference and a vessel of knowledge that builds and develops the educational and teaching capacities of professors/lecturers. It can also be seen as part of the electronic learning system, which brings benefits to students and enables them to retrieve any lectures they need. The main question we aim to answer is whether a knowledge memory can be designed and created to contribute in supporting the educational and teaching capacities of university lecturers. In order to answer this question, this research creates an electronic knowledge database to store explicit knowledge taken from lectures (written, audio and visual). These lectures are prepared and circulated or presented by university professors/lecturers throughout all university colleges and departments. This knowledge database resembles a cognitive memory that grows and develops with time.

Keywords—Knowledge; knowledge database; electronic knowledge database; Knowledge sharing

I. INTRODUCTION

Information and communication technology is an essential tool considering that it has two key abilities. The first is the ability to code knowledge and make it virtual and available. The second is the ability to create networks, with which knowledge can flow and be transferred within organizations (universities). By creating electronic knowledge databases, data can be provided to build the capacities of new and existing lecturers. Through the database, they can access the lecturing methods used by the university's qualified and distinguished professors. This would contribute in building an outstanding teaching staff that is able to provide the university with a competitive feature that favors it over others. This is especially important with the large number of universities currently present and the difficulty to find exceptional staff. Adding to this is the high turnover among lecturers in most universities

caused by job opportunities and advantages provided by other universities to attract the best teaching staff available. Therefore, building an electronic knowledge database for all university lecturers and specializations is necessary.

A. Study Question

The research question can be determined by asking a number of questions. Some of these questions will be answered in the theoretical part of the research. The remaining questions will be tackled in the practical part of the research. The questions are:

1) What is knowledge and how important is it considering that it is part of the intellectual capital?

2) Does the university under study have a knowledge database?

3) Can a knowledge memory (knowledge database) be designed and created to contribute in supporting and building the educational and teaching capacities of university lecturers?

This research shows the importance of adopting tools that are best able to improve the performance of the university. Such tools are tasked with storing knowledge electronically, maintaining it, and ensuring its flow and exchange among human resources who are hungry for this knowledge. Consequently, this would feed into developing and expanding their thoughts and ideas through adopting an electronic medium suitable for this purpose.

We decided to address this issue especially because it became a point of interest to many universities who wish to keep and store knowledge in an electronic manner and share it among staff. This directly feeds into promoting excellence as well as encouraging development among staff members.

B. Methods Used to Collect Data and Information

To address the study question and achieve its objectives, Arabic and foreign scientific sources, such as relevant periodicals, references, internet sites, were consulted to build the theoretical framework.
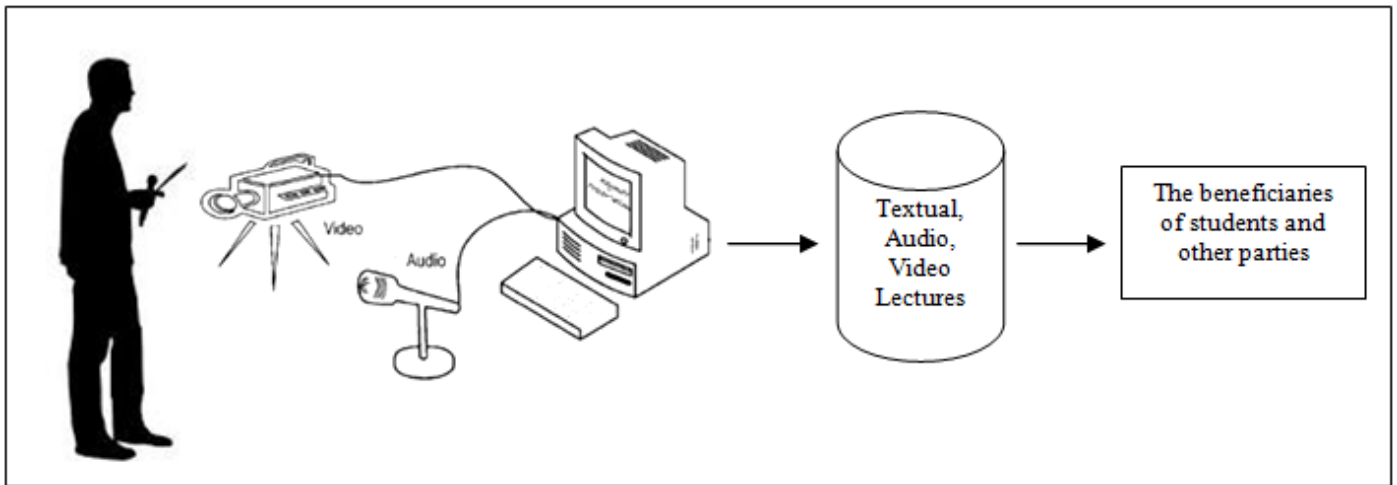
Fig. 1. The proposed system

