Synergizing User's-defined Requirement Design for Crafting a Knowledge Sharing Management System

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***Abstract*— Existing knowledge management initiatives, in most cases, make it easier to create repositories for lessons learned. This is accomplished by employing the internet pattern to search documents, utilizing web-based technologies to facilitate community discussions, or providing support for the gathering of tacit knowledge through the utilization of group decision support systems. However, despite the fact that these solutions have been successful in the short term, it is generally acknowledged that the true solution to the management and sharing of organizational knowledge will be in the development of an appropriate system methodology and process for having knowledge held in a manner that makes use of user-design perceptive. That is, there is a requirement for it to first receive feedback from users. This is the reason why this research approach, which is based on a questionnaire, is being used to identify the most important requirements for a Knowledge Sharing Management System from the users' point of view. According to the findings, 87.5 percent of the participants highly revealed that the general discussion forums and asking questions regarding a specific course is central key to the Knowledge Sharing Management System, because everyone that pass-through left something there. Similarly, the development of a Knowledge Sharing Management System that is suitable for academics in the field of Computer Science is anticipated to improve the effectiveness of knowledge-sharing management in the classroom. The findings presented here make a contribution to the creation of a Knowledge Sharing Management System within the context of higher education institutions' instructional practices.**

Keywords—Knowledge Sharing (KS), Knowledge Management System (KMS), Soft System Methodology (SSM), Joint Application Design (JAD)

I. INTRODUCTION

High education institutions, often known as HEIs, are communities that require a significant amount of knowledge and are involved in the process of both sharing and producing new information. When it comes to the task of academics, which is the primary component of higher education, teaching is a crucial responsibility that must be fulfilled. In higher education institutions (HEIs), the success of the institution is significantly dependent on the quality and expertise of its academic members. According to [1], academic experience in teaching a particular subject is acquired, over the course of many years, through various teaching techniques. This expertise encompasses both the know-what and the know-how regarding teaching the subject at hand. The term "know-what" refers to the fundamental information on the subject matter of the course that must be communicated to the pupils. The implicit knowledge that incorporates educational strategies and best practices for imparting knowledge is referred to as the "know-how" knowledge. The term "teaching-related knowledge" refers to experiences that have been maintained over time and developed through teaching. Academics who teach the same subjects or courses frequently fail to effectively communicate their knowledge with their colleagues. This is because they are faced with a demanding schedule that includes a multitude of obligations, which might hamper their capacity to share their expertise. It is possible that the quality of education that is delivered to students would suffer as a consequence of this lack of knowledge interchange.

It is almost impossible to exaggerate the importance of knowledge-sharing among academics, particularly in the field of teaching, where each and every piece of information has the potential to significantly influence the learning experience of a student [2]. As a means of contributing to the aims of Vision 2030, the Saudi Ministry of Education (ME) places a strong priority on the growth of higher education as one of its top priorities [3]. Because of this, Saudi institutions are constantly looking for new and inventive ways to improve their academic performance and maintain their position as leaders in their field. According to [4], one of the issues that higher education institutions in Saudi Arabia face is the promotion of effective knowledge sharing and collaboration among academics in order to make use of the enormous teaching-related knowledge experience. As an illustration, particular knowledge-sharing management systems are implemented within a classroom setting. As a result of this, the management of knowledge sharing has become an important strategic goal for a great number of academic institutions that are committed to maintaining their competitive edge in an environment that is constantly shifting. Over the course of the past few years, there has been a growing emphasis in academic study on the potential benefits that could be gained by adopting knowledge management systems into educational institutions. According to [5, 6], higher education institutions (HEI) can make use of technology to improve the efficiency of the implementation of knowledge sharing management. Therefore, the establishment of a management system for the sharing of information might potentially help to the facilitation of efficient knowledge transfer and application by academics, as well as the preservation of knowledge for the purpose of benefiting at the appropriate moment [4]. In addition, it will reduce the amount of time that employees at higher education institutions need to spend searching for information that is relevant to their responsibilities. In order to satisfy the requirements of the computer science academics, the purpose of this research is to determine the requirements of the teaching-related knowledge sharing management system. In order to create an effective system, it is necessary to conduct a comprehensive analysis and be aware of the needs right from the beginning. According

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to [7], if this is not done, it might result in severe delays and setbacks during the phases of development which are associated with the overall system. According to the findings of previous research [8-10], the reasons for the failure of Knowledge Sharing Management System (KSMS) implementation in organizations include a lack of active participation from individuals inside the organization as well as a failure to incorporate all important stakeholders. It is advised the incorporation of Knowledge Management System (KMS) users into the design team, helping the identification and resolution of usability difficulties and other hurdles throughout the design phases [9, 11, 12]. For the purpose of addressing this obstacle, this research utilized a combination of soft system methodology (SSM) to determine the nature of the issue, as well as the Joint Application Design (JAD) technique to assess the prototype development process.

