Knowledge Management & E-Learning
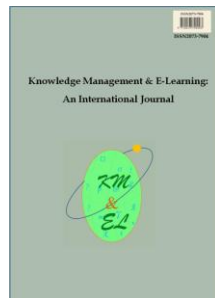
Knowledge sharing practices among doctoral students in JAIST to enhance research skills

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Abstract: This study reports an exploratory investigation of knowledge sharing (KS) practices of doctoral students in Japan Advanced Institute of Science and Technology (JAIST) to enhance research skills. It examines KS concepts, reasons for sharing knowledge, types of knowledge that the doctoral students share with each other, level of agreements on how KS supports the research process and what factors should be considered while sharing knowledge among others. It also explores the barriers of KS among JAIST doctoral students, the suggestions how those KS barriers can be overcome and some recommendations by which research activities can be promoted through sharing knowledge. This study includes both qualitative and quantitative approaches. We conducted face-to-face interviews of 29 doctoral students of three graduate schools of JAIST. The findings confirm that the doctoral students held highly positive perceptions about sharing knowledge with each other, and most of them believe that KS can enhance and promote research skills. Therefore, the findings would be beneficial for all students of three graduate schools of JAIST for further enhancement and encouragement of KS among them.

Keywords: Knowledge sharing; Perceptions; Knowledge sharing barriers; Research skills; Doctoral student

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1. Introduction

Many organizations have realized the advantages and benefits of sharing information and knowledge within the organization (Goh & Hooper, 2009). JAIST is a leading research institution in Japan, with the goal of making significant contributions to the development of the global society (JAIST, 2012). The school of Knowledge Science has been playing an important role to utilize the merits of knowledge management through sharing knowledge. There are two levels of knowledge within an organization: knowledge that resides within the individuals in the organization and knowledge that exists at the collective level, independent of individuals (Spender, 1996). Hara (2007) proposed three broad types of knowledge that may be shared: book knowledge, practical knowledge, and cultural knowledge. The term knowledge sharing (KS) implies the giving and receiving of information framed within a context by the knowledge of the sources (Sharratt & Usoro, 2003). KS is the process of mutually exchanging knowledge and jointly creating new knowledge (van den Hoff & de Ridder, 2004). Basically, KS is done in two ways: a)

By articulation i.e. an individual succeeds in formulating the fundamentals of his/her own tacit knowledge into explicit knowledge that can be stored or formalized or shared within the organization; and b) By socialization that is the sharing of tacit knowledge between people and knowledge moves from tacit to tacit (Nonaka, 1991). KS has also been identified as a major focus area for knowledge management (Hendriks, 1999).

Research on KS in academia has been explored in the past. However, there is little articulated research that focused on KS practices among academics in a research institute/university. For example, Cheng, Ho, & Lau (2009) examined KS behaviour among academics in a private university in Malaysia, while Babalhavaeji and Karmani (2011) determined the factors that influenced KS amongst Library and Information Science faculties, which referred to attitude, intention and intrinsic motivation. In addition, previous studies have not explored the KS practices amongst the doctoral students in a specific research institute of a particular country. As a result, there is a knowledge gap about how doctoral students do KS practices for enhancing research skills and promoting research works in a research institute. Therefore, the current study attempts to reduce the gap by exploring the present state of KS practices among the doctoral students in JAIST to enhance research skills.

The rest of the paper is structured as follows: Section 2 explains the objectives of the study; Section 3 reviews the relevant literature; Section 4 presents research methodology, sample and its background information; Section 5 analyses and interprets the findings; Section 6 presents the discussion with a brief summary, and section 7 concludes the paper.

2. Research objectives

The aim of this study is to explore the state-of-art of KS practices among the doctoral students in JAIST. The more specific objectives of the study are as follows:

- Investigate the reasons for sharing knowledge, types of knowledge that the doctoral students share with each other.

- Examine the level of agreements on how KS capabilities support the research process and what factors should be considered while sharing knowledge.

