

Improving the Nursing Knowledge Using Personal Digital Assistant

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ABSTRACT

Knowledge Management (KM) plays an important role to safeguard and sustain organizations' human capital. This paper discusses the problems faced the nursing student's due to lack of their experience and how KM could provide solution to this problem . In particular, this paper will explore opinions of nursing students and nurse teachers about using Personal Digital Assistants (PDA) as a tool to enhance clinical learning and clinical decision processes.

Keywords

Knowledge management, Personal Digital Assistants, KM technology

1.0 INTRODUCTION

The domain of knowledge management can be used in different discipline such as information system, psychology, sociology, economics and strategy (Argote, McEvily et al. 2003). KM is important for organization this is because today's decision makers face the pressure to make better and faster decisions in an environment characterized by high domain

complexity and market volatility, even though they may in fact lack the experience typically expected from the decision maker and the out come of those decisions could have such a considerable impact on the organization (Becerra-Fernandez, Gonzalez et al. 2004). Knowledge management can be found in various fields, such as industry (Liebowitz 1999), military(Davenport, De Long et al. 1999),chemical(Smol 1992), biological (Smol 1992) and medical (Davenport and Glaser 2002).

This paper has been organized as follow: Section 1 introduces the paper and Section 2 will discuss about the technology for knowledge management. Section 3 briefly discusses about healthcare, healthcare process, nursing process and clinic process. In Section 4 information technology in healthcare is explored, while Section 5 discusses the problems faced by nursing students and Section 6 focuses about the scope of this study. Section 7 explores the pilot study that has been carried out. While, Section 7 shows the results of the pilot study. Finally section 9 concludes the paper.

2.0 TECHNOLOGY FOR KNOWLEDGE MANAGEMENT

The effects of technology on our daily life cannot be refuted. It is impacting on every facet of human activities, and knowledge management in the health industry is no exception. Explicit knowledge needs to be shared within professionals in organizations. With the assistance of technology, it is not necessary for the professionals to meet face-to-face during the working hours. Discussions, meetings are now made possible through on-line discussion, teleconference and emails, and this has significantly changed how organizations work and function (Strong, Trickett et al. 1998; Marwick 2001; Jennex and Olfman 2008).

In particular, software like Lotus Note groupware is an innovative technology that facilitates the sharing of documents and discussions. It allows users to have asynchronous discussions. Such software which is known as groupware helps individuals to work together in groups or teams. Groupware can to some extent support all four facets of Nonaka's knowledge transformation model (Strong, Trickett et al. 1998; Marwick 2001; Jennex and Olfman 2008).

The babble system is another type of knowledge sharing, but much more like conversation. With this system, tacit knowledge could be formed and made explicit. Nevertheless, not all on line meeting systems have the properties of face to face meeting. For example, the videoconferencing system was more like a video telephone rather than a face to face meeting (Strong, Trickett et al. 1998; Marwick 2001; Jennex and Olfman 2008).

Therefore, knowledge management is useful and can be employed in almost all facets of human's life and technology plays an enables role. The next following sections will show how knowledge management and technology can be used in hospitals in general and in nursing education in particular.

3.0 HEALTHCARE

Until the early part of twentieth century, very little could actually be done in hospital to improve the health of patients. Quite often, the rich can afford better health services than the poor ones. Today, patients want to have good and fast care by doctors and nurses. This depends largely on how they assess, plans, implements, evaluates and diagnose the patient in a short (Ashraf, Härkönen et al. 2007). In addition, many healthcare services are now delivered in outpatient settings, where patients receive the required care, and then are allowed to leave. During such care, patients assume significant responsibility for monitoring their own health status, managing their recovery, and communicating with clinicians from home. This increasingly distributed system of specialized outpatient health care places new demands on patients (Prentza, Maglavera et al. 2006).