Concerning the practical framework, data was collected from educational electronic websites or experienced lecturers at the university as shown in Fig. 1. This supports the creation of a computerized module to serve the university concerned with this study.

The study is divided into five parts starting with the introduction as part one. Part two presents the study's theoretical background and part three illustrates the fundamental principles of the intellectual capital. Part four shows practical steps of designing a database for a faculty, while part five presents the conclusions and the implementation ideology.

II. PART TWO: STUDY'S THEORETICAL FRAMEWORK

A. Definition of Knowledge

The concept of knowledge is very old and was the topic of ancient Greek, Roman and Muslim philosophers. The verses of the Holy Quran and the teachings of Prophet Muhammad (peace and blessings be upon him) stressed the importance of knowledge. As a definition, the meaning of knowledge is explained in dictionaries and lexicons as a clear and affirmed understanding of things, facts and behaviors [1]. According to Oxford dictionary, it is the process or act of acquiring information using ones' senses and intuition. Derver psychology dictionary says that it is a term that covers all different forms of learning ranging from understanding, imagination, remembrance, belief, contemplating, judgment and reasoning [2].

The importance of knowledge is found in the fact that it shows the level of people's awareness of what goes around them, and their ability to understand and deal with circumstances. That is because the operations of the brain play a critical role in human behavior. The human brain is the organ that stimulates people to make sound comparisons and decisions that are suitable for finding new problem-solving techniques [3].

The major development of ancient and modern civilizations is only a proof of their ability to learn and share knowledge. This idea can be seen as an integrative accumulative process that happens and forms on the course of relatively long periods of time so that it becomes usable and applicable for solving problems and specific circumstances [4].

Daft mentioned that knowledge consists of two parts: an apparent part that can be directly handled, moved and transferred into paper for easy reference, and a second part that is implicit difficult to document or transfer. This part includes skills, experiences and wisdom of individuals. According to this concept of knowledge, what an organization holds, whether internal system information, skills, or mental capacities of staff, form in their entirety a resource for the organization if they were used and managed in a scientific and reasonable way. This would certainly reflect on the performance of the organization by giving it an advantage over other competitors [5].

B. Types of Knowledge

There are various types of knowledge and those who develop it should be familiar of its differences. In fact, during the process of acquiring knowledge, it is important to know how to select it.

Bolisani & Scarso [6], Lundvall & Johnson [7] and Drew [8] identified four types of knowledge: Know-what, Know-why, Know-how and Know-who. Whereas, Kingston & Macintosh [9] added two extra types of knowledge: Know-when and Know-where. All will be described briefly, as follows [10]:

1) Know-what: includes knowledge of facts which is very similar in meaning to the term information; therefore, it is transferrable. Kingston & Macintosh describe it as the explicit knowledge of things; it includes concepts, as well as material topics and situations. Drew points out that it is used by experts and specialists.

2) Know-why: refers to the scientific knowledge of principles, laws, rationals, reasons, debates, applied research, justification of why things happened and how do they work.

3) Know-how: it's the knowledge of required actions for specific incidents and situations. According to Bolisani &

Scarso, it consists of applied capabilities to execute certain activities and Drew specifically assigns it to creative processes. The know-how relies on lengthy experiments that are the prerequisites of building expert systems. However, the problem with scientific experiment is that they are seldom documented. In short, the know-how is not the knowledge of books but rather a practical experiment.

4) Know-who: comprises of information on who knows what, and who knows how. Drew on this type indicates that it refers to the importance of individuals and social and political relations.

5) Know-when: is the knowledge needed to control actions and incidents [that happened or should happen] at the right timing.

6) Know-where: includes areas where knowledge is needed and asks questions to find where do communications come from? and where are the inputs and outputs of knowledge?

