CHAPTER 4

FINDINGS AND DISCUSSION

A correlational descriptive study was conducted to identify the level of computer knowledge, attitudes and skills of nurses, and describe the relationships among the three variables. One hundred sixty-nine subjects were selected by using proportionate stratified random sampling method. Data were collected with a questionnaire developed by the researcher. Data collection was performed from November 1997 to February 1998 in People's Hospital affiliated to BMU. The SPSS for Windows statistical Package was used for data analysis. The findings of this study were organized into six sections according to the research objectives: (1) demographic data of the subjects; (2) computer knowledge; (3) computer attitudes (4) computer skills; (5) comparison of computer knowledge, attitudes and skills of nurses receiving formal and those receiving informal computer training; (6) relationships among computer knowledge, attitudes and skills.

Demographic data of the subjects

A total of 195 questionnaires were distributed to a proportionate stratified random sample of staff nurses in four clinical units, including medical, surgical, obstetric and gynecological, and pediatric units at People's Hospital affiliated to BMU. There was an 86.7% response rate with 169 completed questionnaires returned for analysis.

The sample of this study consisted of 169 nurses. The age of the subjects ranged from 21 to 49 years with a mean age of 26.48 ± 3.95. Majority of the subjects (84.6%) were aged less than 30 years old. All of the subjects were female. The mean years of working in nursing was 7.10 ± 3.89. Majority of the subjects (77.5%) had less than 10 years of working experience. For the educational level, majority of the subjects (85.2%) was at certificate, while 14.8% were at diploma. For the professional title, more than half of the subjects was junior nurses. For the types of receiving computer training for CHIS use, more than 50% of the subjects received the formal computer training; the others received informal computer training. For the frequency of computer use, before the implementation of CHIS, most of the subjects (69.3%) had never used computers, only 13.6% of the subjects

had opportunities to use computers for almost every day in hospital or in their home; After the implementation of CHIS, there were still 31.4% of the subjects who had no opportunity to use computers and only 26.0% of the subjects reported that they had opportunity to use computers almost every day. For the duration of serving as Order Entry Nurse, the opportunity of serving as Order Entry Nurse was very different. There were nearly 50% of the subjects who had no opportunity, while more than 4% of the subjects who had more than 10 to 12 months opportunities (See Table 1).

Table 1

Demographic Characteristics of the subjects (N=169)

Variable	Frequency (%)
Age (years)	
21-29	143 (84.6%)
30-39	24 (14.2%)
40-49	2 (1.2%)
Years of working in nursing	
1-9	131 (77.5%)
10-19	36 (21.3%)
≥ 20	2 (1.2%)
Educational level	
Certificate	144 (85.2%)
Diploma	25 (14.8%)
Working units	
Medical	79 (46.7%)
Surgical	60 (35.5%)
Obstetric & Gynecological	24 (14.2%)
Pediatric	6 (3.6%)
Professional title	
Junior nurse	100 (59.2%)
Senior nurse	63 (37.3%)
Charge nurse	6 (3.5%)

Table 1

Demographic Characteristics of the subjects (N=169)

(Continued)

Variable	Frequency (%)
Types of receiving computer training for CHIS use	
Formal training	95 (56.2%)
Informal training	74 (43.8%)
Frequency of computer use Before CHIS use	
No use	117 (69.3%)
Once a month	10 (5.9%)
Once a week	19 (11.2%)
Almost every day	23 (13.6%)
Frequency of CHIS use except in charge of order entry	
Almost no opportunity	53 (31.4%)
Once a month	10 (5.9%)
Every week	62 (36.7%)
Almost every day	44 (26.0%)
Duration of serving as Order Entry Nurse	
Almost every day	23 (13.6%)

Table 1

Demographic Characteristics of the subjects (N=169)

(Continued)