It can be seen that there has been a huge revolution in healthcare in a short period. This dramatic increase was due to the development of new techniques such as imaging machines and healthcare technology such as Electronic Medical Records, computerized provider order entry, computerized provider order entry for drugs and clinical decision support systems. Another factor enhancing healthcare in this period is the rise of the nursing profession that improved hygiene and the quality of care (Glenn M. Hackbarth, D. Reischaver et al. 2004; Lichtman, Bigger Jr et al. 2008). It is important to realize that healthcare system has three primary goals: the provision of high-quality care, ready access to the system, and affordable costs. The practical problem in health care policy is that the pursuit of any two of these goals aggravates the third. Thus, a more accessible system of high-quality care will tend to lead to higher costs, while a low-cost system available to everyone is likely to be achieved at the price of diminishing quality. In order to have a good healthcare service, healthcare providers must work as a group, they have to share all their experiences to solve any problems faced by them. Therefore, it is imperative for the healthcare providers to work together and this requires the implementation of knowledge management to share their experience. The next section will discuss the following: - healthcare process, nursing process, and clinic process

3.1 Healthcare process

Healthcare process can be defined as a set of activities, methods, practices to provide healthcare service, and maintain the environment that support the service provider. As healthcare processes are characterized by the fact that several organizational units can be involved in the treatment process of patients and that these organizational units often have their own specific IT applications. It becomes clear that getting data, which is related to healthcare processes, is not an easy task for example diagnostic tests, medical treatments, and laboratory examinations protect and restore health and save lives (Nardon and Moura 2004; Lenz and Reichert 2007).

Healthcare can be divided into two processes clinical process and nursing processes in order to organize healthcare process. These processes can not work independent, they need to work as a group. Therefore, in order to provide a good healthcare processes, the clinical processes with the nursing process need to be connected, hence they work as team.

Nursing and clinical have a direct and indirect connection for example, nurses should have a connection between the clinic so they can know what kind of drugs that they can use for patients.

The next section will discuss about clinical process and nursing process.

3.2 Nursing process

Nursing process is a process by which nurses deliver care to patients, supported by models of nursing. The

American Nurses' Association defined nursing as "The diagnosis and treatment of human responses to actual or potential health problems." The practices (steps) of the nursing process including assessment, diagnosis, plan, implementation, and evaluation are cyclic, overlapping and interrelated (Curia, Gallucci et al. 2005; Hsia, Lin et al. 2006).

Step one. Assessment- is the most critical step and answers the questions: "What is happening (i.e., actual problem)?" or "What could happen (i.e., potential problem)?" This step involves collecting, organizing, and analyzing information/data about the patient. That is two parts: data collection and data analysis. In general, the data collection is a holistic approach and the methods of data collection can be observation, interview, and examination. The data types include subjective and objective data. The former can be "symptoms" that the patient describes; e.g. "I can't do anything for myself." The later can be "signs" that can be observed, measured, and verified; e.g., swollen joints.

Step two. Diagnosis- is a statement that describes a specific human response to an actual or potential health problem that requires nursing intervention.

Step three. Plan- provides consistent, continuous care that will meet the patient's unique needs, includes patient goals and nursing orders. The patient goals are directly related to the patient's problem as stated in the diagnosis, which describe the desired result of nursing care and the nursing order describes what the nurse will do to help the patient achieve the goals.

Step four. Implementation- involves applying the skills needed to implement the nursing order. The major tasks include reassessing the patient, validating that the care plan is accurate, carrying out nurses' orders, documenting on patient's chart and so forth.

Step five. Evaluation- compare the patient's current status with the stated patient goals and has three different operations or purposes: evaluation of the quality of the written care plan, evaluation of the client's progress, and evaluation of the status/currency of the care plan (Curia, Gallucci et al. 2005).

3.3 Clinical process

Health care practices involves complex clinical processes in which high risk and high cost activities take place. A clinical process can be view as a particular workflow where medical (e.g. treatment, drug administration, guideline execution and medical) and non-medical (e.g. patient enrollment, medical records instantiation) activities and events occur (Larsen and Pedersen 2001; Ben-Tovim, Bassham et al. 2008).

The clinical process is to obtain information from unstructured sources, and stored these in the structure

of machine-readable form. This large amount of data can be used in the data mining technology that can detect patterns of adverse events, errors and cost dynamics, hidden in the structure of clinical trials, the risk of his career and poor performance.