- Explore the barriers and problems of KS practices among JAIST doctoral students.

- Seek suggestions how those KS barriers can be overcome and provide some recommendations by which research activities can be enhanced through KS practices.

3. Literature review

Existing literature has identified a wide range of factors that influence KS behavior. These factors could be summarized as: technological factors, organizational or environmental factors, and individual or personal factors (Ardichvili, Maurer, Li, Wentling, & Stuedemann, 2006; Cabrera, Collins, & Salgado, 2006; Barson et al., 2000; McDermott, 1999; Riege, 2007; Paroutis & Al Saleh, 2009). In addition, the motivators for sharing knowledge in online environments were generally categorized into six types: reciprocity, personal gain, altruism, commitment to the group, ease of technology use, and external goals (Hew & Hara, 2007). Empirical research has identified important factors that influence knowledge sharing including individual factors (e.g., lack of trust,

fear of loss of power, and lack of social network), organizational factors (e.g. lack of leadership, lack of appropriate reward system, and lack of sharing opportunities), and technological factors (e.g., inappropriate information technology systems and lack of training (Riege, 2005). Yang (2008) explored how employees process information after they have collected it, and investigated how individual attitudes to learning, sharing and storing influence organizational knowledge sharing. It is suggested that front-line managers should help rank-and-file employees to both learn and share knowledge and encourage the habituation of such behaviour patterns, which would enhance organizational performance. Ruppel and Harrington (2001) explored that intranet implementation is facilitated by a culture that emphasizes an atmosphere of trust and concern for other people (ethical culture), flexibility and innovation (development culture), and policies, procedures, and information management (hierarchical culture), and suggested management should ensure that the proper values are in place to optimize intranet implementation and facilitate knowledge sharing. Their research also added to the body of literature on intranets, IT innovation, and KM. They concluded that the role of trust in intranet growth and KM will continue to be a major concern and may increase in importance as intranets continue to develop. Yang and Wu (2008) proposed a novel agent-based modelling approach to stimulate the actions of KS between actors such as managers, employees in an organization for sharing knowledge. Lin, Lin, and Huang (2008) described the process of KS and creation for teachers participating in virtual teams of a teachers' professional community from different organizations. Azudin, Ismail, and Taherali (2009) carried out a study of KS among workers on their contributions through informal communication in Cyberjaya, Malaysia. On the other hand, Fu, Yang, and Huang (2012) showed that there were both significant gender and educational level differences in KS levels among participants. In particular, female students bloggers showed more KS activities than males in the sense of posting more in each of KS levels, therefore the educators should take into account the gender issue in conducting a blog-based learning environment. They also found that the educational level effect on KS levels was partly significant.

4. Research methodology

This study includes both qualitative and quantitative approaches. We conducted face-to-face interviews of 29 doctoral students of three graduate schools of JAIST. Initially, we selected 35 doctoral students based on their understanding and spoken capability of English, among them 11 from School of Knowledge Science, 14 from School of Information Science (IS), and 10 from School of Material Science (MS). 29 doctoral students (10 from Knowledge Science, 14 from IS and 5 from MS) agreed and took part in the interviews. Since the first author of the paper had no appropriate capability to understand and to communicate in Japanese language, the doctoral students who had spoken capability of English were selected as the population for the study. The interviews were conducted using a structured questionnaire consisting of open- and close-ended questions. The questionnaire was being authored based on the previous studies (Islam, Kunifuji, Miura, & Hayama, 2011; Islam, Kunifuji, Miura, & Hayama, 2012) and personal experiences of the authors. The interviews were carried out from 15 to 29 February, 2012. To ensure the anonymity of the interview participants, we categorized the interviewees into three groups: 'D1' who were in the first year of doctoral program, 'D2' who were in the second year of doctoral program, and 'D3' who were in the third year of doctoral program. The responses of the interviewees to open-ended questions (qualitative data) were coded and thematically interpreted. The basic coding was used in

order to distinguish overall themes, followed by a more in-depth, interpretive code in which more specific trends and practices could be recognized. Thematic analysis was done manually- which was as simple as highlighting different concepts with different colours. The responses to close-ended questions on 5-point Likert scales were analysed using the descriptive analysis techniques of Statistical Packages for the Social Sciences (SPSS) 16.0.

