

Online Instructional Consultation for Higher Education Institutions in Malaysia: The System Architecture

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ABSTRACT

Evolution of communication technologies at present gives impetus to researchers and practitioners by simply put the computer-mediated communication tools on their telementoring application without really understand its potential benefits. This causes several issues and challenges confronting existing telementoring program which are: (a) miscommunication due to lack of nonverbal cues, (b) the need of competency in written communication and technical skills, and (c) document recording, retrieving and reviewing. Thus, in this paper, the focus is the design and development of Online Instructional Consultation (OIcon) system for student and lecturers of higher education institutions. Hybrid modes of synchronous and asynchronous communication that provide nonverbal and verbal cues are incorporated in Online Instructional Consultation (OIcon) system to compensate the identified issues and challenges. We also focus on recording, retrieving and reviewing of recorded consultation document and management is also emphasized. The multimedia communication components from e-consultation model of financial and telemedicine context are adapted. The general structure, modules of OICON system, multimedia communication components, and communication server are illustrated and the potential benefits of OIcon system are presented.

KEYWORDS

Online Instructional Consultation, Mentor-mentee System, Real time communication, Flash Media Server, Computer-mediated Communication

1 INTRODUCTION

Online consultation or commonly known as e-consultation, one of the advancements of communication technology in various contexts [1], [2] and [3], offers great opportunity in enhancing information delivery across time and space. For example, in education contexts, telementoring evolved tremendously with the advancement of CMC tools. Evolution of communication technologies at present gives impetus to researchers and practitioners by simply put the CMC tools on telementoring application. The researchers and practitioners uncritically integrate communication technologies to facilitate online consultation without examining how the communication technology implemented in building and maintaining mentoring relationships. There are several issues remain unanswered which may lead to online consultation or mentoring frustration. These issues and challenges are (a) miscommunication due to lack of nonverbal cues, (b) the need for competency in written communication

and technical skills [4], [5] and (c) the recording, retrieving, and reviewing of the consultation document.

Some mentoring programs are long-term relationships. Thus, it should be designed to support ongoing relationships. Unfortunately, many of the telementoring programs are terminated as soon as the problems of client have been solved. In addition, there is lack of recorded information management and indexed for future retrieval and references. Even if there is, most of the recorded information is in the form of semi-structured information such as dates, announcements, participants' names, or e-mail contents. The programs also rarely make use of the online meeting recording technology capability, which can track a group progress and serve as public record of past actions and decisions. For example, the Electronic Emissary K-124 Telementoring is created with a communication platform that allows mentor and protégé to communicate via private e-mail lists, forum, chat, and electronic teleconferencing. However, for continues consultation activities, the facilitator needs to manually set up the organizational system such as creating personal record and project information. The only archive for future retrieval is the e-mail messages. There is no other verbatim records of online mentoring are stored as archive. Lack of nonverbal cues may reduce the richness of information. It also creates difficulties in maintaining thoughts or discussion themes due to the considerable delays between the sending and receiving time. This may cause miscommunication, which will end-up with consultation frustration.

There should be an alternative way in keeping track and following up the delayed consultation session. Unfortunately, majority of researchers and practitioners did not investigate the capturing of information to be used in future collaborative activities. The failure to record important information, decisions, and actions may affect future individual and collaborative work. Thus, in view of this situation, there is a need to design and develop an Online Instructional Consultation (OICon) system that will facilitate the consultation among students and facilitators in HEIs. OICon system consists of communication server and multimedia components that provide the trustworthiness streaming video method in real-time and delayed-time for video on demand. Holistic approach is adopted in which the designation of multimedia components provide support starting from scheduling until the termination of a consultation session as well as the management of recording online document. Besides that, multimedia components are employed as strategic information tools within this well-planned online instructional consultation to solve the problem addressed. Related work on this research field such as the mentor-mentee system in HEIs in Malaysia, consultation process and existing e-consultation model are briefly discussed. Hopefully, the proposed OICon system would offer with flexible information delivery through the use of multimedia technologies that are not implemented in the existing telementoring or online consultation system.

