



Designing a thesis tele-supervision system for postgraduate medical sciences students

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Abstract

Introduction: Today, progressing science and technology at all domains, including education and research, will bring new opportunities to resolve the communication and interaction problems. The aim of this study was to determine potential factors affecting the thesis supervision and provide a web-based solution.

Methods: This is a developmental study conducted in two theoretical and technical phases at the Shiraz University of Medical Sciences in 2017. The theoretical phase was performed in three stages, including literature review and investigating the existing studies and Delphi's study based experts' view as well as identifying the thesis supervision status based on 200 postgraduate students' point of view. The technical phase had two stages, including to draw processes and to design the physical and logic schemes of the system. The Thesis Tele-Supervision software named SAHPAD was designed by C# and ASP. NET programming languages.

Results: The results showed that out of 40 potential factors specified at the first stage of theoretical phase by using experts' opinion, 13 items were selected as the main factors. According to the results obtained from the students' views at the third stage, the factor of "accessibility" had the minimum score, i.e. 3.15 mean of four, which was the worst status.

Conclusion: The designed system covered from the beginning to the end of the thesis workflow at its electronic frame with its various capabilities such as the interaction of the research team to decide the title, draft the proposal, prepare for thesis defense, etc.

Keywords: Distance education, Medical education, Educational technology, Software

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Please cite this paper as:

Abhari S, Monem H, Garavand A, Bastani P, Rezaei R. Designing a thesis tele-supervision system for postgraduate medical sciences students. *J Adv Med Educ Prof.* 2019;7(4):191-204. DOI: 10.30476/jamp.2019.74926.

Received: 15 December 2018

Accepted: 7 August 2019

Introduction

Promotion of education and research to achieve a desirable and high-level quality has always been raised as a part of the concerns in any educational system (1). Recently, most efforts focused on centralized development on quality improvement of education at the elementary and

secondary education centers in the developing countries, while the developed countries are working on performance enhancement of higher education, especially at their centers of post-graduation (2). One of the most effective strategies to promote the education system in developing countries which leads to human

development index (HDI) growth is to improve higher education quality, particularly at post-graduation grades (3).

There must be three independent main elements, i.e. student, professor, and education system's coherent interaction to acquire high quality higher education (4). In this respect, the role and performance of teachers in all stages of the study is unmatched for students, especially in the academic thesis, which makes this impact very significant. That's why one of the most important factors affecting successful completion of research in postgraduate grades is the correct choice of the supervisor. Supervisor's leading quality and type of supervision in the research interaction by a research system are the most important determinant factors of the thesis quality. Therefore, it's so important that higher education takes these factors into account (5-8). In the past years, the thesis supervision process and what makes it a desirable route for student-supervisor interaction has been emphasized at the universities of Canada, USA, United Kingdom and Australia. Similarly, international studies have indicated how the thesis supervision process is a critical factor in success in writing dissertations and their real-time completion. What can be seen in the majority of the existing bases is undeniable interrelationship of supervisors and students and its effect on the students' success or failure to complete the course and write a dissertation with high-quality and real-time (9-11). Lovitts and Nelson have denoted satisfactory communication with supervisor as the most important factor affecting the students' decision about staying or leaving the Ph.D. course. Also, many researchers have indicated its effect on the students' success, their overall satisfaction about the course, and even the success of their future career. Girves and Wemmerus considered the quality and the relationship between the student and professor as a factor that has direct relevance with the quality of the process and the final result, and even some of the experts have mentioned this factor as the only and most important aspect (12, 13).

Various problems may arise since thesis supervision process is time-consuming and complex. The researchers divide the problems associated with the thesis supervision into two categories of organizational and individual factors. Organizational factors incorporate policies and procedures designed to guide the students, some of which include the student-supervisor interaction, the number of students supervised by the professor, and the lack of appropriate facilities and supportive services. Individual factors also include issues such as the

presence of an unprofessional and inexperienced professor, or the different backgrounds and academic research interest of the professor and student. Additionally, professors individually have assumptions about how the supervision process is; therefore, they may tend to have a specific style in the student guidance (5, 6, 14-21).

Postgraduate students have often experienced problems such as delay in the thesis completion, change in title, modification of the scope of the research, change in research objectives or even prevention of thesis defense. These problems are usually due to the students' natural inexperience about the process of scientific research fulfillment, the weakness of the educational and research system, and poor supervision of the process of conducting research by supervisors and advisors. The extent of such issues is three times that of the problems related to research design, data collection, and data analyses as well as the writing of the final report. While some studies show that the lack of supervisory rules and instructions in supervision of the supervisors is one of the challenges, regulating the supervising processes is of the urgent needs of the higher-education system and of each educational and research institution. Therefore, in general, student's interaction and cooperation with the supervisor and advisor are necessary in order to perform the thesis process properly (5, 7, 9, 10, 14-18, 21, 22).

Today, the progress of science and technology in all domains, including education and research, has created new opportunities for resolving communication problems. Novel technologies can greatly revolutionize the interaction between the professors and students involved in the thesis process. Studies show that Information Communication Technology allows improvement in access and enhancement of the quality within the educational domain. The higher-education system needs to use information technology in order to promote the quality of research-education processes (11, 23-27).