4.1. Sample and its background information

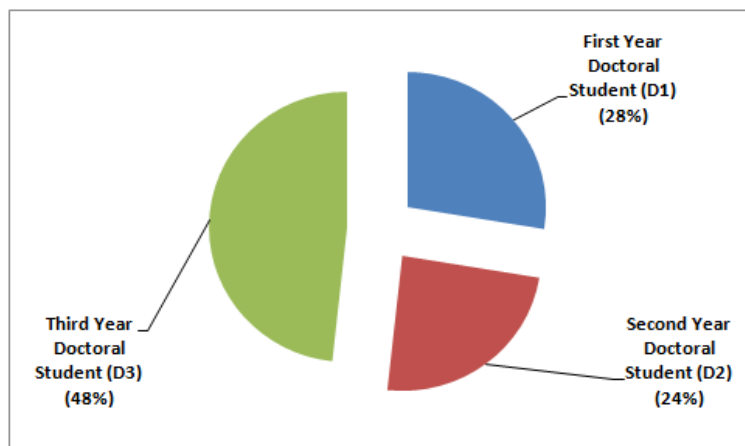### 4.1.1. Attributes of the interviewees

Fig. 1. Present position of the interviewees

Fig. 1 indicates that the highest percentages (48%) of interviewees were third year doctoral program students (D3), followed by 28% of the first year doctoral student (D1) and (24%) of the second year doctoral student (D2).

4.1.2. Distribution of the interviewees based on the schools to which they belonged
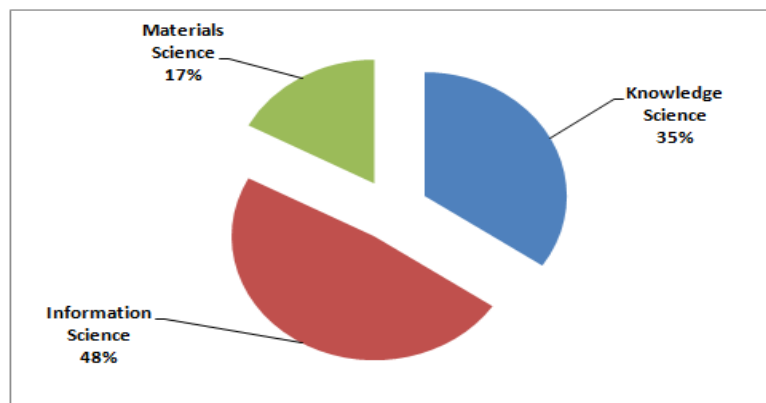

Fig. 2. School-wise distribution of the interviewees

Fig. 2 shows that 48% of the interviewees were from the School of Information Science, followed by School of Knowledge Science (35%) and School of Materials Science (17%).

5. Findings

This section described the understanding of KS, the reasons for sharing knowledge, types of knowledge that the doctoral students share, how KS capabilities supports research process, the factors to be considered while sharing knowledge with others, problems and barriers of KS, suggestions and recommendations to overcome the barriers, and to promote research activities through sharing knowledge.

5.1. Understanding of knowledge sharing

Different interviewees reported their understanding of KS from different point of views, although their basic level of understanding was almost the same. For example, one D2 defined KS as "the process by which knowledge is transferred, disseminated and shared among a group," while one D1 reported that "KS is continuous activities through which experiences, skills, information, expertise and ideas are exchanged directly or indirectly among man to man, or man to organization or man to country." One D3 stated that, "KS is acquiring some information or tools or ideas and technologies through discussions or assistance between individuals", and similarly, another D2 defined KS as "sharing information and knowledge through many kinds of media such as web pages, discussions, meetings, email, etc." One D2 reported that "KS is a process in which participants communicate and exchange information about diverse subjects," while another D1 mentioned that "KS is an activity through which knowledge i.e. skills, expertise and information are exchanged among people," and another D3 defined KS as "the activities by which knowledge is exchanged among friends or within a community."