The maintenance of patient records requires a lot of time and effort, even in the cases that is well documented. Furthermore, patient records usually do not capture information from communication sessions (e.g. face-to-face communication) between physicians. As a result, technology are used such on the PROGEMM (PROcess-Oriented GEneric Management of Medical Knowledge) in order to support the specification, maintenance, and execution of clinical processes (Baron, Fabens et al. 2005).

4.0 INFORMATION TECHNOLOGY (IT) IN HEALTHCARE

In general, IT allows health care providers to collect, store, retrieve, and transfer information electronically. However, more specific discussion of IT in health care is challenging due to the lack of precise definitions, the volume of applications, and a rapid pace of change in technology (Glenn M. al. 2004; Ovretveit, al. 2007). Information technology has the potential to improve the quality, safety, and efficiency of health care. The volume of application, and a rapid of change in technology. Drivers of investment in IT include the promise of quality and efficiency gains. Barriers include the cost and complexity of IT implementation, which often necessitates significant work process and cultural changes (Glenn M. Hackbarth, D. Reischaver et al. 2004). Technology has many impacts on healthcare. For example if the doctors or nurses or other care givers want to monitor the status of their patients, they can use the wireless sensor network which enables them to know the status of their patient by receiving all changes or data of the patient on the Personal Digital Assistant anywhere they may be at the hospital (Ashraf, Härkönen et al. 2007).

In clinics, we can see that technology has a direct impact to assist in executing the clinical process by providing intelligence functionalities based on workflow mining techniques, and in monitoring process during their execution. The doctor can know all the information about his or her patient, and the doctors could monitor the patient while he is in his room (Curia, Gallucci et al. 2005).

The following section will explore the problems of nursing students.

5.0 PROBLEMS FACES NURSING STUDENTS

Increased number of nursing students' enrollment and limited clinical learning experiences and support are amongst the issues that need careful attention by nursing education sector. As a result students keep on having problems in identifying, defining, analyzing

and articulating the nature of their information needs (Eric Christensen and Elinor C. Greene 1998; Alan Barnard, Grove et al. 2005; Sumpster 2006). Nurses students should be technically competent and familiar with the advanced technology to cope with upcoming challenges and changing health care needs (Cheek and Doskatsch 1998; Huffstutler, Wyatt et al. 2002; McCannon and O'Neal 2003; Kennedy, Krause et al. 2008). This is due to the lack of hands-on experience accessing and utilizing relevant information in real-life, environment and fast decision making process. Nursing teachers and clinical staff have long observed that students have difficulty transferring knowledge and skills in clinical setting and prioritizing patients' needs (Directorate General of Education & Training, 2008). There is a need to discover strategies to provide a new way of learning that will help students accessing information's needed while doing their practice.

This requires means to bridge the gap at the clinical area. Therefore, there is a need to identify educational supports that could help students develop analytic and hand-on practice skills (Directorate General of Education & Training, 2008 ; Stakeholders Survey Report on General nursing Program, 2008). According to the studies conducted in nursing field in general and nursing students in particular, the following problems are highlighted:

- a) lack of hands-on experience accessing and utilizing relevant information in real-life, real-time nursing experiences (Kidd and Kendall 2007; Voll and Hills 2007). This is because nursing students still learning and they will not know what is the right decision at the point of care.
- b) lack of information sources at the "point of care"(Henderson 1982; Dawes and Sampson 2003; Andrews, Pearce et al. 2005; Escoffery, Miner et al. 2005; Voll and Hills 2007). Because there is no referace that they can go back once they face any new problem while they are doing their practical in hospitals, and they cant take with them all the notes that they took in class.
- c) students clearly stated the importance of accessing information at the point of care to make proper decision (Andrews, Pearce et al. 2005; Escoffery, Miner et al. 2005). Because once they face a new case, they have to read about that and get the right information at that time and knowing how they can solve the case.
- d) Teachers commented that students face difficulties in getting the appropriate information due to lack of information sources or not knowing which source is appropriate and difficulty to contextualize the information (Edwards and Hammer 2004; Andrews, Pearce et al. 2005; Escoffery, Miner et al. 2005) .