Lundvall & Johnson point out that types 1 and 2 can be easily codified and are included in explicit knowledge, while types 3 and 4 are difficult to be encoded and eventually fall under tacit knowledge.

Another more widely accepted taxonomy on knowledge, first introduced by Polanyi [11] and popularized by Nonaka and Takeuchi [12], is their categorization of explicit and tacit knowledge. According to these two, explicit knowledge is that which can be expressed in words and numbers and can be easily communicated and shared in the form of hard data, scientific formulas, codified procedures or universal principles whereas tacit knowledge is highly personal and hard to formalize. Personal insights, intuitions and hunches fall into this category of knowledge.

C. The SECI Model and Knowledge Conversion

The model was based on Polanyi's definition of tacit and explicit knowledge. In fact, Nonaka mentioned it in his book entitled "The Knowledge Creating Company" [13]. He then further explained it in his joint book with Takeuchi under the same title [12]. The main idea here is that there is a spiral interactive movement between explicit and tacit knowledge. This movement is accompanied by four conversion processes of knowledge that lead to the formation of the new organizational knowledge. The model consists of four blocks each representing a fundamental process of conversion (See Fig. 2). The mechanism of knowledge conversion in the SECI Model is explained as follows [14]:

1) Socialization: transfers tacit knowledge owned by an individual to a group of individuals working at the organization. This is possible at inter-organizational level through social interaction between employees, , and between employees and customers/suppliers or any recipient of the organization's services.

2) Externalization: knowledge is transferred from tacit to explicit on the individual to group level. Externalization is the second process of knowledge conversion. Moreover, Nonaka & Takuech indicated that it is an essential process as it converts knowledge from one type into a totally new type [tacit to explicit] [12].

3) Combination: here, explicit written knowledge [whether codified or digital] is converted to encoded bundles or configurations of explicit knowledge, which is also written. The conversion into explicit knowledge requires previous cognitive and mental processes.

4) Internalization: converts explicit knowledge to tacit knowledge from a group to individual's level. Nonaka &Takeuchi stress that continuous learning and collecting of the working individual's expertise through on-the-job-learning support the internalization process [12]. Conversion is achieved by redoing tasks and following relevant instruction. Furthermore, conversion takes the form of intellectual models that are known as the technical method.

D. Knowledge storage (Knowledge memory)

It includes processes of retention, sustainability, accessibility, retrieval and location. An institution may put in a lot of effort to acquire knowledge. Nonetheless, knowledge might be vulnerable to being lost either by failure to recall/remember it or retrieve it when needed [15]. Consequently, storing knowledge and the ability to retrieve it is a critical element in Knowledge Management. Often, this element is referred to as the "Organizational Memory", which is a term that refers to storing and recording intellectual capital. It comprises of the information which individuals use to work with, in addition to the knowledge in the systems and structures of that specific organization [16].