According to one D3, "KS is a process through which information relevant to anything, skills, critical knowledge and experiences are shared with students or among people or within organizations, or among societies or even within family members," while another D3 reported that "KS corresponds to roughly sharing information among the public. Such sharing should improve the intellectual level of both the society and the individual." Similarly, one D3 reported that "KS is to exchange experience and knowledge from someone who have good knowledge," and another D3 stated that "KS is key element in personal and academic growth and highly motivation to achieve research goals." Interestingly, one D1 reported that electronic knowledge is comparatively easier, and intellectual knowledge that human being has, can be shared through interactive processes, teaching, etc.," while another D3 stated that "KS is to use common resources of information, to be updates about the research of others and to discuss and present own research ideas to different researchers."

5.2. Reasons for sharing knowledge

KS is extremely important because it links individual learning with organizational learning (Kim, 1993). We examine the level of agreement regarding the factors/reasons for sharing knowledge and analysed them in Table 1 using descriptive analysis techniques of SPSS 16.0.

Table 1
Level of agreement regarding the factors for sharing knowledge

Statement	N	Min.	Max.	Mean	Std. Dev.
Gain preliminary ideas of research topics and fundamental research skills	29	2.00	5.00	4.21	.86
Exchange important sources of information and knowledge	29	2.00	5.00	4.21	.77
Acquire knowledge and learn how to write a research article/paper	29	2.00	5.00	3.93	.92
Exchange and learn how to write a good doctoral dissertation	29	2.00	5.00	3.83	1.00
Exchange and share the merits and demerits of different research methodologies	29	2.00	5.00	4.17	.76
Obtain knowledge about how to access necessary knowledge resources very easily	29	2.00	5.00	4.06	.84
Learn appropriate knowledge for handling & operating the latest technologies	29	2.00	5.00	4.03	.94
Enhance individual research skills through knowledge sharing with each other	29	2.00	5.00	4.10	.82
Valid N (listwise)	**29**				

Table 1 indicates the reasons for sharing knowledge that the highest mean score was 4.21 on 5-point Likert scales for the statement of "Gain preliminary ideas of research topics and fundamental research skills" and "Exchange important sources of information and knowledge," while the lowest mean scores were 3.83 and 3.93 for the statements of "Exchange and learn how to write a good doctoral dissertation" and "Acquire knowledge and learn how to write a research article/paper." The second highest mean score was 4.17 for the statement of "Exchange and share the merits and demerits of different research methodologies," followed by the score of 4.10 for the statement "Enhance individual research skills through knowledge sharing with each other," 4.06 for "Obtain knowledge about how to access necessary knowledge resources very easily," 4.03 for "Learn appropriate knowledge for handling & operating the latest technologies."

5.3. Types of shared knowledge

KM authors categorize and classify knowledge in different ways. For instance, knowledge can be classified into two broad categories: tacit and explicit (Tiwana, 2000). However, the interviewees were asked to specify what type of tacit and explicit knowledge they share among others. Their views were as follows:

5.3.1. Sharing of tacit knowledge

One D3 stated that "most of the time, he shared practical knowledge with other students. Sometimes he also shared cultural knowledge, society experiences and comparisons," while another D3 reported that KS depends upon requirements of research domain but he preferred to share practical knowledge." One D2 mentioned that usually she shared

knowledge with others based on her experiences whereas another D3 reported that he shared how to make use of different tools and technologies, and how to be clearer in explaining ideas." Similarly, one D3 stated that he shared computer skills, writing skills, and computer programming skills, all of them are practical knowledge," while another D3 reported that he shared the way or techniques how to make good presentation." Furthermore, one D3 expressed that he shared experimental procedures and theoretical approaches to solve research problems, while another D3 reported that he shared know-how knowledge of experimental research.