The goal of SSM is to investigate and comprehend the requirements that are associated with human activities that are relevant to knowledge management. JAD, on the other hand, seeks to involve end-users and stakeholders in the development process while simultaneously reducing the likelihood of miscommunication and misconceptions that tend to occur in traditional techniques of requirements gathering. It was therefore possible for participants to provide instant input on the system's visual and functional qualities. This real-time feedback is quite helpful for the purpose of tweaking and getting the prototype better.

II. LITERATURE REVIEW

A. Knowledge Management System

According to [13], one of the most essential ways to assist a university administration in the creation, sharing, management, and dissemination of knowledge is through the use of knowledge management (KM). According to [14, 15], the implementation of such processes is a promising method for improving the performance of an organization, as well as its productivity and innovation capability. According to [16], with the utilization of these procedures, educational institutions are able to more effectively capture, store, and transmit knowledge. It is the responsibility of knowledge management (KM) to supply academics at higher education institutions with pertinent information that could be used in enhancing curriculum development, reducing the amount of time required [17], improving pedagogical and learning outcomes [18], and enhancing productivity and performance [19]. Establishing a well-coordinated integration of many components, including as personnel, procedures, and technology, is absolutely necessary in order to efficiently manage knowledge. The accumulation, compilation, storage, dissemination, and evaluation of knowledge are all made possible by this integration. The careful management of these components enables firms to guarantee that their knowledge resources are employed in an efficient manner, which ultimately results in improved decision-making, enhanced performance, and increased success. According to [20], the sharing of information is often considered to be the most important aspect of a knowledge management system. In addition to this, the tactics that it employs contribute to the growth of both individuals and organizations [21]. Ranjan and Khalil [22] pointed out that one of the primary goals of Knowledge management (KM) in academic settings is to facilitate the exchange of knowledge among faculty members across a variety of academic programs. Many HEIs face difficulties in their existing knowledge management procedures, which results in less than ideal collaboration and information exchange. This is despite the fact that the necessity of knowledge sharing is widely accepted. The scholarly discourse, on the other hand, highlights the necessity for Knowledge management in public academic institutions to address critical knowledge processes. These activities include the skilled capture, archival, management, and dissemination of knowledge. In order to guarantee the productive implementation of such a system, it is of the utmost importance to have a full understanding of the user requirements that are in accordance with the specific circumstances and requirements of higher education institutions. For the purpose of designing a teaching-related knowledge sharing management system in higher education institutions in Saudi Arabia, this study employs the Joint Application Design (JAD) methodology.

III. RESEARCH METHODOLOGY

A. Soft Systems Methodology

The Soft Systems Methodology, sometimes known as SSM, is a strategy that is used to investigate and solve difficult management and organizational problems. In the 1970s, Professor Peter Checkland was the one who created it, and it has since found widespread application in the field of information systems [23]. When dealing with human perception, values, and social systems, SSM is especially helpful because of its practical application. This helps to capture the many perspectives and concerns that are held by the individuals concerned. Through the utilization of a method known as "Root Definitions," SSM is able to explain the nature and purpose of a system. In order to accomplish this, it is necessary to characterize the pertinent systems and subsystems, as well as their functions, owners, and the environment in which they function. When it comes to addressing "soft" problems, which are ill-defined, include various views, and are frequently characterized by human subjectivity, structured solution modeling is particularly useful. In order to assist companies in exploring and comprehending the complexities of their circumstances prior to implementing changes, it offers a problem-solving strategy that is both structured and interactive. Analysis of system needs is performed by Soft Systems Methodology (SSM), with a special focus on the "human activity system" that necessitates the assistance of a computer system [24]. In a prior phase of this study [25], data was gathered by conducting seventeen semi-structured interviews with individuals holding a variety of academic positions and having diverse degrees of teaching experience in the Faculty of Computer Sciences at Jeddah University. The interviews were conducted with the purpose of gaining a full understanding of the teaching-related knowledge activities that are currently being carried out by the faculty, as well as the requirements that computer science academics have for a new tool that may facilitate the sharing of knowledge. For the purpose of gathering the participants' thoughts on teaching-related information sharing among peers in higher education institutions, the interview questions were devised. An invitation to participate in the interviews was sent via email to all of the faculty members working in the Computer Science (CS) department at Jeddah University in Saudi Arabia. Reference [25] found that current practices reveal a notable challenge: the absence of efficient communication channels beyond traditional face-to-face interactions. This issue is compounded by academics' heavy teaching commitments, leaving them with minimal time for