1.1 Overview of Mentor-mentee System for Higher Education

In most universities in Malaysia, the mentor-mentee system is implemented by assigning a lecturer to a number of students (mentees) for the purpose of providing guidance and consultation relating to academic matters. For example, the Faculty of Engineering of Universiti Kebangsaan Malaysia (UKM), implemented the system with the purpose of identifying problems faced by students who do not perform academically [6]. These students will undergo a motivation program on the curriculum skills. The system also tries to enhance good relationships and interaction among the students and lecturers [7]. In Universiti Malaysia Sarawak (UNIMAS), the mentor-mentee system is conducted in the Faculty of Medicine and Health Science in which the role of a lecturer is to assist students in their curriculum and solve academic problem. However, in Kolej Profesional Mara Beranang, the mentor-mentee system acts as a platform for solving the personal matters instead of the academic-related matters.

Research on the higher education in Malaysia had found that majority of students show their dissatisfaction towards the mentor-mentee system especially regarding the meeting with their supervisor for consultation [8]. A preliminary study conducted at College of Arts and Science (CAS) of Universiti Utara Malaysia (UUM) shows that 54.7% out of 108 respondents have problems with their lecturers. Students having problem in meet their supervisor when both of them are at a distance sometimes, timing problem and having the problem in record consultation

session or take note during consultation session [9]. This may due to sometimes, lecturer may have conduct emergency meeting, attend to the outstation seminar and may not meet their students for a period of time. Besides that, during the training and practical period for undergraduate students, both students and supervisors are constrained by distance.

2 BACKGROUND STUDY

The common e-consultation models consist of several basic components, collaborative tools and their functionality, capability and consultation processes. In any e-consultation system, the matching of alternative technology to consultation processes and more specifically the task involved is necessary [10]. In this paper, two existing online consultation system are reviewed. It is expected that the features and communication components applied in these online consultation systems would be complimented in the OICon system.

2.1 Financial Service Remote Consultation

Financial service consultation [11] provides assistant for customers in completing tele-consultation through touch screen interface at the client side. It is designed as a help desk system that serves only one client at a particular time. The designation of this consultation takes into consideration various participants' remote conversation skills, roles and asymmetrical communication between customer and staff. Besides that, it is

designed based on the e-consultation processes as shown in Figure 1..

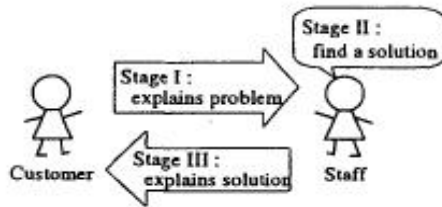


Figure 1. Consultation Processes

Two functions that provide support for asymmetrical communication are tele monitoring and tele operating. Both staff's and customer's terminals are provided with window for tele operating but with different functions. A customer has the knowledge about his or her problems but do not have the skill in solving problems. Thus he or she needs to explain problem to the consultant that has the knowledge of solving their problems by using text chat component and videophone (see Stage I). Customer's terminal side activities are captured and being observed at the window of the tele monitoring at consultant's terminal. At the same time, the consultant will try to find a solution (see Stage II).

Tele-operating window at the staff's terminal is embedded with functional buttons that control activities such as the map or figure which are displays at customer's terminal. This enables the staff to explain the problem (see Stage III) and guide the customer in completing the consultation procedure by remotely operating the customer's terminal. The Financial service remote consultation system is a real-time consultation conducted by using videophone or video conference and share-window function. A consultant can provide instruction by remotely control the customer's terminal. In

addition, the consultant can take over the control of customer's operation in order to provide support for customers who are unfamiliar in using such system.

2.2 Virtual Consultation for Telemedicine Education

Virtu@l Consult@tion (see Figure 2) is a Medical Simulation-based Training model developed by [12]. Its purpose is to provide support for students to simulate a medical consultation from different locations, using the current pedagogical methods based on clinical cases and integrating electronic resources. Since most of the available computer support systems do not support multi-users and asynchronous environment [12], this system focuses on synchronous consultation by adding some extra functionality.