In recent years, some studies have been done on thesis supervision at many countries, which correspond to the mentioned issues; for instance, the study performed at a well-known university of Australia showed that students' satisfaction rate about supervision of the thesis by supervisor and advisor was 67 percent in 2007, which represented a 12% decrease compared to 2006. Few studies have been done on the thesis supervision process and how the research team interacts in Iran. In a similar study done at an Iranian medical sciences university in 2009, the results showed that the average total satisfaction of the students from the research experience acquired as to thesis

supervision was 58% (28). The final report of the British Academy of Higher Education also denotes that the respondents have introduced the supervisor as the most important factor in the success of their research programs (29). In another study, students stated that the causes of discontent was the assignment of a topic for thesis to a supervisor who doesn't have specialty about it, allocation of insufficient time to study, inability to guide the students, and finally the lack of professors' sufficient knowledge and skill (30).

Given the challenges with which the professors and students are faced during writing the thesis, and since the same study has not been conducted in Iran, which covered different dimensions of the design of thesis supervision software, this study aimed to determine potential factors affecting post-graduate students' thesis supervision in Shiraz University of Medical Sciences and offer a web-based solution in 2017.

Methods

The present study was a developmental one that was carried out in two theoretical (this phase was needs assessment and situation analysis) and technical phases in order to determine the potential factors affecting the thesis supervision and offer a web-based solution for post-graduate students of Shiraz University of Medical Sciences in 2017 (Figure 1).

Theoretical phase

At the first stage of theoretical phase, 40 aspects were identified as the potential factors affecting the thesis supervision, which was carried out by literature review, investigation of former studies in other countries and existing

documents and regulations of post-graduation in Iranian higher education as well as the workflow of thesis performance in Shiraz University of Medical Sciences' post-graduate courses.

Then, at the second stage of the theoretical phase, the dimensions specified in the first stage were entered into Delphi stage of the study by using a questionnaire, which 14 expert professor of the Shiraz University of Medical Sciences including post-graduate managers from different facilities belongs to that participated in this survey.

Two rounds were performed to answer the research question. In the initial round, factors from the literature were presented to all experts. In the second round, the factors added by the experts in the first round were directed to the experts of the first round.

At this stage, there was a questionnaire containing questions with five options (the fifth option was the most important and 1 had the lowest importance). Items with a score of 0-1.66 were rejected; those with a score of 1.67 to 3.33 entered the second round, and those with the score of 3.34-5 were confirmed.

The ANONA test and LSD were used in order to identify the most important factors agreed by the professors. After Delphi was completed in two rounds, 13 dimensions were selected as the most important factors influencing thesis supervision from the viewpoint of expert professors.

In the third stage of the theoretical phase, a questionnaire according to the previous stage was designed by the researcher to determine the current status of thesis supervision from the viewpoint of graduate students. The questionnaire had four parts. The first part dealt

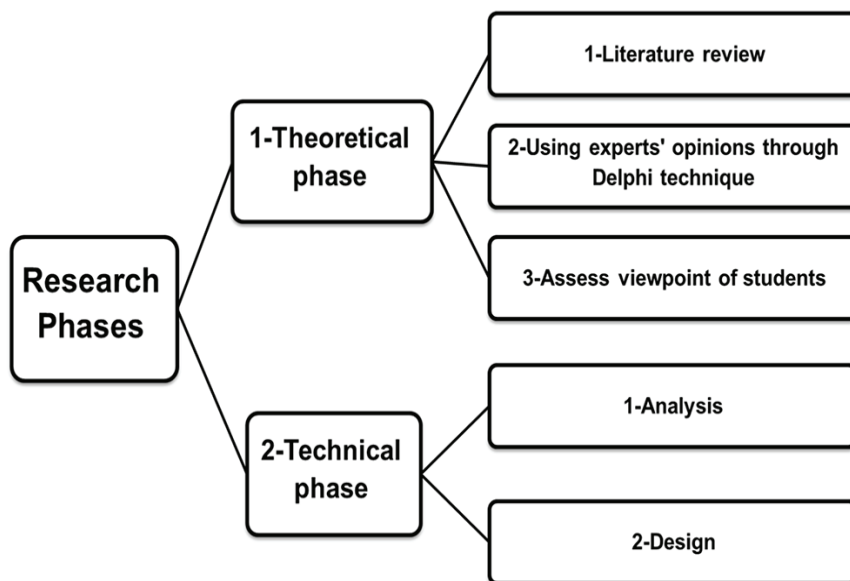


Figure 1: Research phases

with the student's demographic information and had 5 closed items. The second part was about the overall satisfaction rate of the students from the supervisor and included the single item with five options Likert scale (5 highest and 1 lowest satisfaction). The third division of the questionnaire was about determining the status of thesis supervision and how the supervisors interact according to the indicators specified formerly; it had 13 items with a Likert scale of four options (4 was the maximum and 1 was the lowest scores).

The content validity of the questionnaire was confirmed by three faculty members of the medical education department (one professor and two associate professors) and three of the faculty members of the health services management department (assistant professors). To assess the reliability, we first distributed the questionnaires among 30 postgraduate students of the faculty of medicine and after data collection and early analysis, Cronbach's alpha was 94% that indicated the high level of reliability of the questionnaire.

To select of the students, we used the cluster sampling method with allocation proportional to the number of students per faculty. Finally, in the third stage that was performed according to the previous stages, the students' viewpoints about the factors influencing the thesis' supervision were reviewed. At this stage, 200 questionnaires were distributed among the students of nine schools (School of Medicine, School Paramedical, School of Health, School of Management and Medical Informatics, School of Pharmacy, School of Rehabilitation Sciences, School of Nursing and Midwifery, School of Nutrition and Food Sciences and School of Advanced Medical Sciences and Technologies); then, 194 questionnaires were completely gathered. The response rate in this survey was calculated 97%, that represents a high response rate among the participants.