knowledge exchange. The findings underscore the critical necessity for CS academics to share insights on course content, as well as tacit knowledge concerning optimal teaching methodologies, student engagement techniques, and the utilization of teaching tools. Participants overwhelmingly advocate for developing an integrated technological platform tailored to the specific needs of CS academics, fostering asynchronous knowledge sharing accessible across various locations and time zones. The problem situation was identified by using Soft Systems Methodology (SSM) as an analysis tool, and the findings of the interviews were used to determine the problem. This position presents a number of challenges, most of them are associated with the methods for managing knowledge, the exchange of knowledge connected to teaching, and the manner in which this is supported. Through the development of an all-encompassing information system that is designed to facilitate activities linked to knowledge-sharing, this study presents a fundamental description of a solution to the problem of barriers to knowledge-sharing in the teaching profession.

IV. Proposed System

The requirements and needs of actual users were gathered as part of the process of building this system, and then those requirements and wants were mapped to the functionality of the knowledge management system. Computer Science academics will be able to produce, collect, store, and share their knowledge through the system that is being suggested. We can only hope that it will make it easier for academics to share their knowledge on teaching, which will ultimately lead to an improvement in the quality of computer science instruction. A compilation of requirements and needs that were gathered from interviews is presented in Table 1, along with the features and functionalities that match those requirements and needs within the knowledge management system. The solution is a comprehensive web-based knowledge sharing management system that possesses a few particular functions. This solution was developed in response to these needs:

A. Knowledge Creation and Capture

This functionality makes it easier to document teaching experiences by enabling users to share suggestions for particular modules, their experience with modules, how to make assessments for modules, teaching methods, problems that occurred in the laboratory, any errors that were found in the code, and corrections for particular learning tools and modules. It furnishes a device for the production of content and the contribution of tacit knowledge. Personalization is an approach that helps to capture tacit knowledge and can be shared. This could be a useful method.

B. Document Management

Using this option, users are able to save the documents that are associated with the modules in a single location. This gives users the ability to download and examine these papers anytime they require them. Because of this, academics will be able to handle content in a more efficient manner. Moreover, it enables users to search for documents and materials and recover them in a short amount of time. This is an example of a codification approach that makes it possible to reuse previously acquired information.

C. Knowledge Searching and Retrieval

Searching for and retrieving documents within the proposed system is accomplished with the help of this functionality. Users have the ability to choose keywords or suggest content that is relevant to the content they are looking for, allowing them to specify what content they would like to search for. Users will be able to easily discover specific knowledge on the system because to its powerful search capabilities, which will be provided by the system.

TABLE I. Requirements and needs and their corresponding features and functionalities within the knowledge management system

User requirements and needs	Functionality and features
Participants need to be able to document and share their knowledge, including suggestions for modules, experience with modules, how to make assessments for modules, teaching methods, issues in the lab, any error in the code, and correcting modules and learning tools.	Knowledge creation and capture
Participants need to be able to search and retrieve the knowledge they documented when they need it.	Knowledge storage/ retrieval
Resources or documents for all courses need to be in one place.	Document management
The participants need a means of asynchronous communication to discuss issues with colleagues who teach the same courses. For example, sharing a file as a video or image.	Discussion forum
Participants want an interactive platform to share and interact with their colleagues.	Social features

D. Discussion Forums

It is recommended that this feature will make it easier for academics to collaborate and communicate with one another at any time and from any location. This would encourage academics to share their knowledge relevant to teaching, ask questions, and participate in discussions.

E. Social Features

This feature that is being proposed is intended to be integrated into the platform to encourage user engagement and the exchange of knowledge. Users will have the ability to rate the information that is presented, which will emphasize very valuable content. On posts, photographs, and other forms of information that are shared, for instance, users can make comments and replies. In addition, viewers have the ability to show their enthusiasm for the material by clicking a "like" or "favourite" button. The proposed system requirements, which were developed from the findings of the interviews, are satisfied by these functions.