Therefore, the nursing students face difficulties in getting the appropriate information during their practical experience due to the lack or limited information, and resources.

The next Section 6.0 discuss the scope of this study and Section 7.0 presents the pilot study While Section 8.0 discusses the results.

6.0 THE SCOPE OF THIS STUDY

This research has been done in one of the nursing institutes in the sultanate Oman. Currently there are 11 nursing institutes around the country, two in Muscat Governorate (capital of Oman) and 9 in the interior (rural) regions. These institutes conduct a three year General Nursing Program (GNP).

The objectives of the GNP includes preparation of competent qualified nurses who will be able to deliver safe and effective nursing care at various levels to individuals, families and communities utilizing the nursing processes as modality of care.

The program of the GNP includes a practical component to allow nursing students to employ theoretical knowledge in clinical practice. Students are usually posted in groups to clinical fields and supervised by clinical teachers from the institute and clinical staff nurses. As per the statistics of the Ministry of Health in Oman, Nursing institutes have a limited number of clinical faculty in each institute as well as the health care institutions suffers from shortage of nurses. It has been noted that the teacher student ratio in each clinical rotation is about 1:15 ("Department of Health Information and Statistics", 2007).

This means that students spend most of their clinical time without supervision and guidance which affects the skills development and employing theoretical knowledge. It has also a negative impact on the quality of care they are providing to their patients ("Directorate General of Education & training ",2008). Nursing students are expected to deliver safe and competent care utilizing nursing process. Patient assessment is the first and initial task that leads to identification of patient needs or problems (Hsia, Lin et al. 2006).

7.0 PILOT STUDY

The purpose of this pilot study was to explore opinions of nursing students and nurse teachers about using PDA as a tool to enhance clinical learning and clinical decision. The study question for this pilot study is what is the perception of nursing students and nurse teachers about PDA as a tool to enhance clinical learning and clinical decision?

7.1 Study design, setting and sample

A descriptive cross sectional study was conducted in Oman at Ibra Nursing Institute, Ministry of Health, 22nd of June and 1st of July 2009. The sample included 40 participants (32 second year nursing students and eight clinical teachers). A self-report questionnaire was used to collect quantitative and qualitative data with a response rate of 100%.

7.2 Description of the tool & ethical consideration:

The questionnaire was developed by the researcher. It consisted of three parts: (1) Having got and usage of PDA, (2) Perception of PDA (3) problems and challenges in accessing information and defining patient's problems in clinical training. First part questioned participants if they have PDA and the extent of using it to access online content. In the second part of the questionnaire participants were asked to rate their perception about problems of information access by students during clinical training. Also they were asked to rate their perception of PDA as a tool to enhance clinical training and health care. A 5-point Likert perception scale consisted of 16 statements (three items related to problems of information access and 13 items related to perceived benefits of PDA); where 5 means strongly agree and one for strongly disagree was used to assess perception on benefits of PDA. In part three participants were asked to indicate problems that students face to access information at the "point of care" or "point of need and challenges they face in defining patient problems and selecting appropriate interventions during clinical training in the absence of teachers and preceptors.

The questionnaire was checked for face and content validity. Cronbach's alpha reliability test was applied to check internal consistency of constructs within the perceived benefits' subscale of teachers' and students' questionnaire. Cronbach's alpha scores for the constructs were 0.890 and 0.60 respectively; these score reflected internal consistency and indicated homogeneity of the statements in the perception subscale.

Permission was sought from the concerned authorities at Ibra Nursing institute. The researcher gave brief presentation about PDA technology and its general uses to the participants including the aim of this phase of the study. The purpose and direction to complete the questionnaire and a statement assuring anonymity and confidentiality were enclosed also with the questionnaire. Completing the questionnaires indicated that respondents agreed to participate in the study.

7.2 Data analysis:

Data was analyzed using SPSS Version 16. Descriptive statistics and content analysis were used to answer the study question. Perception about PDA as a tool that would enhance clinical learning was assessed based on a predetermined mean scale where:

- 1) ≤ 3 as negative perception.
- 2) $< 3 - < 4$ as moderate positive perception.
- 3) ≥ 4 as high positive perception.