We entered the extracted data into SPSS version 20; then they were analyzed by descriptive and analytical statistics. Exploratory Factor Analysis was also used in order to identify and determine the potential factors affecting thesis supervision.

Technical phase

The systems development life cycle (SDLC), also called the application development life-cycle, is a term used in systems engineering, information systems and software engineering to define a process for analysis, design, implementation and evaluation an information system (31). The technical phase was performed based on the two first stages of SDLC development methodology.

In the first stage of the technical phase, after

the present process of thesis fulfillment was drawn and the factors affecting the thesis supervision and challenges of the current process were determined (the first phase of the research), capabilities and end-user requirements were specified for a web-based system that electronically enables the thesis supervision; then, the inputs, processes, outputs, and workflows were designed for the system by the researchers and development team, using software analysis engineers.

In addition, by utilizing Unified Modeling Language (UML) use-case diagrams, sequence diagrams, and activity diagrams were drawn for the intended system. The Unified Modeling Language (UML) is a general-purpose, developmental, modeling language in the field of software engineering that is intended to offer a standard approach to visualize the design of a system. A use case diagram at its simplest is a representation of a user's interaction with the system that displays the relationship between the user and different use cases in which the user is involved. A sequence diagram shows, as parallel vertical lines (lifelines), different processes or objects that live simultaneously and, as horizontal arrows, the messages exchanged between them, in the order in which they occur (32, 33).

It is necessary to remember that system feasibility was performed at the first phase of the study, which is one of the most important parts of the software engineering analysis step.

The design phase defines, in detail, the essential specifications, features and actions that will fulfill the functional requirements of the proposed system which will be in place. This is the step for the end users to deliberate and control their specific business information needs for the proposed system. It is during this phase that they will consider the necessary components (hardware and/or software) structure (networking capabilities), processing and procedures for the system to accomplish its objectives. Also, the programming real code is written in this phase (32, 33).

At the second stage of the technical phase, according to the analysis carried out in previous stages as well as considering specifications, requirements and data elements determined for the proposed system, we designed the physical and logical models of the system.

Based on these models, programming for thesis tele-supervision software (in Persian) was done with programming languages including ASP.NET and C# based Visual Studio's Integrated Development Environment version 2012. In addition, SQL Server database management system version 2012 was used to develop the system's database management.

Results

Results of theoretical phase

Results obtained from first and second stages of the theoretical phase are presented in Table 1. Expert professors and postgraduate managers specified thirteen aspects as the most important dimensions affecting the thesis supervision. Table 1 presents the most important factors that are ordered based on priority.

67 percent of the students in this study were female (167 people), and the remainder were male (64 people). The mean age of the subjects was 28.4 years. 64 percent (128 people) were master students, and others (66 people) were Ph.D. students. Furthermore, the secondary findings of the current study indicated that 40.2% of the students in Shiraz University of Medical Sciences were completely satisfied with their supervisor's performance, and totally over 62% of the students reported that they were satisfied with the performance of their supervisor, about 11% of them were repined, and 26% of others

revealed a moderate level of satisfaction.

The findings of this study showed that there was a significant difference among the factors affecting the thesis supervision based on the expert professors and post-graduation directors' viewpoints.

As shown in Table 2, the students who participated in this study have appropriately evaluated the status of thesis supervision and the way the supervisor interacts with them.

According to Table 2, the factor of "fair behavior toward the student" attained the maximum score of mean, and factors of "Accessibility," "continuous assessment of the student," "Discussion and negotiation about the subject of the thesis", and "Mastery of the subject" had the lowest mean.

The KMO test (data adequacy index) in Table 2 was more than 0.9, indicating that the data was sufficient for factor analysis. In addition, the value of the Bartlett test index was acceptable at 95% level and was statistically significant.

Table 1: Forceful factors affecting thesis's supervision based on viewpoint's post-graduation managers (expert professors) ordering by importance

No	Indicator	P
1	Track the progress of work status	0.04
2	Provide an appropriate feedback to student's ideas and problems	
3	Holding regular sessions with student	
4	Explicit expression expectations from student	
5	Aid and facilitate to student about access to resource and facilities	
6	Support in writing thesis	
7	Assist how to prepare a student for defense meeting	
8	Accessibility in several methods (in person, phone, email, etc.)	
9	Mental and emotional support from student and communicate friendly	
10	Aid to write the article extracted from thesis	
11	Present a feedback of report's the progress of work to post-graduation department	
12	Mastery of the subject	
13	A good response to student's mistakes	

Table 2: Distribution of potential indicators affecting thesis's supervision based on the viewpoint of students

no	Indicator	Mean	Standard deviation	The amount of common factor before extraction	The amount of common factor after extraction
1	Fairly behaving with a student	3.43	0.66	1.00	0.50
2	Considering a student's comments	3.31	0.67	1.00	0.55
3	The reasonable requests by supervisor	3.24	0.64	1.00	0.51
4	Provide feedback to a student	3.24	0.73	1.00	0.62
5	Responsibility of the supervisor	3.19	0.79	1.00	0.64
6	Effective supervising and leading	3.17	0.80	1.00	0.73
7	Accessibility	3.15	0.84	1.00	0.42
8	Give motivation to the student	3.22	0.73	1.00	0.61
9	Taking Continuous assessment from the student	3.15	0.74	1.00	0.74
10	Discussion and negotiation about subject of the thesis	3.15	0.74	1.00	0.63
11	Having a logical approach to the research	3.33	0.69	1.00	0.57
12	Mastery of the subject	3.15	0.85	1.00	0.61
13	A good response to the student's mistakes	3.17	0.76	1.00	0.65

According to the data shown in Table 2, the sixth factor of “Effective supervising and leading” had the highest percentage in the variance among the scores, so that it was the variance of the common factor. On the other hand, the seventh “Accessibility” index had the lowest percentage of the variance among the scores. The higher the number of commonalities is, the better the variable serves as a marker for the related factors; in other words, a variable with a high commonality is a purer index of common factors, and it has less a sole variance.