5.3.2. Sharing of explicit knowledge

One D3 reported that he shared websites, You Tube videos, e-books in PDF forms, conference papers, journal articles as explicit knowledge, while another D3 mentioned that she shared conference websites, slide presentations, format of research paper or doctoral dissertation or dissertation sample as well as application forms for research grants of international conferences, etc. Another D3 stated that he exchanged references and research papers to clarify ideas and augment discussions whereas one D2 mentioned that he shared books and published articles/papers particularly her own publications. Furthermore, one D3 reported that, "in case of explicit knowledge, often he shared books, lectures notes, while he got those from different media including journals articles and conference papers," while another D3 similarly stated that he shared knowledge extracted from books, published articles and lecture notes."

5.4. How knowledge sharing capabilities support research process

KS is envisaged as a natural activity of the academic institutions as the number of seminars, conferences and publications by academics is far exceeding any other profession, signifying the eagerness of academics to share knowledge (Cheng, Ho, & Lau, 2009). This study measures the level of agreements about how KS capabilities support the research and reports the result in Table 2.

Table 2
Level of agreements about how KS capabilities support the research process

Statement	N	Min.	Max.	Mean	Std. Dev.
Knowledge acquisition capability is significantly increased	29	3.00	5.00	4.10	.77
Knowledge transmission capacity is significantly increased	29	2.00	5.00	4.03	.78
The capability of exchanging knowledge is significantly increased	29	3.00	5.00	4.24	.74
Accessibility to a wide range of knowledge sources/resources is significantly increased	29	2.00	5.00	4.13	.92
The capability of sharing knowledge enhance research work significantly	29	3.00	5.00	4.31	.71
Valid N (listwise)	**29**				

Table 2 shows that the highest mean score was 4.31 for the statement of "the capability of sharing knowledge enhance research work significantly," while the lowest mean score was 4.03 for the statement of "knowledge transmission capacity is significantly increased." The second highest mean score was 4.24 for the statement of "the capability of exchanging knowledge is significantly increased," followed by 4.13, 4.10 and 4.03 for the statements of "Accessibility to a wide range of knowledge sources/resources is significantly increased," "Knowledge acquisition capability is significantly increased," and "Knowledge transmission capacity is significantly increased" respectively.

5.5. Factors to be considered in knowledge sharing

The interviewees were asked to specify what factors should be considered while sharing knowledge with others in academia. The responses are presented in Table 3 using descriptive analysis techniques of SPSS 16.0 on 5-point Likert scales.

Table 3 indicates that the highest mean score was 4.34 on 5-point Likert scales for the statement of "knowledge should be accurate, reliable and up-to-date," while the lowest mean score was 3.48 for the statement of "Knowledge should cover all aspects of research (e.g. methodologies, techniques and tools)." The second highest mean score was 4.27 for the statement of "Knowledge should be easy to understand and use," followed by the score of 4.00 for the following statements of "Knowledge should be as much comprehensive as possible" and "Knowledge should be available in various sources of academia (e.g. Laboratories or library)."

Table 3
Level of agreements regarding factors that should be considered during KS

Statement	N	Min.	Max.	Mean	Std. Dev.
Knowledge should be accurate, reliable and up-to-date	29	3.00	5.00	4.34	.77
Knowledge should be as much comprehensive as possible	29	1.00	5.00	4.00	1.10
Knowledge should be easy to understand and use	29	2.00	5.00	4.27	1.03
Knowledge should cover all aspects of research (e.g. methodologies, techniques and tools)	29	1.00	5.00	3.48	1.05
Knowledge should be available in various sources of academia (e.g. laboratory or library)	29	2.00	5.00	4.00	1.04
Valid N (listwise)	**29**				