The result of the pilot study is shown in next Section 8.0

8.0 RESULTS

a) Usage of PDA/mobile phone

Responses to the first two questions of the study revealed that most of the respondents (students and teachers) 75% of them had PDA or mobile phone. 65.6 % of the students use PDA or mobile phone in order to access online content on varied times and 31.3% never used it. Data showed that 12.5% of teachers had used PDA to access online content while 87.5% of them never used it.

b) Perception on PDA as a reference tool in clinical setting

Participants responded to a five-point Likert scale with a range of Strongly Agree (5), to Strongly Disagree (1) The 16 statements were categorized into two main categories: Access of Information and Benefits of PDA. The mean scores of responses by students and teachers of both categories are presented in tables 1 and 2 respectively. Data showed that the range of mean scores for benefits of PDA as perceived by students was 3.69-4.47. On other hand the range of mean scores for benefits of PDA as perceived by teachers was 3.75-4.57.

Table 1: Table 1: Mean scores of students' perception on access of information and perceived benefits

	Items	N	Mean
A	Access of Information		
1	I face problems in searching data in order to solve patients' problems in my clinical training.	32	4.06
2	During your training, do you go back and search in books in order to solve problems.	31	3.90
3	I have problems in retrieving data while doing my clinical training.	31	3.81
B	Benefits of PDA		
4	Mobile technology can provide greater opportunities for social impact that other information and communication technologies share.	32	4.19
5	I am excited about trying new technologies in my study.	32	4.47
6	I do not use PDA now but I do have plan in future to use it to help me in my study and future work	31	4.16
7	PDA will help me during my clinical training.	32	4.38
8	Accessing to internet using wireless technology will help me during clinical training and future work.	32	4.38
9	PDA is more useful with a wireless technology.	32	4.22
10	PDA is more useful than laptop during your study and future work.	32	4.28
11	PDA is faster to accesses information as compared to a text reference.	32	4.25
12	If I have a PDA and have free time at home I will use PDA in order to gain knowledge from its reference sources.	32	3.88
13	PDA will help me to be sure about nursing/clinical decision before taking it.	32	4.38
14	PDA will improve the patient health out come.	32	3.69
15	PDA will enhance my learning.	31	4.23
16	PDA will save time and effort.	32	4.44

Table 2: Mean scores of teachers' perception on Students' access of information and perceived benefits

	Items	#	Mean
A	Access of Information		
1	Students face problems in searching data in order to solve patients' problems during their clinical training.	8	4.50
2	During clinical training, students go back and search in books in order to solve problems.	8	3.75
3	Students have problems in retrieving data while doing their clinical training.	8	4.38
B	Benefits of PDA		
4	Mobile technology can provide greater opportunities for social impact that other information and communication technologies share.	8	4.38
5	I am excited about trying new technologies in clinical teaching.	8	4.00
6	I do not use PDA now but I do have plan in future to use it to help students in their study and future work	8	3.75
7	PDA will help students during their clinical training.	8	4.12
8	Accessing to internet using wireless technology will help students during clinical training and future work.	8	4.00
9	PDA is more useful with a wireless technology.	8	4.25
10	PDA is more useful than laptop for students during their study and future work.	8	4.00

11	<i>PDA is faster to accesses information as compared to a text reference.</i>	8	4.57
12	<i>If students have PDA and have free time at home they will use PDA in order to gain knowledge from its reference sources.</i>	8	4.12
13	<i>PDA will help students to be sure about nursing/clinical decision before taking it.</i>	7	4.25
14	<i>PDA will improve the patient health outcomes.</i>	8	3.88
15	<i>PDA will enhance students learning.</i>	8	4.38
16	<i>PDA will save time and effort.</i>	8	4.12

Further examination of mean scores, results indicated that respondents' perception of PDA was deemed to be positive. Mean scores reflected moderate to high positive perception as per the predetermined perception scale (figure 1). All items were scored positively by both students and teachers. However, students' rating for items 3, 4, 11, 12, 14 and 15 were lower than teachers' rating. This may due to the fact that teachers' expectations and anticipations are different from students and they have higher aims. The Figure 1 shows the Distribution of mean score responses of students and teachers on access of information and benefits of PDA