The findings indicated a major dimension or an important factor in explaining the variance of the data. Therefore, it can be inferred that all 13 questions of the questionnaire are classified into a specific dimension, which is the same as the student-professor interaction.

The results of independent t-test in two male and female groups showed that there was no statistically significant relationship between gender and students’ viewpoints as to the status of thesis supervision and the way the supervisors interact with students ($P \geq 0.05$).

Also, other findings of the study showed that there was no significant relationship between the students’ educational grade and their viewpoint on the supervision status of the thesis and the way the supervisor interacted ($P \geq 0.05$).

Results of technical phase

The Web-based system developed “SAHPAD” has 5 main user types (administrator of the system, student, professor, head of the department, and director of graduate studies) (Figure 2).

In this system, the site administrator is responsible for the technical management and administration of the users. The director of graduate studies is responsible for overseeing all thesis processes. The head of the department is responsible for confirming the pre-proposal, proposal, and thesis. The professor is responsible for student supervising and advising. The student is responsible for performing and writing pre-proposals, proposals, and thesis.

Professors and students are two key users of this system. The main activities of the

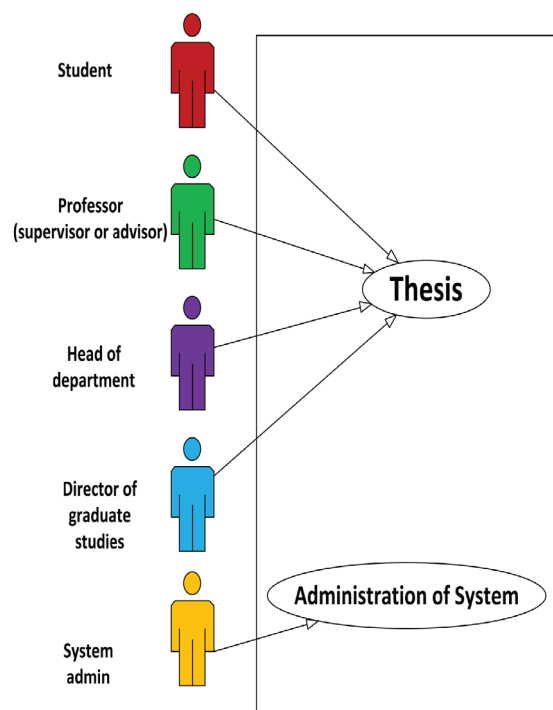


Figure 2: Use-case diagram for all users of the system

professor in the system are: Sign into the system, communicate with the director of graduate studies, read or view, submit and edit, verify and send, supervise, advise, and chat online and offline (Figure 3).

The main activities of the student in the system are: Sign into the system, read or view, submit and edit, and chat online and offline (Figure 4). According to Figure 5, the activities of the four users involved in the thesis process (student, professor, head of the department and director of graduate studies) are related to each other in a logical sequence (Figure 5).

The developed system digitalizes the interactions from the beginning to the end of the thesis fulfillment process among the research team together and with directors of the research center. The major functional area related to SAHPAD system is shown in Table 3.

The main capabilities covered by SAHPAD system is shown in Table 4.

Table 3: The main functional area of the SAHPAD system

No	Functional area of the SAHPAD system
1	Interacting student with supervisor and advisor to decide on the subject
2	Interacting student with supervisor and advisor to prepare sketch of the proposal
3	Interacting student with supervisor and advisor to apply modifications provided by examiners, at the deferent part of thesis procedure
4	Interacting student with supervisor and advisor to write an article based on the thesis
5	Interacting student with supervisor and advisor to prepare for the defense meeting of the thesis
6	Interacting student with supervisor and advisor at throughout steps from conducting and editing of the thesis

Table 4: The major capabilities of SAHPAD system

No	Capabilities
1	Negotiating student with supervisor and advisor independently and collectively
2	Recording the scientific, operational questions and difficulties by a student
3	Submit comments, tips, and pieces of advice provided by professors
4	Notification of reminder messages and alert to the student, professors, administration, the head of the department and director of post-graduation department when it is required.
5	Assessing the performance of professor from student and vice versa
6	Discussing professors and student about preparation for defense of the thesis
7	Worktable for articles extracted from the thesis
8	Directive communication among professor, the head of the department and the manager of post-graduation department
9	Management reporting for the manager of post-graduation and for the head of the department as well as monitoring the process of each thesis
10	Scheduling table for in person and online sessions of student with supervisors
11	Noticing defense meetings, relevant research workshops, regulations and news related to post-graduation by the administration
12	A library of appendix files belongs to professor and student (articles and e-books related to the thesis)
13	Access to websites and scholar portals.