V. Prototype

Using the Figma platform, which is a computer-based prototyping tool, a medium-fidelity prototype of the suggested system was constructed in order to investigate the practicability of our proposed solution. This prototype was constructed on the basis of an explanation of the intended functions and features that were presented earlier. The prototype is being designed with the intention of satisfying all of the end users' criteria and determining whether or not all of the processes are understandable to them. For the purpose of

evaluating the prototype of the proposed system, the Joint Application Design (JAD) technique was utilized.

A. Joint Application Design JAD

When it comes to eliciting and establishing user needs, the Joint Application Design (JAD) methodology emerges as a technique that is suitable. JAD, which is well-known for its collaborative and participatory nature, places a strong emphasis on the participation of stakeholders, including members of the faculty, in the process of research and development. In the context of the academic environment, where a variety of viewpoints and roles are required, this methodology is especially pertinent because it requires a participatory approach to the process of obtaining requirements. According to [26], the JAD methodology necessitates conducting a user requirements analysis as well as holding a workshop in which users and developers work together to determine and get approval for system requirements. According to [27, 28], the advantages of JAD include the fact that it speeds up the process of designing the system and enhances the quality of the system from the point of view of the consumers. JAD places an emphasis on the requirements and expectations of the user. Sensuse [12] found that the literature demonstrates that JAD is capable of producing accurate outcomes in the development of systems. During the process of building a system, it is vital to determine the actual demands of the users. Using this information, it will be easier to identify the traits that are required in the organization that has a variety of characteristics. According to [26], the findings of JAD are validated by the individuals who participated in the workshop and are the end users of the system. According to [28], the implementation of JAD consists of the following five steps: First, Determine the purpose of a JAD session. Second, Gather initial user requirements (in this prototype). Third, Prepare the session. Forth, Implement JAD session. Fifth, Document the aspects approved in the JAD session.

B. JAD session

The JAD session is intended to collect useful information from members of the development community and other stakeholders. MoSCoW guidelines were utilized in order to ascertain the order of importance for user requirements. Rule MoSCoW is comprised of four different statuses: As stated by [29], there are four categories: "Must have," "Should have," "Could have," and "Won't have." Those functional needs that must be considered in the system are referred to as "must have" requirements; if the system does not include these functions, it will be unsuccessful. The functional needs that should be present are those that are required for success but are not absolutely necessary. Some functions that could be performed are not as vital as they should be. Functions that are not necessary to be fulfilled are not included. These rules are intended to serve the purpose of confirming the functional requirements that the users require. After that, it is necessary to include it into the system that is being presented. The "I Like, I Wish, What If" method was also utilized in order to collect sincere input from the participants. It is a straightforward approach that can be utilized to cultivate helpful feedback from people. Statements beginning with "I Like..." were designed to encourage end users to provide positive feedback regarding the aspects of the prototype that they enjoyed. It provides an opportunity for end users to contribute their suggestions about how the prototype could be improved by using comments that begin with "I Wish..." When you ask yourself "What If...," you can come up with some fresh thoughts or suggestions. When all of these factors were taken into consideration, it was possible to fulfill all of the functional requirements of the proposed system and to solve the issues that had been brought up in the earlier interviews. There were eight people who participated in the JAD session that would evaluate the prototype. A variety of jobs were held by participants inside the Faculty of Computer Science at Jeddah University. Additionally, participants had a variety of academic experiences and were IT developers. Through the use of Zoom, the workshop was conducted online. There were two different methods utilized in order to recruit volunteers. Attending online workshops and providing an in-depth description of the system's objective for facilitating the sharing of teaching experiences in higher education among computer science academics is the first technique that may be used. In order to convey the concept to the participants, we devised an initial scenario that aimed to determine the mechanism of the prototype as well as the actuators that were included in our prototype. In order to fulfill the requirements of the users and to make it clear whether there are any shortcomings or drawbacks, we offered a scenario representing each function. In order to obtain the participants' feedback, direct questions were posed to them, and their participation in the discussion was encouraged. In the second method, an electronic survey was distributed to the participants at the conclusion of the JAD session. The purpose of this survey was to collect input in order to validate the suggested functions on the system. The poll touched on seven different functions. There were four questions for each function, three of which were based on a Likert scale with five points (Strongly agree = 5 to Strongly disagree = 1), and one of which was an open-ended question about the end-user recommendation. Following that, open-ended questions were posed to the end-users in the form of "I like, I wish, and what if" inquiries in order to collect additional input. According to [30], the results of the survey were analyzed by employing fundamental descriptive statistics for the quantitative data and an inductive methodology for the qualitative data sets.