Variable	Frequency (%)
Frequency of CHIS use except in charge of order entry	
Almost no opportunity	53 (31.4%)
Once a month	10 (5.9%)
Every week	62 (36.7%)
Almost every day	44 (26.0%)
Duration of serving as Order Entry Nurse	
No	81 (47.9%)
1 - 4 months	63 (37.3%)
5 - 9 months	18 (10.7%)
10-12 months	7 (4.1%)

Computer knowledge of the subjects

The overall computer knowledge scores of the subjects ranged from 10 to 20 with a mean score of 15.72 ± 2.25 which was at moderate level. For four subparts of computer knowledge, system security knowledge was at high level with a mean score of 3.67 ± 0.52; the CHIS knowledge was at moderate level with a mean score of 5.12 ± 0.89; the knowledge regarding limitation of CHIS was also at moderate level with a mean score of 1.68 ± 0.49; while basic computer knowledge was at low level with a mean score of 5.24 ± 1.58. (See Table 2).

Table 2

Mean, standard and range of computer knowledge scores and the subparts (N=169)

Variables	possible score	Mean	SD	Range
Basic knowledge	8	5.24	1.58	2-8
CHIS knowledge	6	5.12	0.89	2-6
Limitations of CHIS	2	1.68	0.49	0-2
System security	4	3.67	0.52	2-4
Overall knowledge	20	15.7	2.25	10-20

Subjects were categorized into three groups according to their computer knowledge scores. The overall computer knowledge was at low (4.1%), moderate (71.0%) and high level (24.9%). For subparts of computer knowledge, nearly 59% of the subjects were still at low level in basic computer knowledge; More than 54% of the subjects were at moderate level in CHIS use; More than 69% of the subjects were at high level in limitations of CHIS and system security (See Table 3).

Table 3

Frequency and percentage of the subjects according to knowledge level (N=169)

Variable	Low level N (%)	Moderate level N (%)	High level N (%)
Basic knowledge	99 (58.6%)	54 (32.0%)	16 (9.5%)
CHIS knowledge	9 (5.3%)	92 (54.5%)	68 (40.2%)
Limitation of CHIS	2 (1.2%)	50 (29.6%)	117 (69.2%)
System security	4 (2.4%)	48 (28.4%)	117 (69.2%)
Overall knowledge	7 (4.1%)	120 (71.0%)	42 (24.9%)

Computer attitudes of the subjects

The possible score of overall computer attitudes as measured by NCAS was 18 - 90. The overall computer attitudes scores of the subjects ranged from 46 to 78 with a mean score of 61.94 ± 5.61 which was neutral. For the three subparts of computer attitudes, motivation was positive with a mean score of 22.23 ± 2.50; beliefs was neutral with a mean score of 20.96 ± 2.29; satisfaction was also neutral with a mean score of 18.75 ± 2.32 (See Table 4).

Table 4

Means and Standard Deviation and range of computer attitudes

and the subparts (N=169)

Variables	Possible score	Mean	SD	Range
Belief	30	20.96	2.29	13-27
Satisfaction	30	18.75	2.32	13-26
Motivation	30	22.23	2.50	15-29
Overall attitudes	90	61.94	5.61	46-78

Subjects were categorized into three groups according to their computer attitude scores. It was shown that the subjects rated their overall computer attitudes from neutral (82.2%) to positive (17.8%). For three dimensions of computer attitudes, nearly 60% of the subjects rated their computer beliefs as neutral, more than 87% of the subjects rated their satisfaction with CHIS as neutral, nearly 60% of the subjects rated their motivation toward CHIS and computers use as positive (See Table 5).

Table 5

Frequency and percentage of the subjects according to
attitudes level (N=169)

Variable	Negative N (%)	Neutral N(%)	Positive N (%)
Belief	1(0.6%)	101(59.8%)	67(39.6%)
Satisfaction	1(0.6%)	148(87.6%)	20(11.8%)
Motivation	0(0.0%)	66(39.1%)	103(60.9%)
Overall attitudes	0(0.0%)	139(82.2%)	30(17.8%)

Computer skills of the subjects

The possible score of overall computer skills as measured by NCSS was 16 - 64. The overall computer skills scores of the subjects ranged from 35 to 57 with a mean score of 45.38 ± 3.94 which was at moderate level. For three subparts of computer skills, CHIS skills was at moderate level with a mean score of 21.26 ± 2.56; basic skills was at moderate level with a mean score of 19.10 ± 1.90; system security skills was at moderate level with a mean score of 5.02 ± 0.68 (See Table 6).