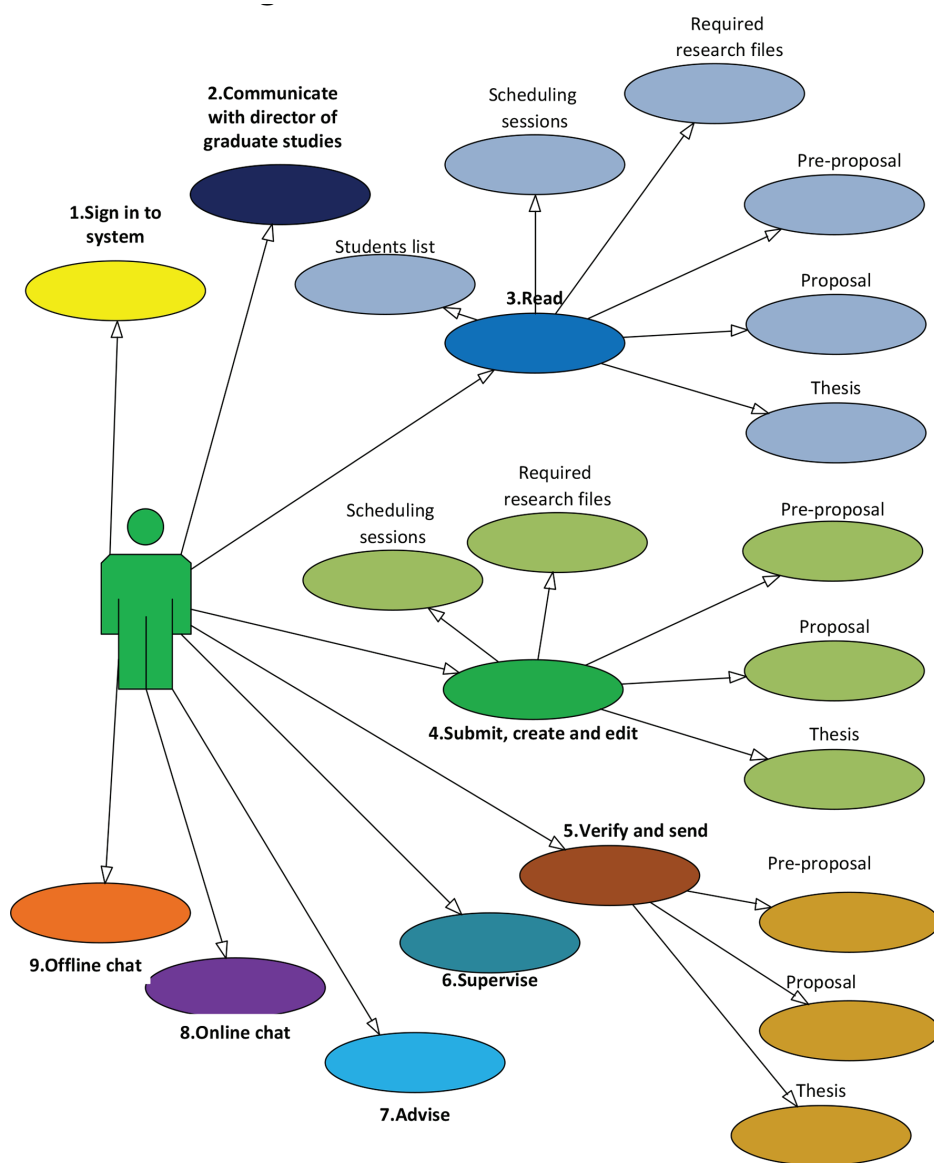


Figure 3: Use-Case diagram for professor

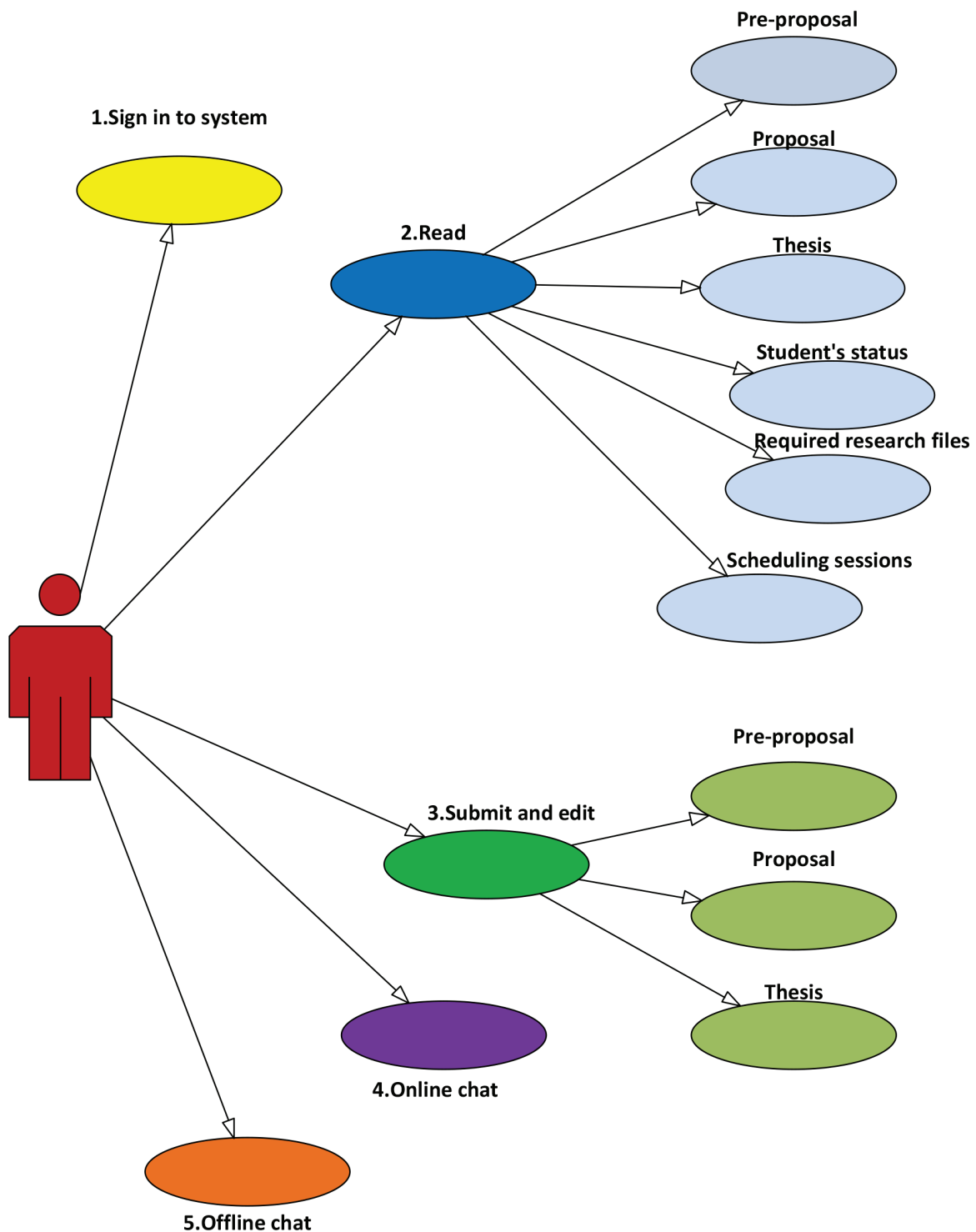


Figure 4: Use-Case diagram for student

Discussion

Discussion for of theoretical phase

The results of this study showed that the factors affecting the supervision of thesis were different in terms of the degree of importance, based on the faculty members and post-graduate managers' opinions. In other words, some of the factors have

a considerable effect on the thesis supervision process for post-graduate students, while some