By the same token, to ensure continuity of the organization's knowledge base and achieve maximum benefit, this knowledge is ought to be stored, saved and retrieved at all times. Therefore, Knowledge Management should establish Organizational Memory [17].
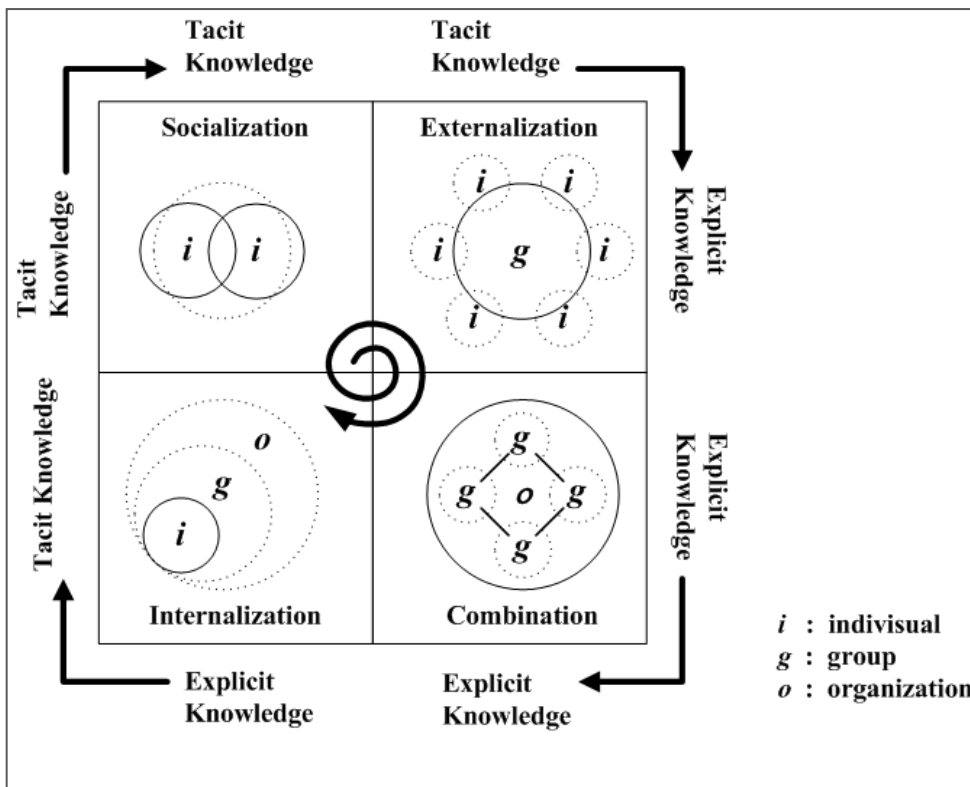
Fig. 2.   The SECI Model and Knowledge Conversion Source: Nonaka and Konno [13]

III.   FUNDAMENTAL PRINCIPLES OF INTELLECTUAL CAPITAL

Identifying the organization's assets, namely its intellectual assets such as knowledge depicted in an equation, a trade secret, an invention, a program or a process etc, is crucial to the organization's vision, its strategic plan, as well as its endeavors to gain competitiveness advantage.

Hence, the future of knowledge-dependant organizations relies heavily on the ideas they possess. In this age of information, greater attention is given to intellectual assets that are not only measured but might also outweigh its material wealth [18].

A. Firstly: The definition of Intellectual Capital (IC):

According to the Organization for Economic Co-operation and Development (OECD), Intellectual Capital is a subset of "intellectual assets". Malone considers IC as intellectual materials such as knowledge, information, intellectual property and experience, which can be used to create wealth [20].

Furthermore, IC can also be identified as "the knowledge that could be converted into value" [21]. Conversely, Hansen, Nohria and Tierney [22], demonstrated that "intellectual capital is the competitive measure that operates the creative and strategic development of an organization which depends on creativity and innovation, which are considered the key elements that lead to the survival of an organization in the quickly changing work environment."

Furthermore, knowledge is considered a new type of intellectual capital. Since knowledge is the information one has and benefits from, it is dissimilar to data that can be converted

to information. It is rather a combination of categorized experiences derived from one's vision or that of a company. The aim is to reuse the available information resources - of a company per say - in a positive manner. Knowledge generates new knowledge; thus, the intellectual capital never depletes, it is rather increased by accumulation [18].

B. Secondly: Components of Intellectual Capital:

Writers and researches did not agree on a unified classification of IC and ultimately identify its components. Davenport & Pursak [21] came up with a model of three main components: Human Resources, Intellectual Assets and Intellectual Property. Edvinsson & Sullivan [23], however, provided a model for companies' capitals, which is divided into two main components: the first is the material capital, while the second is dedicated to intellectual capital that includes both human capital and customers' capital. As to Stewart [24], he noted that IC breaks down to three components. The first is *workers*: who provide knowledge, innovations or solutions to customers' problems and eventually achieve profits for the company. Secondly, the *working system*: meaning the organizational structure or hierarchy that's being adopted by the organization. It is also the set of rules and principles the company abides by for its internal procedures, whether inter-organizational or with costumers in external environments. Lastly, the *customers:* who are an important source of information that is employed to further develop the company's production [24].

The human intellectual capital (education, capabilities and skills) is converted into a structural capital, i.e. a systematic documented knowledge and rules. In other words, it converts

tacit knowledge into explicit knowledge to avoid losing valuable knowledge owned by human competencies should they leave the place of work [25].