Table 6

Mean and standard deviation and range of computer skills

and the subparts (N=169)

Variables	possible score	Mean	SD	Range
Basic skills	28	19.10	1.90	15-28
CHIS skills	28	21.26	2.37	14-25
System security	8	5.02	0.68	3-7
Overall skills	64	45.38	3.94	35-57

Subjects were categorized into three groups according to their computer skill scores. Most subjects rated their computer skills at moderate level (See Table 7).

Table 7

Frequency and percentage of the subjects according to computer skills level (N=169)

Variable	Low level N (%)	Moderate level N (%)	High level N (%)
Basic skills	2 (1.2%)	156 (92.3%)	11 (6.9%)
CHIS skills	0 (0.0%)	119 (70.4%)	50 (29.6%)
System security	27 (16.0%)	136 (80.5%)	6 (3.5%)
Overall skills	0 (0.0%)	139 (82.2%)	30 (17.8%)

Comparison of computer knowledge, attitudes and skills among nurses receiving formal or informal computer training

Nurses' computer knowledge, attitudes and skills were calculated for means and SD, then t-test was used to analyze the difference of scores between nurses receiving formal and those receiving informal computer training. The results of this study showed that there was no significant difference between nurses receiving formal and those receiving informal computer training in computer knowledge, attitudes and skills (See Table 8).

Table 8

Comparison of computer knowledge, attitudes and skills among nurses receiving formal or informal computer training

Variables	Nurses with informal training (Mean±SD)	Nurses with formal training (Mean±SD)	P value
Knowledge	15.53±2.30	15.86±2.22	.337
Attitudes	62.00±6.18	61.89±5.16	.904
Skills	45.11±3.92	45.59±3.97	.433

Relationships among computer knowledge, computer attitudes and computer skills

Partial correlation was undertaken to analyze the relationships among computer knowledge, attitudes and skills. The findings showed that computer skills were positively associated at low level with computer knowledge and Computer attitudes. However, computer knowledge did not show any significant correlation with computer attitudes (See Table 9).

Table 9

Partial correlation coefficient and p value among computer knowledge, attitudes and skills

Variables	Computer knowledge	Computer attitudes	Computer skills
Computer Knowledge	1.0000 p=.		
Computer Attitudes	.1081 p=.163	1.0000 p=.	
Computer Skills	.2060 p=.007**	.2710 p=.000***	1. 0000 p=.

Note: ** p < .01, *** p < .001

The relationships among subparts of computer attitudes, knowledge and skills were also analyzed using Pearson's correlation coefficient. Computer skills were positively correlated to motivation at moderate level, also with beliefs at low level. However, computer knowledge was not significantly correlated to nurses' beliefs, satisfaction and motivation (See Table 10).

Table 10

Relationships among subparts of computer attitudes and computer knowledge and skills

Variables	Beliefs	Satisfaction	Motivation
Satisfaction	.3645		
	p=.000***		
Motivation	.5559	.3773	
	p=.000***	p=.000***	
Computer knowledge	.0678	.0938	.0244
	p=.381	p=.225	p=.753
Computer skills	.1583	.1160	.3211
	p=.040*	p=.133	p=.000***

Note: * p < 0.05,   *** p < 0.001

Discussion

The discussion of this study was presented in three sections: Discussion of the descriptive data related to computer knowledge, attitudes and skills, discussion of the comparison of computer knowledge, attitudes and skills of nurses receiving formal and those receiving informal computer training, as well as the discussion of the findings related to the relationships among the three major variables.