of them have a small effect on it. According to the result, the expert professors and managers of post-graduate department considered the following factors as the most important factors affecting the thesis supervision: tracking the progress of

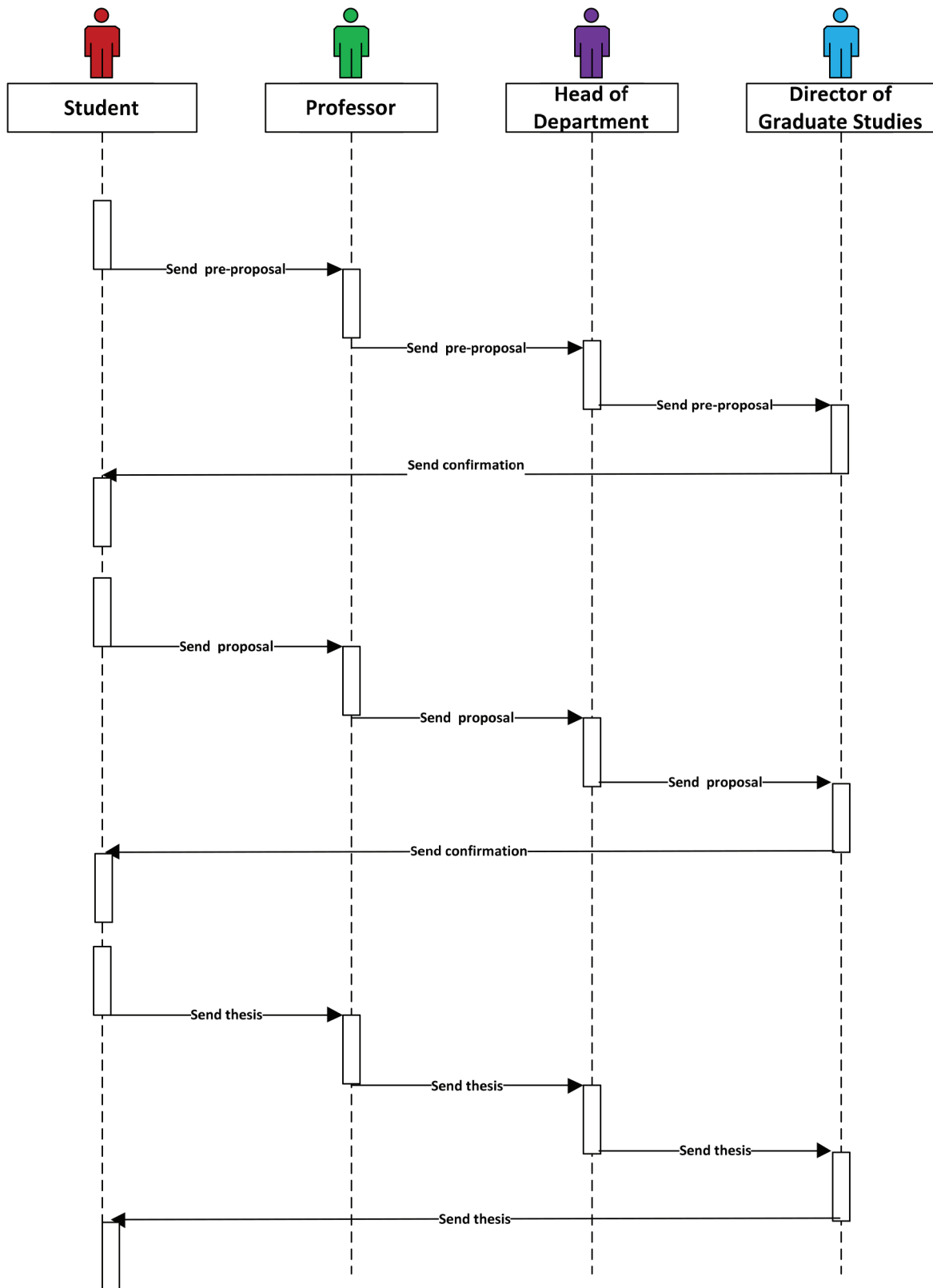


Figure 5: Sequence diagram of system

work status, providing an appropriate feedback to the student's ideas and problems, holding regular sessions with students, expressing the expectations from the students explicitly, aiding and facilitating the students about access to