5.6. Problems and barriers of knowledge sharing

Goh and Hooper (2009) identified "the barriers of knowledge and information sharing into 11 broad categories: remuneration, organizational environment, time and resources, training and education, information technology, management practices, information quality, information access, information security, people's beliefs, fear and attitudes, and information awareness" (p.27). However, in this study, most of the interviewees reported

that language as well as cultural gap is the main problems of sharing knowledge among doctoral students in JAIST. Some of them found other problems of KS. For example, one D3 stated that "there is an ego problem, i.e. some do not get ready to accept other knowledge and sometimes biased knowledge has been shared among us to motivate other researchers in their fields of research. In addition, seniors or juniors do not describe the right point while sharing knowledge." One D2 reported that there is a lack of fundamental knowledge among many of us for exchanging information or knowledge. Sometimes, the topic in discussion is extremely detailed and on-the-fly discussion without preparation is not good in quality." Another D2 reported that there is a lack of club and lack of interactions through sports and cultural activities, while one D3 mentioned that some cultures do not support knowledge sharing among peers. Interestingly, one D3 reported three problems of KS, which are as follows: "a) Differences in languages or language competency; b) Different interests of research and perspectives; and c) A lot of research assume some impractical limitations that might contradict." One D2 reported that "it is difficult to share knowledge with people working in other fields;" while another D2 mentioned that "he is not having opportunities to share knowledge with other students."

Some doctoral students also reported that students are busy with their studies and don't match time with other to share knowledge. For example, one D2 reported that "some students don't want to speak and share because they are busy and some want to keep secret their study." One D1 reported that "some research is too deep. Sometimes, she does not understand what her friend want to explain and share with her," while another D3 stated that research topics are diverse, therefore, it is not so beneficial to share knowledge with other." Furthermore, one D3 reported that privacy and novelty of research may be copied by others through sharing knowledge.

We also obtain the level of agreements of the interviewees with the following statements on 5-point Likert scales regarding the problems and barriers of KS, which have been analysed in Table 4 using descriptive analysis techniques of SPSS 16.0.

Table 4
Level of agreements about the problems and barriers of KS

Statement	N	Min.	Max.	Mean	Std. Dev.
Language barriers	29	1.00	5.00	3.76	1.36
Psychological barriers (For those who are not interested to participate in the knowledge sharing process)	29	2.00	5.00	3.44	.78
Lack of appropriate knowledge for exchanging and sharing with other	29	1.00	5.00	3.34	.94
Lack of time	29	1.00	5.00	3.17	.92
Lack of formal knowledge sharing forum	29	1.00	5.00	3.90	.98
Valid N (listwise)	**29**				

Table 4 indicates that the highest mean score was 3.90 on 5-point Likert scales for the statement of "Lack of formal knowledge sharing forum" and the lowest mean score was 3.17 for the statement of "Lack of time." The second highest mean score was 3.76 for the statement of "Language barriers," followed by 3.44 and 3.34 for the following

statements respectively: "Psychological barriers (For those who are not interested to participate in the knowledge sharing process)," and "Lack of appropriate knowledge for exchanging and sharing with other."

5.7. Suggestions to overcome the barriers of knowledge sharing

The interviewees were asked to provide some suggestions that could overcome the barriers of KS among students. The suggestions received from the interviewees are categorized and analysed in the following themes:

a. Establishing a formal knowledge sharing forum

One D3 reported that "establish knowledge sharing forum in JAIST would overcome the problems of KS," while one D2 sought to have opportunities or forums to share and acquire knowledge," and another D2 suggested that they should have a formal framework for sharing knowledge among others." Another D3 claimed that there should have routine knowledge sharing forum.