VI. Evaluation of Prototype

For the purpose of obtaining thorough information and feedback, the findings of the JAD sessions were combined with the survey respondents' responses. The replies that were supplied by the participants have been separated into two unique groups, which are referred to as non-functional requirements and functional requirements.

A. Functional requirements

A scale was used to determine the extent to which participants agreed with the statement "I believe this function is necessary" (see Fig.1 for further information). As a consequence of the findings, it was determined that every single participant was in complete agreement with the idea of creating discussion forums for particular classes in which they could pose questions and provide replies. In terms of the necessity of a general debate platform for communication, 87.5% of respondents strongly agreed, while 12.5% of respondents agreed. In terms of showing a discussion forum, 87.5% of respondents highly agreed. Eighty-seven point five

percent of the participants expressed satisfaction with the discussion forum feature and related to it. Furthermore, 87.5% of the participants highly agreed with the idea of producing a new post to capture the teaching experience by utilizing a template and adding comments to the post, whereas 12.5% of the participants agreed with the use of the template. Everyone who took part in the discussion expressed a strong agreement with the display of the posts and the search for a particular post. Eighty-seven point five percent of the participants expressed satisfaction with the documenting teaching experience functions (POST) and indicated that they were related to them. During the JAD sessions, each and every participant gave their unequivocal consent to supply the system with resources that were associated with their respective classes. The P2 stated that as an academic, "it is essential for me to view all of the resources that are associated with my module and to share my teaching experience with my colleagues regarding the system". In addition, the majority of participants were in agreement that the system should be able to filter teaching experience documents according to the teaching experience of users and should also enable users to view all teaching experience documents specific to each module. One of the participants, P3, stated, "We need a method that will allow users to access the posts for the special courses." In the event that the system gives each user with their own profile N, the participants emphasized the significance of maintaining communication with their coworkers on the system.

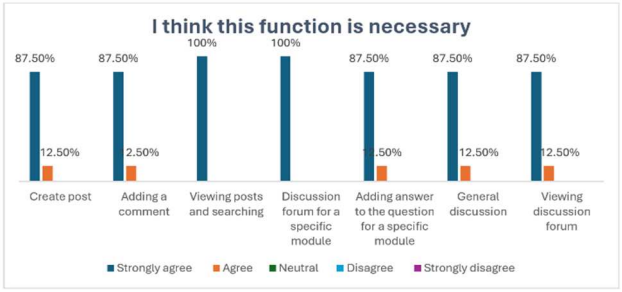

Fig. 1. Participants' agreement with priority function requirements.

B. *Non-functional requirements*

a) Operational requirements:

Two different operational criteria were mentioned by the participants. First, they stated that the system ought to be able to be accessed from a variety of platforms, including mobile devices like smartphones and tablets. During the session, participant P3 made the following statement: "It ought to be open and usable on mobile." The second need that was highlighted was that it should be an open space platform that would allow users who registered it to access all of the resources, discussion boards, and posts that were already available. All of the attendees were in complete agreement with this concept. Participant P2 provided the following example: "When I need to open the platform, I need to access all posts, the discussion board, and resources related to my modules or any modules if I need it".

b) Usability:

In the survey, participants rated the degree to which they agreed with the statement "I think this function is clear" for each function (see Fig.2).

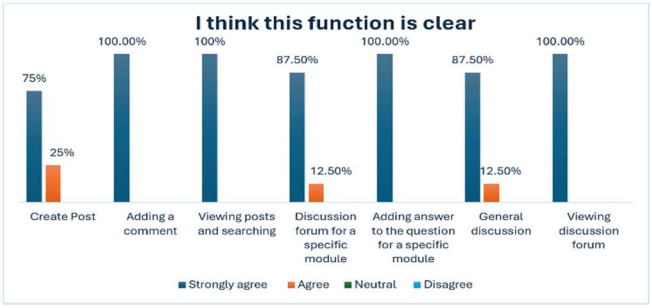

Fig. 2. Participants' agreement on the clarity of the functions.

The results show that 87.5% of the participants strongly agreed that the general discussion forums and asking questions about a specific course were clear, while 12.5% agreed it. They noted that the question template requires clarification messages for each attribute. All participants strongly agreed that adding answers and viewing the discussion forums were clear. About creating posts for teaching experience, 75% strongly agreed that the template was clear, while 25% of the participants agreed. They suggested adding information for each attribute on the template to clarify what information is required there. Participant P3 said: " I think the template needs to add clarifying messages for each attribute". All the participants strongly agreed that adding comments and viewing all posts were clear.