resource and facilities, supporting the students in writing thesis, assisting in how to prepare a student for defense session, having accessibility in several methods (in person, phone, email, etc.), supporting the student mentally and emotionally

and communicating friendly, aiding to write the article extracted from the thesis, presenting a feedback the progress of work to post-graduate department, having mastery over the subject and a providing a good response to the student's mistakes, which they ordered by importance degree. In a similar study performed at one of the Malaysian Universities, researchers interviewed 45 faculty members; then, they analyzed their views on the supervision of thesis in post-graduate grades. Next, they categorized the factors affecting the management of thesis in the five groups, including essential, very important, important, and insignificant. According to the results of this study, eight indicators were considered as mandatory and important indicators. Given that, the results of our study confirmed the findings obtained by Hei and Wei. (34). According to Zuber et.al. (2008), having a supportive role, encouragement of the student at the right time, the professor's skill in modifying the article adopted from the thesis, having the responsibility of the supervisor, the interest of the student and supervisor in the subject of research, and the supervisor's sufficient experience in conducting the scientific research are known as the most important factors influencing the thesis supervision (35). The findings of the study are also consistent with most of the cases by Zuber et al. (35) Sidhu et al. (2013) and Wilkinson et al. (2005); they explored the unique role of the supervisor in the success of thesis, Moreover, have found that the process of writing a thesis is influenced by many factors. They introduced a trait for a good supervisor whom it was leadership participation at all stages of the thesis supervision, including subject selection, drafting of proposals, examiners' adjustments, a compilation of chapters, preparation for defense, and writing an article based on the thesis. As the results of the study showed, the researchers suggested indicators such as providing a mutual feedback, taking a supportive role by the supervisor, and tracking the progress of work as the key factors affecting the thesis supervision (36, 37).

It seems that the results of similar studies from other countries are consistent with the findings of our study; showing that there are common aspects of a thesis supervision process in higher-education systems. Furthermore, it seems that a thesis supervision process (which is a kind of mutual relationship and interaction between students and professors) has the derivation and nature related to human sciences and psychology science, so that it can be assumed that the similarity to the results of various studies is rooted in the resemblance in human's mental structure.

Our findings of the current status of thesis

supervision from the viewpoint of postgraduate students indicated that most students were satisfied with the performance of their supervisors and only a small percentage of them expressed dissatisfaction with the performance of their supervisors. Based on the results of this study, there was a significant difference between the students' satisfaction with the performance of the supervisor in different faculties of Shiraz University of Medical Sciences ($P \leq 0.05$); School of Pharmacy, School of Health, and School of Medical respectively received the most satisfaction rate and School of Nutrition and Food Sciences and School of Advanced Medical Sciences and Technologies respectively got lowest score. According to the results, students' satisfaction seems to be related to the old-line faculty. In other words, the degree of satisfaction of postgraduate students with the performance of supervisors in schools is higher than the newly established faculties since they have more experience, higher age, and more background in admitting and educating postgraduate students.

In this sense, there are similar studies conducted at Tabriz University of Medical Sciences and at Gilan University of Medical Sciences in Iran; the researchers reviewed the degree of satisfaction in different faculties studied (medical, dentistry and Pharmacy) and reported a statistically significant difference, which is consistent with our findings (28, 38).

Based on our results, the mean score of total satisfaction of postgraduate students in Shiraz University of Medical Sciences was estimated to be at a middle level from the performance of the supervisors in the supervision process of thesis (77%).

Pender, in his research findings for the Graduate Careers Council of Australia, reported that the students' satisfaction with the guidance of supervisors was 78% (39). It seems that, considering the comparison of the results of the present study with other related studies, the satisfaction of postgraduate students of Shiraz University of Medical Sciences with the performance of supervisors is relatively acceptable. We can greatly improve the current status by applying appropriate policies and utilizing new methods and techniques.

Other results from our study showed that the factor of "fairly behaving from the supervisor with the student" had the highest mean scores and indicators of "accessibility," "continuous assessment of student," "negotiation on the subject of the thesis" and "mastery of the subject" jointly received the lowest mean score. In other words, based on the students' views, the performance

of the supervisors in the indicators attained higher the mean score was more appropriate, and in the indexes with a lower mean score, was inappropriate. It seems that according to our results, three out of four indicators that obtained the lowest scores (accessibility, continuous assessment of the student, negotiation about a subject of the thesis) are directly related to such factors as lack of time and busyness of professors and a low ratio of the professor to students.