Figure 2. Virtu@l Consult@tion Model with Main Functionality

The advantage of Virtu@l Consult@tion is the multimedia data exchange that makes simulation medicine consultation more realistic than the face-to-face simulation, besides enabling sharing of information among users. The main functionality of this

model is the ability of the physicians to ask questions to in guiding them to express their problems. [12] emphasized that Virtu@l Consult@tion model provides an integrated medical education synchronous consultation, which mainly consists of web server, database, and include the following functionalities:

- A medium for multi-users that include tutor, patient, secretary, and physicians to collaborate and accelerate the access and delivery of information.
- Chat application interface and chat server.
- Multimedia data, principally medical imagery or photographs that use to complete the exams and medical records can be retrieved from graphic database and shares on cooperate electronic whiteboard.
- Cooperative tool Electronic whiteboard component implemented with modification tools that allow multi-users to zoom in, zoom out, write, and draw annotation on the images.
- Sharing of physician's notes, medical records and comparison of their notes with other physician's notes.
- Images and sound player are implemented with the aim of simulating the patient's problem area. The multimedia information and learning material delivery during consultation session is stored in a database
- Accessing to external resources and document such as e-books,

commented or interactive clinical cases, medical images, and others can facilitate the learning process by providing extra knowledge.

The design of a consultation system should take into consideration the users' requirement. Although videophone in the remote financial consultation provides a unique feature of real-time interaction among participants in visual and verbal form, it becomes inefficient and useless for customers whose personal computers do not have web camera. Thus, textual chatting or input features should be applied as an optional support communication tools. Likewise, the display-change of the financial service consultation and shared-window whiteboard of the medical tele-consultation system can be applied in this online instructional consultation model as document or application presentation function.

For maximum effectiveness, a system should have capabilities to conduct various activities during remote consultation without any interruption. The capabilities are video conferencing, instant messaging, application, and document sharing. By having these functions, time can be saved because only a few efforts is required whereby one consultant can serve many clients with similar problem simultaneously. Database and web server are essential to enable the user to retrieve the consultation record or documentation.

Obviously, new features and components will added several advantages to online instructional consultation application. Based on the review, the e-consultation for instructional technology, the

characteristics, and concepts of consultation and existing e-consultation models, has found the online instructional consultation system should be possible to:

- facilitate one to many consultation
- provide participants with various options of communication tools
- request data stored in database
- request help from peers other than facilitator
- increase problem solving skills with the help of shared-window components
- obtain multi-participants through online polling for decision making stages

3 ONLINE CONSULTATION PROCESSES & TASK INVOLVED

Many authors and researchers proposed consultation processes by dividing the consultation model into three phases: entry level, analysis-diagnosis, and problem solution [13], [14], [15], [16], [17], [18], [19] & [20]. However, according to [21], consultation processes may differ according to consultation purposes, tasks, and actors involved. This indicates that there is no standard common consultation guideline of consultation processes. The processes of instructional consultation in HEIs may differ from those conducted in secondary school since the actors, tasks, and students' academic levels and communication abilities are not the same. Literature review on several principles and guidelines suggested by [22] on designing the e-consultation had found that e-consultation that creates online event structure has beginning to an end. People should be informed the

purpose and context of online consultation so that recruitment of other people to join the online consultation session as well as dissemination of consultation contents after termination of consultation session can be done.

In this system, three core phases for instructional consultation in higher education include: pre-consultation, online consultation session, and post-processing phase. Three sub processes of online consultation session are: problem posting, discussion, and decision making as illustrated in Figure 3.

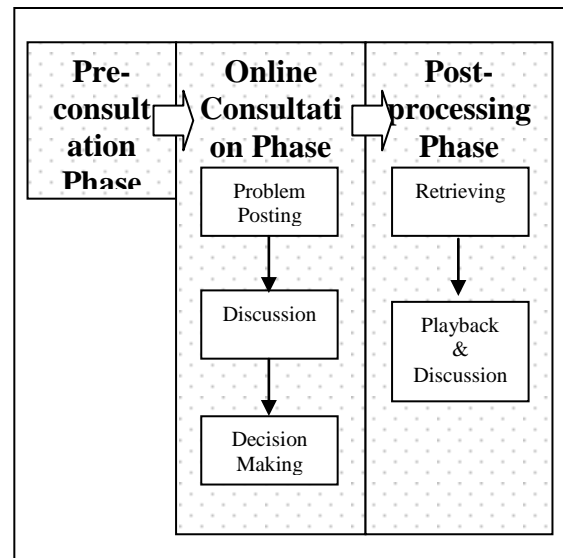


Figure 3. Illustration of Online Instructional Consultation for HEIs

The pre-consultation phase, includes introductory of upcoming consultation session, appointment and announcement making, time and date scheduling, and mail invitation. In this phase, students who are voluntarily seeking help from their supervisor are the initiator. An online appointment form to request for an online consultation session will be send. Having checked the e-mail, the supervisor will then send the conformation on either rejecting or