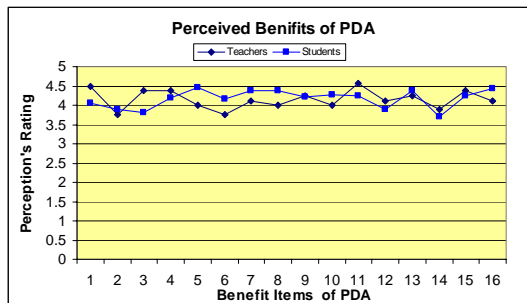


Figure 1: Distribution of mean score responses of students and teachers on access of information and benefits of PDA

c) Problems and challenges

This section contains two questions. The first question was related to problems students face to access information at the point of care, the second question was associated with the challenges that students face in defining patient problems and relevant intervention.

First question:

Students were asked to reflect on problems they face to access information at the "point of care". Teachers were asked also to reflect on the same. Content analysis of the answers revealed that

"lack of information sources and difficult to get the needed information" was a common phrase expressed by the respondents. This answer overlapped with the

respondents answers to the items in the "information access" subscale, as more than 75% of students agreed with the three statements in the subscale i.e. "I face problems in searching data in order to solve patients' problems in my clinical training During your training", "I go back and search in books in order to solve problems" and "I have problems in retrieving data while doing my clinical training". Similarly teachers responses to the same items coincide with students' responses and their agreement with the statements are even higher than student's rating (87%).

The main two themes emerging from respondents' statements were:

a) Sources of information:

The lack and inadequate sources of information was expressed explicitly by some students and was implicit in the comments offered by others. Some students commented as follows:

".....The source of information not enough because we have only books", "Sometimes there is nobody to explain to us things that we did not understand", "The teacher is not available when we need".

Teachers commented that students face difficulties in getting the appropriate information due to lack of information sources or not knowing which source is appropriate. Besides that, they have difficulty to contextualize the information. Examples of their comments were as follows:

1. *"Students find difficulty to search for information and they are stuck at a point where they are not sure with what to continue and how to go about providing care",*
2. *"Difficult to get the needed information at the time, which may require the student to go back home & search",*
3. *"Waiting to come to initiate to find information from books",*
4. *"Lack of resources, inadequate information, incorrect information, not clear with instruction given".*

b) Reliability of information

Responses of some student suggest they have difficulty in deciding which source and information is relevant to the patient situation that would advice them to select the appropriate care. Examples of students' comments were:

1. "I don't have more sources for getting information and I have difficult in writing the nursing diagnosis as priority",
2. "We can not find internet or laptop to find the latest information about disease" "May be bad solution",
3. "Some unit of investigations is different".

Similarly, teachers' comments supported the students' point of views regarding the suitability of sources and information. Some of the comments are presented below:

4. "Not knowing where / which book will give information",
5. "Knowledge of the students in using the references in collecting the suitable information",
6. "The appropriate references".

Second question:

Insufficient sources of information available to students was apparent also in both students and teachers responses. Examples of students' comments were:

1. "No or lack books to read this",
2. "Not enough references",
3. "No doctor explains that for us".

Although teachers have similar concerns about sources of information but Teachers' comments somehow focused on the issue of current and up-to-date information which are indirectly related to the type of information sources available to students. Examples of teachers' comments were as follows:

1. "In lack of information they depend on library and other reference sources to get the needed facts and to define patient problems using them",
2. "Up to date information may be missing".

Based on the findings of this study, data suggest that PDA can be used as a technology to assist students in clinical learning and make appropriate clinical decision.

9.0 CONCLUSION

This paper shows how knowledge management technology has a direct impact in our life and in particular how knowledge management has a direct impact in healthcare. This paper investigates what is the opinion of using mobile technology in nursing study and if they prefer to use it in there study and also what are the problems they face them in there study and what are the problems they face in the teacher point of view.

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