Ghadirian et al. (2014) in their study have reported that the most important challenges to the process of supervising thesis in Tehran University of Medical Sciences from students' point of view was "the weakness of timely feedback from the student and the professor", "weakness of the appropriate communication skills of the supervisor", "the deficiency of curriculum and mechanisms for monitoring the process of a thesis supervision", and "the weakness of the skill and knowledge of the supervisor in research management" (40). Krauss et al. (2010) have found that the most important problems of conducting thesis from the viewpoint of Ph.D. students from University of Putra, Malaysia was a limitation of time and busyness of the professors, lack of sincere interactions and weakness in managing expectations (41). Mabrouk et al. also have mentioned (2000) that the main reason for the students to choose a supervisor was "Access to the supervisor" (42). Takizawa et al. (1998) also have recognized that many postgraduate students from one of Japan's top universities were rarely able to have meeting with their supervisor, and the supervisors did not have enough time to track the status among the students (43).

Discussion for of technical phase

The software developed in this research will facilitate and manage the students' interaction with the supervisors and advisors from the first stages during the process of thesis supervision (topic selection) to the final stages (extracting the article from the thesis after the defense meeting) in the information technology field. In other words, this software will play a role in the student's interaction with the supervisor at all stages of the thesis, including selecting a topic, submitting a proposal, editing a thesis, holding defense meeting, and extracting a paper from the thesis.

One of the main applications of this software can be to facilitate the interaction between postgraduate students in distance education at virtual schools (distance e-learning) and their professors in the process of thesis fulfillment because one of the challenges of virtual disciplines

is the students' limited access to supervision due to distance. In addition, the software records the activities and interactions between the students and supervisors during the thesis process, which can allow the university's research directors to use the software to monitor the performance of supervisors and students and the degree of interaction and the participation of each of them at all stages of the thesis writing.

In line with our findings, in large-scale researches conducted by Aghayee et al. (2012 and 2016) and Hansson et al. (2015) at the University of Stockholm, the researchers have described that Information and Communication Technology have benefits for the thesis, and utilizing computer systems in the process of supervising a thesis can improve the effectiveness and efficacy of the interaction between the students and supervisors and, consequently, enhance the quality of postgraduate thesis. In another part of their study, researchers have introduced a web-based software system developed at the University of Stockholm. They have mentioned that the goal of designing this system is to manage and supervise online remote thesis. Next, they highlight the benefits of this system by reducing the time of thesis writing, improving the scientific quality of thesis, improving the efficiency of the process, enhancing the students' creativity, increasing the flexibility of doing things, and boosting the student's motivation. In another part of their research, the researchers outlined the main features of the designed system, including idea bank management, an online interaction of the student with a supervisor or via SMS service, specialized resource management, plagiarism check test, room dialogue, and self-evaluation. Subsequently, by carrying out the quantitative and qualitative study, after collecting the questionnaires and conducting interviews with the users, they analyzed their views about the level of system accuracy and their satisfaction with the system. Accordingly, the users' satisfaction was a good level and their views about the system applicability were also highly evaluated. The results of these studies and the system developed at the University of Stockholm, Sweden, are similar to those of the present study and SAHPAD system in a variety of dimensions (11, 44-49).

In another study by Yan et al. (2012) aiming at designing an advanced web-based system to support the thesis process and knowledge sharing at a well-known university in China, the researchers described the capabilities and benefits of the developed system; then, they explained the results of evaluating the users' views on the system. From the users' point of view, the designed system can improve the communications

and interactions between the professors and students, and it will accelerate and facilitate their performance. Despite the relative satisfaction of the users of the system's performance, about half of the users were dissatisfied with the user interface and stated that it had been relatively difficult for them to work with this web-based software. At the end of this study, researchers have indicated that feedback and comments from the users must be taken into account to upgrade the second version of the software (50).

Paul et al. (2008) in their study had considered that the Information and Communication Technology and mobile technology have benefits for management of postgraduate research department and students' thesis and can improve the quality and increase the effectiveness of the research. In their study, that was a combination of quantitative and qualitative methods, they evaluated and analyzed the user's views about functioning of the mobile-based system for thesis supervision at Makerere University. The results indicated that the users were highly satisfied with the impact on the system designed to improve the process of fulfilling their thesis. Users recognized that the use of this mobile-based system allows to improve interactions and motivation, create a deep sense of closeness with supervisors, and accelerate the completion of the thesis. At the end of their research, researchers recommended that postgraduate program managers and decision-makers use Information and Communication Technology-based systems within the field of higher education, especially distance education (51).

Considering the results of the current study and the findings of other similar local studies and those conducted abroad, it seems that one of the reasonable solutions to resolve problems or improve these challenges is to create an appropriate communication platform for the interaction between the supervisor and students regardless of place and time. A suitable platform which can facilitate the students' access to the supervisor and mutual interaction between them will strengthen the supervision of the thesis management process for the education and research managers by providing a variety of tools, and improve the quality of the thesis.

Conclusion

According to the findings of this study and the results obtained from other studies in our country and others, information technology and communication can be used to improve the quality, effectiveness, and efficacy of higher-education systems. Today, the use of e-learning has been spread throughout the world. Information

technology and communication projects on principles of analysis, design and implementation can be considered a unique opportunity which will greatly reduce the problems related to of the post-graduation domain, such as poor interpersonal communication and interactions, inadequate access to necessary resources and information, low-quality of thesis, time-consuming nature of research processes, and delays in graduating, waste of time and cost, etc. We first focused on specifying the factors affecting the thesis supervision and analyzing the current status of Shiraz University of Medical Sciences in management domain and the thesis supervision for post-graduate students; then, we developed the supervision system for the professors and students. Based on this, interactions among the main stakeholders (students, professors, and post-graduation educational and research officers) involved in the thesis completion can be carried out in the context of this system. The system will also be able to serve as a management tool in order to supervise postgraduate educational and research executives on the process of supervising and writing thesis.

Conflict of Interest: None declared.

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