accept the appointment. Once the supervisor accepts the appointment, he or she needs to create an online consultation room. Meanwhile, a notification mail that contains the minutes and meeting agenda are sent to the student's mailbox. The e-mail is integrated to reduce the ambiguity of communication. The supervisors can also be the initiator of consultation session in which they can make announcements online to recruit their students to join online consultation.

Consultation session refers to the time in which participants engage in various consultation events such as online consultation, form submission, on-going consultation monitoring as well as providing guide to the participants on how to take part. During the consultation session, the lecturer has the autonomy to control the participant's activity. Students will start by explaining their problems to the lecturer. Before giving proper advice, lecturer may need clarification on the student's problem. Usually, in handling this kind of tasks, multiple cues and immediate responses are required. Unfortunately, the text-based CMC tools cannot communicate such nonverbal information and cue gestures compared to the videoconference component. Hence, to cater this kind of communication, the combination of rich and lean medium is necessary. There are several communication components that support the virtual consultation environment by providing various communication tools that enable them to share idea and obtain immediate feedback. Most importantly, it provides a sense of community whereby they do not feel disconnected with each other in the virtual environment.

Post-consultation phase includes post session discussion and delayed consultation session follow-up. During a decision-making session, lecturer may recommend several solutions. This session usually ends once consensus has been achieved or solutions are being left to the consultant to be decided. Sometimes, a consultation conclusion may be delayed to the next consultation session because not all decision can be made in a short time. Thus, consultant may need to retrieve the previous session recorded document, agenda and list of participants by sending another invitation mail. Therefore, for this purpose, a combination of communication technologies with consultation document management feature can create a spectrum of media richness. This will increase the effectiveness of information delivery and leading to a higher performance of satisfaction.

4 OICon ARCHITECTURE

As mentioned before, there are three issues and challenges regarding the existing telementoring program which are miscommunication due to lack of nonverbal cues, competence in written and technical skills as well as issues concerning recording, retrieving and playback of recorded consultation session. Thus, a system architecture that blends of multiple modes of telementoring programs is developed.

The system leverages all types of communications media and opportunities, so that it will be more effective in formalizing mentoring programs. Moreover, there should be an alternative way of maintaining the mentoring sustainability by archiving the

consultation contents, controlling its retrieval as well as disseminating of the contents and results [22]. This section discusses the client-server architecture, a web-based consultation platform that served as client-side, that is used to access the HTML page of the online consultation with built-in Shockwave (SWF) embedded file. The server-side server the HTML pages content, deliver the content stored in database to be display in web sites.

Figure 4 presents the two main servers of the client-server architecture of the OICON prototype: Web and Flash Media. In Adobe Flash Media Server, the client and server are connected through the RTMP Protocol. A web server delivers the clients over HTTP. A PC that acts as the server side consisted of the web server and Flash Media Server. When a client sends a request to view the website that contains flash player in the web server. Then, the web Server streams the data to display the flash on the web browser through reliable protocol HTTP. After that, the SWF file is connected to an application on the Flash Media Server and the server will streams the data over a persistent connection using RTMP. This means that users work on both protocols simultaneously.

The synchronous communication tools such as instant messaging, video conferencing and screen sharing that stream data in real time are supported by the functionality provided by Flash Media Server. The RTMP is a reliable TCP/IP protocol developed by Adobe system for delivering high impact audio, video, and data stream over the flash player and server. Besides that, it also covers the flash video stream and MP3. RTMP enables the multiple transmission

of synchronous audio, video and data channel along the single communication channel.