Computer knowledge of the subjects

In this study, the overall computer knowledge of the subjects was at moderate level. It indicates that the overall computer knowledge of the nurses still needs to be improved. Even though the knowledge of system security was at high level□ some subparts had low scores. The knowledge of system security included the knowledge of using password and understanding computer viruses. The score for using password was found to be at high level. Password is an identification to be able to gain entry into patients' health care record (Sweeny, 1985). In this hospital, every nurse working at ward owns and uses herself password so as to take responsibility for data accuracy entered by herself.

So, the knowledge regarding password was concrete and useful for nurses, and had been mastered very well. For computer viruses that should be known among all nurses, 92% of the subjects understood the harm of computer viruses, and only 78.1% of the subjects knew the infectious way of computer viruses. So the score for this subpart is low. According to Mills, Romano and Heller (1996), computer viruses are artificial create programs or codes, they can destroy computer files, and slow down the speed of computer implementation, even make the computer systems fall down paralytic status. Computer viruses can spread through using computers or floppy disks infected computer viruses. Since system security is vital important for CHIS implementation, this hospital had sealed up all floppy disk drivers in CHIS network in order to prevent virus infection. Nurses can not use personal floppy disks in computer network, and most of them had no computer experience before CHIS use. Therefore, they had not enough knowledge and experience on virus infection. According to Bryson (1991), all nurses working with computer systems must be aware of system security because the nursing work environment would be heavily computer-based in future. System security related to the accurate of data entry by nurses and the normal

implementation of computer system. Therefore, the subjects' knowledge in system security in the present study still needs to be improved.

In the present study, the knowledge of CHIS use included the purpose and functions of CHIS, as well as a series of operational knowledge regarding CHIS use. The study found that most of the subjects rated their knowledge of CHIS at moderate to high level. This might be because that all of them had opportunity to accomplish order entry task in their shift. More than 52% of the subjects had served as Order Entry Nurses for 1 to 12 months. To be Order Entry Nurses, they had to know how to operate CHIS. Even though the other 47% of the subjects had no opportunity to serve as Order Entry Nurses, they still had some opportunities to do order entry task or do order entry exercises repeatedly by using self-learning software in their shifts. Therefore, they had to be taught either through formal or informal computer training, thereby, they know about CHIS use.

The other aspect of knowledge was to understanding the limitation of CHIS. The study found that nearly 85% of the subjects knew that the CHIS were still at low level of functioning. Many functions of CHIS were not available. And

even though many nursing tasks can be computerized, nurses' direct patient care can not be accomplished through computers. However, more than 15% of the subjects did not know these limitations. Since the understanding of CHIS limitation may be less important for nurses to use CHIS, and mostly when any new system was introduced only the system benefits would be elaborated, the limitation of CHIS had not been emphasized.

Another interesting findings was that the basic computer knowledge got the lowest mean score. This knowledge included the understanding of computer hardware and software, the components and their functions of computer, computer vocabulary, operational steps of computer, and some common knowledge regarding computer use. In 1988, NLN suggested that the practicing nurses were divided into three different level users of computers. The informed users can use information systems and have an awareness of, understand, use and interact with those systems in their practice. The proficient users can modify and evaluate information systems. The developers can innovate, design and develop new information systems for nursing. NLN expected that all nurses should be at least at informed user level, most nurses should reach proficient user level, and only

those nurses with advanced preparation will become developers (Grobe, 1988). Obviously, all of the subjects in the present study could use CHIS, they had mastered the basic computer knowledge needed for operating computers and using CHIS. All of them had reached the informed user level, but only few of them reached proficient user level. The proficient nurses could evaluate CHIS, express their satisfaction toward CHIS, and present the opinion to modify some computer program. Therefore, the level of the subjects' computer knowledge was inconsistent with requires of informatic competencies of the practicing nurses (Grobe, 1988). It indicates that most nurses need to improve their computer knowledge level to proficient user level.