b. Increasing the use of English as a language of education

One D3 reported that JAIST should increase the use of English as a language of education in order to overcome the barriers of KS, while another D3 stated that the most important thing is to reduce the language barriers for solving the problems of KS. Similarly, another D3 mentioned that in order to solve the problems of KS, JAIST should fix a minimum language competency in a common language so that students can participate in brain storming and sharing knowledge more actively.

c. Laboratory rotation system to promote knowledge sharing among faculty members and students

Interestingly, one D3 suggested including 'Laboratory rotation system' with a special features of doctoral program. For example, individual lab of each school can introduce and arrange day-long monthly seminars in which all doctoral students will present their research progress and research results. Scheduling should be prepared centrally and such seminars should be arranged and held on using the laboratory rotation system. She also added that JAIST should promote the ideas of KS among the faculty members and students to solve the psychological barriers of KS. Similarly, one D1 suggested arranging some casual tasks once in a month at the lab-level and once at the school-level to enhance KS activities.

d. Forming a club, organizing cultural programs and enhancing sports activities

One D2 suggested that JAIST should form a club, organize cultural programs and enhance sports activities in order to overcome the problems of KS, while another D3 similarly suggested practicing communication through socialization and collaborative works outside research that may help to become intimate, as a result they could share their experiences and knowledge with each other more easily.

e. Creating an internal lab Wikipedia or knowledge space

One D2 proposed that JAIST should have an internal lab Wikipedia alike website for discussion, in which anyone in the lab can share his/her views and knowledge via writing research paper(s) and or article(s). Similarly, another D3 suggested that JAIST could

maintain a database and create knowledge space for sharing experiences, information and knowledge among the doctoral students of JAIST.

f. Changing mind-set and working as a team

One D1 urged changing the mind-set and mentality toward sharing knowledge, otherwise it becomes difficult to share knowledge smoothly. For example, if one thinks that he/she has a lot of research experiences and knowledge, and if he/she shares that knowledge with others, they will also acquire such knowledge, therefore he/she will not share his/her knowledge." In this regard, one D3 suggested to be little bit open-minded and forget everything where the people from and be friendly in order to overcome the problems of KS.

Another D3 suggested working as a team that will increase the KS activities. As a result, the existing problems of KS will be solved easily.

5.8. Recommendations to promote research activities through sharing knowledge

The interviewees were also requested to offer some recommendations by which research activities can be promoted through sharing knowledge. The suitable ways that were received from the interviewees are noted below under some specific themes:

a. Organizing discussion groups and/ or weekly meetings

One D3 recommended that some formal meetings apart from lab seminars exclusively based on sharing of mutual research interests within JAIST and internationally would be a great step to enhance research motivations, while another D3 argued that KS should be followed by discussions, and then a formal KS forum will be a suitable way to improve and promote research activities. Another D2 recommended that JAIST should organize discussion forums and hold activities such as open campus for people to introduce about their research, while one D1 stated that "students must have to discuss and share their practical and experimental knowledge in a group discussion and deeply think each and every topic of his research in order to enhance their research skills." Another D3 recommended that there should be proper groups of student from different labs on similar research topic with uni-language, while another two D2 emphasized on holding weekly meeting, research logging and on designing knowledge-based systems/ Wiki construction (about the content of research).

b. Using social network and groupware

One D2 recommended using the social network or groupware to make a good collaboration of KS, while one D3 proposed that some research blogs in JAIST website should be created on different research topics that can promote research works through sharing knowledge. One D1 argued that research activities can be promoted by using social network and tools which provides collaborative working.

c. Creating useful environment for knowledge sharing and interaction between junior and senior students

One D3 recommended that JAIST should create real useful place for gathering people who have good knowledge, while one D2 reported that the interactions between junior and senior students should be increased for sharing knowledge smoothly.

d. Arranging seminars or workshops to improve interest in and skills for knowledge sharing

One D3 recommended that some seminars should be conducted to develop KS skills or arranged training or workshop to grow interest for sharing knowledge among the students. Thus student must be willing to participate in the KS activities. Another D3 urged to arrange seminars, special lectures and workshops that could promote the research works through KS, and another D3 recommended arranging book reading seminar that can enhance research activities through KS.

e. Enhancing communication among all local and foreign students

One D3 recommended that research activities can be enhanced through communicating with foreign students from different countries and Japanese students through as many channels as possible, for example, attending parties, while another D1 emphasized on making mutual understanding for creating value through sharing knowledge which could promote the research activities.