C. Thirdly: The Importance of Intellectual Capital

Intellectual capital is a good long-term profitable investment. Nonetheless, to accomplish the rewarding results, sacrifice should be made; it can be in the form of costs that are put upfront to obtain it. Yet, intellectual capital is the single resource that does not fall under the law of diminishing returns. Indeed, it never depletes; quite the contrary; it is an ever-growing accumulative resource that is used in generating and developing new ideas. Therefore, intellectual capital is regarded now as the actual capital on which companies' failures and successes depend [18]. Thus, modern administrations have based their selection processes on individuals with knowledge capabilities and are keen on providing more knowledge-stimulating environments. Given that, institutions and also countries have shifted their focus to intellectual capital since it is a primary indicator of a country's wealth.

Despite the downsizing of human resources by modern technology, as they have replaced many staff members, the remaining human resources are thought to be the ones with better qualities and competencies. Their stay is determined by their ability to grasp and apply modern technologies efficiently. The importance of intellectual capital is on the rise due to the domination of information technologies in this day and age [26].

Researchers see that knowledge has become an essential source for competitiveness. Therefore, organizations should equally own knowledge and be well-experienced on how to manage it. Those two skills together form what is known as "intellectual capital".

IV. PART THREE/ PRACTICAL ASPECT-STEPS OF DESIGNING A DATABASE FOR FACULTY LECTURES

This topic will be discussing the main steps -suggested by the researchers as shown in Fig. 3- on designing an electronic database for Isra University (IU), as follows:

A. Facts about Isra University Knowledge database

According to the researchers at Isra University, there is a number of knowledge sources that could be adopted to build a reliable knowledge database, such as:
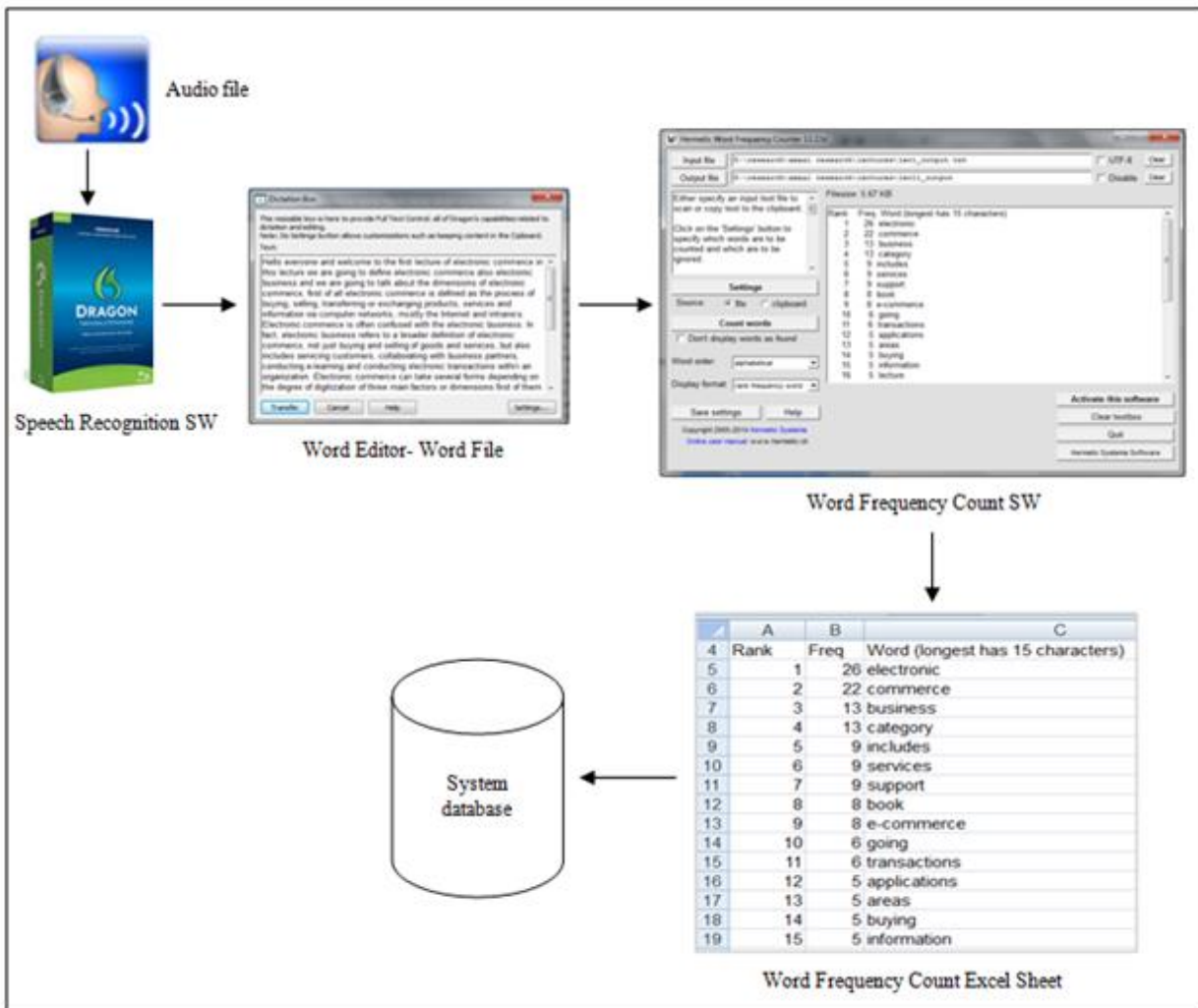