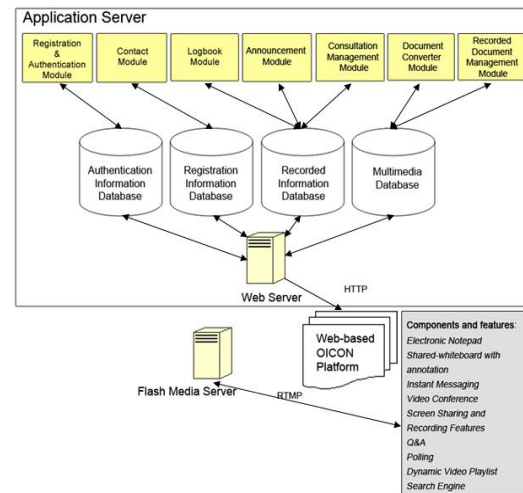


Figure 4. Client-server Architecture of OICON System

In this system, seven modules have been constructed. The module registration and authentication control the accessibility and identity of user in the online consultation platform through web server. When a facilitator or student passed the authentication, the contact and authentication modules will transfer the list of personal details information and online activities option that correspond to the identity and access level of the user so that he or she can sign in. There are two conditions in which consultation can be initiated:

- Consultation session initiated by students for emergency consultation.
- Consultation session conducted according to the facilitator's consultation schedule

The first condition corresponds to an informal mentoring in which the

consultation time is not bounded to the lecturer's working hour. It is frequently conducted at anytime especially when the student needs to deal with emergency matters. Student makes online appointment with facilitator by filling up online appointment form. The students will then receive the feedback form from the facilitator. If the facilitator approves the appointment, the student can schedule the meeting, send invitation mail to other peers and join in the meeting room. All agenda and setting will be stored in a recorded information database.

The second condition refers to the consultation session, which is conducted according to the facilitator's consultation schedule. This condition is time-bounded and has to be conducted by following the planned mentoring procedure. Facilitator initiates formal consultation session by uploading the online consultation schedule, creating new conference room, sending invitation mail to students and joining the conference room. This enables students or mentees to get informed with the latest announcement from their lecturers through an announcement module. Once participants pass the authentication processes and enter the conference room, an instruction video will be displayed to assist novice users in using the online consultation CMC tools. During an online consultation session, student and lecturer's terminals are provided with a set of communication tools and features in which the data, video, and audio are streamed through the RTMP protocol as included in the Flash Media Server. As the consultation documents increasing added, there is a need to organize them in a systematic way to prevent daunting

task each time updating is done. These consultation-recorded documents are categorized into two types:

- Audio-visual recorded document
- Consultation documents other than audio-visual document.

Generally, there are different ways of organising and playing back these two types of recorded document. Video assets are organized in the form of dynamic thumbnail view, list the provide users with a brief dynamic preview of video segment before retrieving the video. There are two media players. Live Streaming Media Player is for streaming the real-time video during audio or video conferencing, whereas, Recorded Media Player is for playing back the recorded audio and video documents that are stored in multimedia database. Put in simple, by using video streaming mechanism, the media assets are not stored in the clients' Internet temporary cache files. This prevents the media asset to be saved and modified by unauthorized people. Besides that, the streaming media method enables the live video and audio to be recorded and playback as video on demand (VOD) in recorded media player.

On the other hand, other recorded documents such as presentation slide, word document, and spreadsheet, are organized in thread and sequential model. This method is used to handle the increasing recorded of consultation documents as well as to simplify the daunting task on the updating process. For retrieving recorded document from the multimedia database, search engine system is developed. Retrieving of video asset by using calendar, chat room ID, agenda ID, and name of participants are functional. Thus, in this research model, keyword such as participants' name,

selection of chat room, date by using calendar component, agenda, and related topic are applied.