6. Discussion

This study explored the present status of KS practices among the doctoral students in JAIST to enhance research skills. It was found that different interviewees reported their understanding of KS from different point of views, although their basic level of understanding was almost the same. This study revealed that doctoral students of JAIST are sharing knowledge to gain preliminary ideas of research topics and fundamental research skills, and to exchange and share the merits and demerits of different research methodologies with the highest mean score of 4.21 on a 5-point Likert scale. Most of them reported that they are sharing practical experiences, computer skills, writing skills, programming skills and different types of experimental knowledge as part of tacit knowledge. They also shared books, lecture notes, websites, You Tubes videos, e-books in PDF forms, conference papers, journal articles, presentation slides, format of research paper or doctoral dissertation as explicit knowledge in order to enhance their research skills. They perceived that the capability of sharing knowledge enhance research work significantly with the highest mean score of 4.31 (on 5-point Likert scales), followed by the capability of exchanging knowledge is significantly increased, accessibility to a wide range of knowledge sources/resources, and knowledge acquisition and transmission capability is significantly increased through KS. They also agreed with the statement (with the highest mean score of 4.34) that knowledge should be accurate, reliable, and up-to-date, followed by the statements 'knowledge should be easy to understand and use', 'knowledge should be as much comprehensive as possible' etc., which should be considered while sharing knowledge with others. The interviewees also faced some problems and barriers in sharing knowledge among them. For example, differences in languages or language competencies, lack of frequent social interactions, different interest of research and perspectives, lack of adequate opportunities to share knowledge with others, and cultural gaps among the doctoral students. They also reported their level of agreements with the statement 'lack of formal knowledge sharing forum (with the highest mean score of 3.90), followed by the statements of 'language barriers', 'psychological barriers', and 'lack of appropriate knowledge for exchanging and sharing with others.'

In order to overcome the problems and barriers of KS of the interviewees, they suggested that JAIST should establish formal KS forum, increase the use of English as

the language of education, introduce laboratory rotation system, promote KS among the faculty members and students, form a club, organize cultural programs, enhance sports activities, design internal lab Wikipedia or create knowledge space, change mind-set and work as a team. They also recommended that doctoral students should form discussion groups and hold weekly meeting among them, they should use social networks and groupware, create useful environment for KS, increase interaction between junior and senior students, enhance communication among all local students and foreign students, and JAIST should arrange some workshops or training on KS skills exclusively for the doctoral students so that they could enhance their research work through smooth sharing of knowledge.

7. Conclusion

These findings offered benefits to both doctoral and masters' students. For masters' students, they offer a comprehensive understanding of KS concepts, and the distinctive type of knowledge what they share for academic research. The quantitative analysis presents the level of agreements regarding the reasons for sharing knowledge, how KS supports the research process, factors to be considered while sharing knowledge by which masters' students could be aware of the important factors of KS.

For doctoral students, the quantitative and qualitative analysis of different problems and barriers of KS in JAIST offers a complete picture of KS among doctoral students. These findings also are offered as a set of suitable suggestions and recommendations in order to overcome the problems and barriers of KS, and how research activities can be promoted through sharing knowledge. The findings confirm that the doctoral students held highly positive perceptions about sharing knowledge with each other, and most of them believe that KS can enhance and promote research skills. Therefore, the findings would be beneficial for all students of the graduate schools of JAIST for further enhancement and encouragement of KS in their schools. Other research institutes/universities may be encouraged to promote their research activities through sharing knowledge among the researchers, students and faculty members.

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