Fig. 3.   System Scheme

1) E-learning websites that is used by IU departments like the colleges of Science and Information Technology, Pharmacology, Nursing and Engineering. A page is dedicated for every lecturer. Lectures are being uploaded to the professor's designated page either as texts or as a Power Point presentation.

2) Since some departments do not have direct access to such websites, and in order to communicate with the students, researchers had no choice but to obtain the materials separately from the faculty and then upload the lectures in an electronic format.

3) The third and key source is the audio and visual lectures, which is thought to be the hardest to obtain as they not only require the approval of the faculty member providing them, but also the permission of the presidency of the university (IU). Moreover, cameras should be installed at the lecture halls in order to acquire the audio/visual materials. But since the halls are used by multiple academics, instructors that are not listed on the website [with little or no experience at all] can turn off the camera during their class. At the same token, they themselves can benefit from the service and see how lectures are being given professionally.

4) Another way to obtain recorded lectures is to ask the instructors and professors themselves to record some lectures in their offices during their free office hours. Doing this is very important even before the department decides to start recording lectures. The reason is that in order to convert an audio file into a written document (word file), we need to use speech recognition programs which are usually user-dependent. This means that the user has to train the program to recognize his/her voice and the way he/she talks before using it.

One more thing users need to know is that speech recognition programs work best when users dictate what they want to say- users should not talk fast- and they should keep the microphone close to them; otherwise the number of errors in the recognition process will increase.

B. Practicality

This topic focuses on the materials suggested by the researchers pertaining to designing a data of knowledge for universities, as follows:

1) System Analysis

Fig. 3 illustrates a scheme suggested by researchers for the process of lecture storage. It was translated electronically through a system specifically designed for universities and colleges as per specialization.
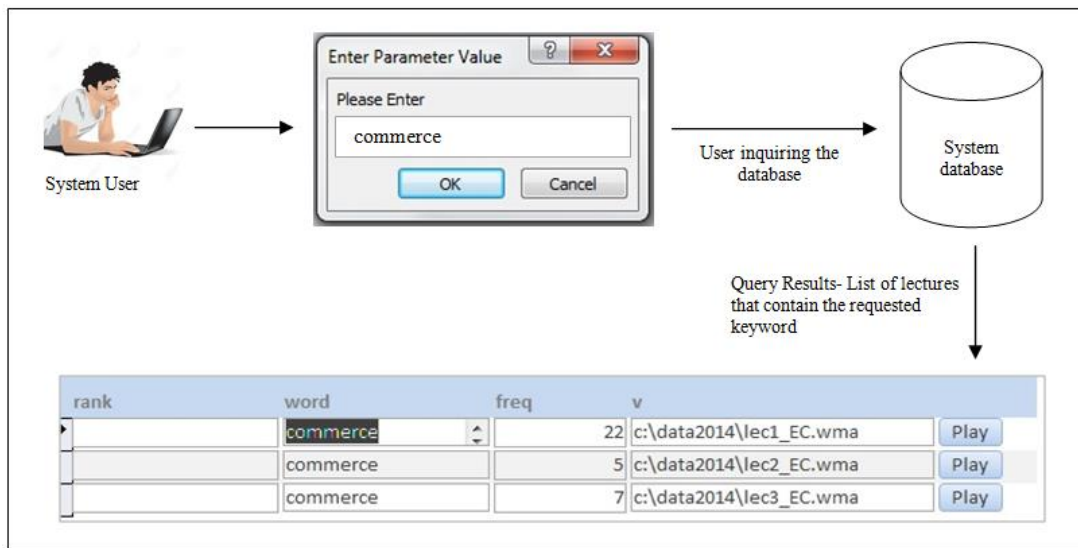
Fig. 4.   User inquiring the system