5 OICon CHARACTERISTICS and ADVANTAGES

By creating a central point of browser-based online consultation platform, the accessibility of information stores, delivery of information through CMC tools, websites and online service will be accelerated across the virtual community. The OICon model provides a systematic way to facilitate the shifting of the face-to-face consultation to an online consultation with the used of CMC tools. The major values of online instructional consultation application for education contexts are discussed in the following section:

a) Recording, Retrieval and Playback

Recording of a consultation session to be kept as archive provides great advantage for those who missed a consultation session to catch up or conduct peer discussion. With the used of Camtasia Studio Screen Recorder and Presentation, a facilitator can record the consultation session including the online collaboration activities and its screen sharing activities. Playback of the online recorded session is applicable with the flash media player embedded in the OICon website. Additional communication components such as “leave comment” and “instant messaging” enables peer-to-peer discussion. The online consultation platform that hosts the ongoing discussion or provides link to relevant external online discussion space, where students can keep discussion, give a

great advantage for people who prefer to retrieve multimedia document.

b) Management

The organization and coordination of the recorded document and mentee's are specially tailored for facilitators. These recorded documents include consultation session recording, presentation slide and personal recorded document that are uploaded or stored by participants, session agenda and minutes that record date, time, list of participants of a consultation session. Mentee's management function refers to the storing of mentee's details in a database. Feedback tools are provided for mentees to give feedback after a consultation session. Participants of an online consultation should be kept informed of the consultation contents such as consultation decision, survey results, and recorded consultation document. Sometimes, the consultation session may be terminated before solving the problem.

Therefore, it is a necessity to store consultation information of a particular session, which include participants information, recorded consultation document to engaged participants, and send them feedback at the end of the consultation session. Besides, students who subscribe as mentees under a supervisor but does not take part in the online consultation session may feel confuse about the consultation lessons. Online-recorded consultation document retrieval and playback provide easy access for them to follow up the missing session.

The way the consultation information is stored, retrieval and organized should be a concern to the researchers as there

is a large portion of information available over the network which are stored in unstructured form. In addition, the current information retrieval tools are poor at finding heterogeneous information. Consultation documents and information that are not organized in a consistent pattern will create difficulties for those who are doing the searching.

c) The Need of Personalization for Online Instructional Consultation

The objective of personalization is to deliver pertinent contents to an individual or group of users according to their roles and preferences [23], [24]. Basically, a student will be assigned with an experienced lecturer that has the expertise and knowledge that are relevant to the student's academic course. Each user usually has different level of access authorization and preferences to webpage contents. Users are given authority to subscribe to a particular consultation newsletter, keep in touch with groups of people with common interest and to be informed regarding the consultation events updates or particular topics currently under discussion. According to [22], the ability to recruit participant to online events as well as to disseminate consultation contents to participants after consultation session is crucial for an online consultation success.

Personalization as the process of providing relevant content based on each person's profile. The users create the profiles by submitting online sign-up form or through user details from existing database. Through user's profile, students can view consultation contents that they subscribe, latest

consultation that are posted by their mentor, send mail or make appointment online, create consultation room as well as involve in a post-session discussion and leave comments on recorded consultation document. With the aim of personalization functionality, facilitator can manage their mentee's information such as students' attendance list, send appointment feedback for mentee as well as send invitation mail to group of mentee. Furthermore, user profiles can be used to keep in touch with groups of people. If an online consultation application can get people to sign up as mentee under various supervisor, it can also provides the people with consultation session updates that send consultation invitation mail from other mentee under the same supervisor.

6 CONCLUSIONS

Enhancing instructional consultation for higher education through technology, in this research study, is conceptualized as an effective way on supporting typical consultation processes specifically on the task scenario of both students and lecturer's requirements. OICON system provides alternative means of delivering contents and services as well as providing participants an extraordinary range of options. In this way, students and lecturer can involve actively in an online consultation at a remote place. The session is not just between lecturer and students but also on post-session discussion among peers. Point of correspondence includes implementation of CMC tools to facilitate online consultation processes for academic advisory purpose. This prototype system consists of communication server and multimedia components that provide the

trustworthiness streaming video method in real-time and delayed-time for video on demand. Holistic approach is considered in this system in which designation of multimedia components provide support start from scheduling the consultation time until termination of consultation session as well as management of the recorded document online. For maximum effectiveness, designation of OICON system based on preliminary study on students' requirement for mentor-mentee system in higher education, the functionality and features to be included besides principles and guideline for online consultation as posited by [22]. It is hoped that more development of communication technologies in assisting online consultation in higher education will be considered at relevant points in future research.

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