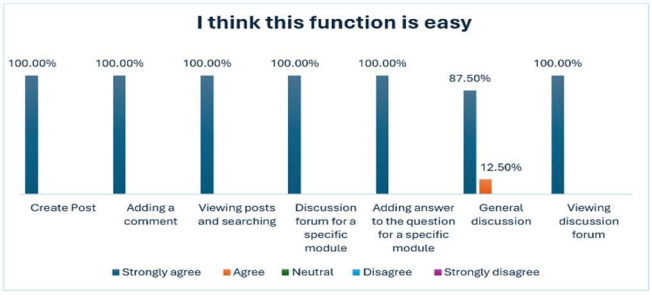

Fig. 3. Participants' agreement on the ease of use of the functions.

In response to the statement "I think this function is easy", all participants strongly agreed that all functions were easy to use, except the general discussion forums, where 87.5% strongly agreed, while 12.5% of the participants agreed (see Fig.3).

When asked about the statement "I believe that this task takes a short time to complete" 87.5% of the participants strongly agreed that the process of making new posts required a short amount of time, while 12.5% of them were neutral about the matter. In their feedback, they remarked that it took some time to fill out all of the fields in the template. As a result, they advised that each mandatory field be marked with a symbol, and they advocated that a suggestions menu should display when they filled in the teaching experience type and applied it to the fields on the template. On top of that, 87.5% of the participants were in complete agreement that browsing posts only required a short amount of time. It was unanimously agreed upon by all of the participants that the time required to ask questions, respond to them, and see the discussion forums was rather brief (see Fig.4). They suggested using tags to filter posts and categorize queries within the discussion forum for a certain course alongside the name of the course, despite the fact that they did remark that seeing all

of the course threads took a short amount of time. Participant P4 provided an example by saying, "I believe that in order to be more efficient and save time, we need to implement a method that categorizes questions according to the course." This will allow me to identify questions that are connected to my query, which will help me avoid duplicating my question. If there are no questions that are comparable to mine, I will be able to write my own question.

Fig. 4. Participants' agreement about completing tasks in a short time.

VII. DISCUSSION AND CONCLUSIONS

The purpose of this research was to validate the proposed solution for the implementation of a teaching-related knowledge sharing management system among computer science academics working in Saudi higher education institutions to meet all of the functional requirements of actual users. To accomplish this goal, this study combined Soft Systems Methodology (SSM) and Joint Application Design (JAD), which ultimately resulted in the development of a system that adopted a user-centric approach [27]. Based on the findings, it is possible to conclude that the functions and features of the proposed system are suitable for the case study of computer science academics. Furthermore, it is anticipated that these features would facilitate the effective usage of knowledge-sharing management in the teaching context by computer science academics at Saudi higher education institutions. Knowledge production and capture is the primary purpose of the system, and its primary reason for existence is to document the educational experience by collecting the tacit knowledge of practitioners. As a result, the system that is being proposed gives users the ability to create a post and add comments to this post. The post is formatted according to a certain template that was developed especially for this particular setting. The second function is the discussion forum, which allows users to ask questions and publish answers. This forum can be general or related to certain modules according to the user's needs [24]. This will make it easier for people to communicate with one another and exchange their information. In addition, there is the resources (Document management) function, which allows supervisors of modules to upload any and all documents that are associated with respective modules. Slides, exercises, and examinations are all included in this. In addition, the findings demonstrated that the searching and retrieving features were essential in order to save time; nonetheless, they proposed the utilization of tags for posts and questions in order to improve the quality of the function. According to the findings, the functionality and design of the suggested system were easy to understand and straightforward to operate. Some suggestions for improving the design include providing information messages on each attribute on the templates when users create a post and ask questions, as well as adding a symbol to signify required fields. Both of these suggestions are intended to improve the designs. The findings indicate that users are very satisfied with the amount of time they spend on tasks. All of the appropriate recommendations were incorporated into the design. The proposed system streamlines the sharing and implementation of teaching-related knowledge among computer science academics. In future work, the teaching-related knowledge-sharing management system will be implemented and evaluated by experimenting with actual users. However, the perceptions and experiences of the surveyed CS academics from Jeddah University may differ from those of others. Therefore, it's crucial to consider the variations in educational systems and professional training across different countries and use diverse sampling methods in future studies for improved external validity.

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