The proposed system as shown in Fig. 3 captures the recorded video and audio files from the instructor. The audio file is then passed to a speech recognition program that will convert it to a word file. Afterwards, a word count program is used to count the frequency of each word in that file so that when a user wants to search for some keywords he/she will be able to do so.

The speech recognition software that was used in our proposed system is Dragon NatuarallySpeaking 12.5. It was used to convert the audio lecture to a word document. The word file was then passed to Hermetic word Frequency Counter 13.223 software to create the word frequency excel file. The database of the system was created using Microsoft Access. Now when a user (student, instructor, etc.) wants to retrieve a lecture that has the keyword 'commerce' for instance (see Fig. 4), it will retrieve all lectures that contain this keyword according to its number of occurrences (frequency) and then the user decides which lecture he/she wants to watch or listen to.

2) System design

Several tables have been designed to store data according to their type, (for instance digital, analog, history, etc..) Each table has a unique primary key, and is interlinked with the rest of the tables to facilitate the inquiry and information retrieval processes later on.
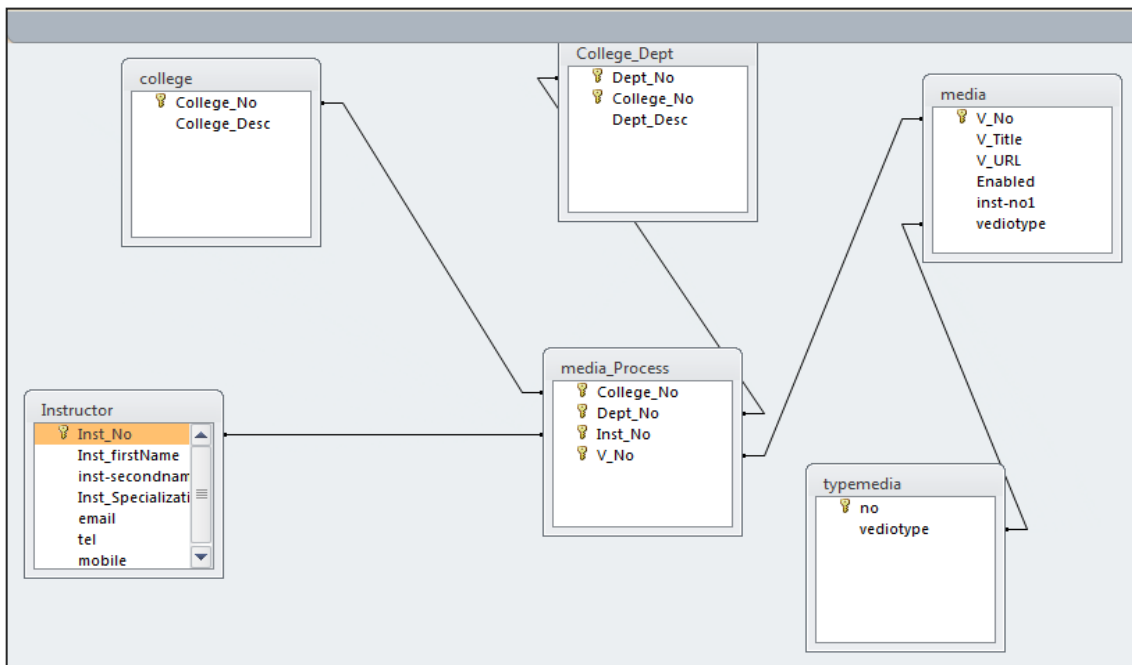
Fig. 5. The tables of the system using Microsoft Access

3) Establish relationships between tables

Relationships between tables are created upon providing primary and foreign keys. In this fashion, the main table and its sub tables will be identified easily and more efficiently done quickly on one hand, and it will keep the information under control on the other hand. Fig. 5 illustrates the relationships between tables.

4) System's interface and windows

Below is a brief description of the interface used in the system:

a) Main interface of the system:

It includes the list of lecturers/instructors, departments, colleges, and courses of each department, with learning materials according to its type; audio, video, and text-based materials (see Fig. 6).
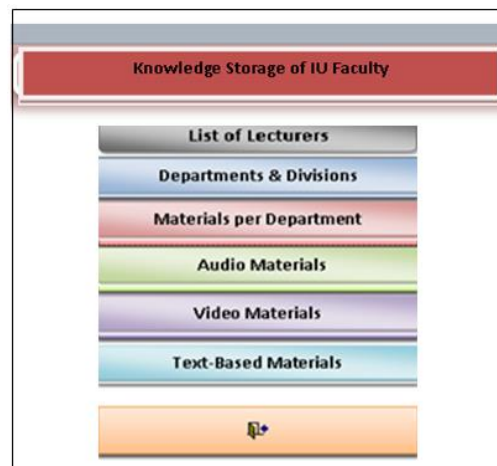
a) Faculty interface:

The interface allows adding, omitting and amending the list of faculty members and provides a bio on every instructor (as shown in Fig. 7).

C. Advantages and limitations of using the proposed system

In this section we will be discussing the advantages and limitations that were identified by the researchers during the development of this system. The advantages are:

- The programming model is composed of a database to store various information and knowledge as per university department.

- Streamlined informative and user-friendly interface to offer users fast and easy access of to the knowledge they are looking for.

- The module saves time, effort and costs.
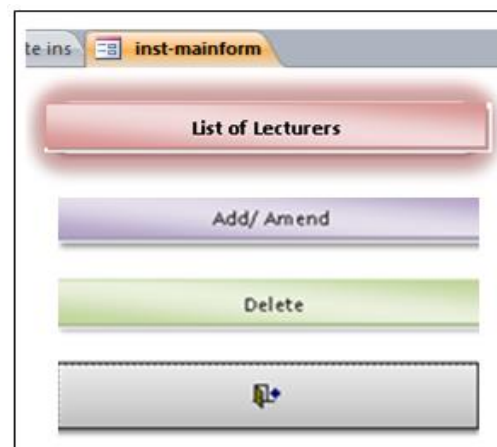

Fig. 6. The main interface

Fig. 7. Lecturers interface

- It offers quick and continuous updates. More so, password changes could be done from time to time.

- The model is adjustable, as future amendments can be easily applied.

- Elements can be added and/or deleted and authorities can be revoked and/or changed.

Whereas limitations are:

- Personal resistance from instructors and professors towards recording their lectures.

- The accuracy rate of speech recognition software plays a major role in the success of this database.

- Speech recognition software is user dependent; it means that each user of this software has to train the program on the way he/she talks and pronounce the words.

- Speech recognition software recognize only one language at a time (i.e. English in our case) while many of the lectures held in Isra' university are mixed (both languages Arabic and English are used at the same time) which makes it hard for the speech recognition program to accurately recognizes every word said by the instructor at that lecture. In this case, instructors have to go back to the word file generated by the speech recognition program and correct the words that were wrongly recognized.

V. CONCLUSIONS AND FUTURE WORK

Transferring and sharing knowledge is one of the most important stages of knowledge management in any institution or organization. The main objective of the study was to provide a proposed solution to what our Arab universities suffer from in terms of exchanging and sharing information between instructors and students and between instructors themselves. This study was able to achieve this objective through:

1) Presenting a theoretical framework about the definition of knowledge, its types and importance considering that it is part of the intellectual property of organizations.

2) Analyzing the situation on the field and study how knowledge flows currently in Isra University. Study the ability to computerize and store this knowledge in a database to build a knowledge memory approved by the university.

3) Building a proposed knowledge database that holds the lecturers' notes in all its formats whether texts, presentations, videos or audio recordings of lectures.

The proposed system was tested by the three researchers including recording lectures, storing them into the system and retrieving them. The system fulfilled all the users' requirements and the user-interface was easy to interact with. The MIS department at Isra University will start using the system on Oct. 2015 so that researchers are able to test the system over a whole academic year. After that, the system will be evaluated by the three researchers at the end of the 2015/2016 academic year and later on results will be published.

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