In addition, the study found that more than 50% of the subjects did not know the accurate sequences of turning on and off computer. About 20-50% of the subjects lacked of knowledge related to computer vocabulary and the functions of computer components as well as some common knowledge regarding computer use. Although this basic knowledge had been taught during formal computer training, the content of training was designed with less emphasis on basic computer knowledge but more emphasis on the actual use of CHIS which was directly related to CHIS use and task accomplishment of

nurses. Also in the informal computer training, the trainers mostly emphasized on the knowledge of CHIS use.

From literature review, there was only one reports regarding nurses' computer knowledge level. Burkes (1991) measured 56 ICU staff nurses' computer knowledge level using a 13-item self-developed computer knowledge questionnaire regarding using nursing information system knowledge. Subjects had a choice of a true, false or uncertain type of response for each question. The results showed that majority of the subjects selected "uncertain" responses on 6 of the 13 questions which indicating nurses' computer-use knowledge deficits. Other studies focused on the content of computer education required for practicing nurses and nursing students (Bryson, 1991; Carter & Axford, 1993; Saranto, 1997; Sweeney, 1985).

Computer attitudes of the subjects

The results of this study demonstrated that the overall computer attitudes of the subjects were neutral to positive in which most was neutral. Of the attitudes, motivation got the highest mean score, followed by beliefs, while satisfaction obtained the lowest mean score. According to Vroom (1964, cited in Burkes, 1991), motivation is the force or willingness to use a computerized nursing system.

This study demonstrated that majority of the subjects were willing to use CHIS and varieties of computerized nursing programs, and using CHIS motivated them to learn more computer technology. In China, computers have been introduced into more and more professional fields. Moreover, they have just been introduced into some people's homes, schools, and colleges in recent years. Computers are serving as newborn things to enter many people's everyday life. The increasing use of information technology applications in everyday life may bring a widespread recognition that information technology has an important role to play in many aspects of health care (Simpson & Kenrick, 1997). Therefore, nurses' motivation to learn and use computers was positive.

Beliefs is an expectation that using computerized nursing systems will lead to preferred outcome (Vroom, 1964 cited in Burkes, 1991). According to Ajzen and Fishbein (1980), beliefs represent the individual's own direct or indirect intellectual evaluation of the object based on facts collected or acquired. The study found that most of the subjects' beliefs were neutral which means they did not have strong beliefs on the benefits of computer use. This might be because the general information regarding the benefits of implementation CHIS and computers in nursing had

not been introduced in detail in formal and informal computer training. Moreover, most of the subjects had no computer experience before CHIS use, and they had not been exposed to variety computer systems. After CHIS implementation, even though CHIS had brought some benefits in nursing, such as, paperwork and times of running errands had been decreased, nurses had not seen the obvious benefits and power of an integrated HIS.

According to Vroom (1964, cited in Burkes, 1991), satisfaction is an attitude of preference for a certain computer-use outcome. Satisfaction is influenced by individual's values about how things ought to be, and serve as the standards of assessing things (Ajzen & Fishbein, 1980). In this study, among three aspects of computer attitudes, overall satisfaction got the lowest mean score. By examining the items of satisfaction, nearly 80% of the subjects mentioned that CHIS decreased paperwork and improved medication management regimen. About 50% of the subjects were disagreed with the flexibility of the order entry program, and the promotion of doctor-nurse collaboration. They mentioned that the standard order program in CHIS was inflexible, doctors have to follow it, otherwise, nurses will ask for doctors to revise orders in

order to accomplish order entry task. Furthermore, more than 50% of the subjects considered that order entry using CHIS took much more time than manual procedures. This may be a reflection that some nurses were not skillful in using CHIS. In addition, since many subsystems of CHIS were not available, nearly 30% of the subjects had recognized that using CHIS had not improved nursing efficiency.

The overall computer attitudes were neutral. This appeared to be associated with a lower satisfaction with CHIS, and uncertainty in CHIS outcome. This finding was partly inconsistent with several previously studies (Marr, 1988; Murphy, Maynard, & Morgan, 1994; Newton, 1995). Those studies found that nurses' computer attitudes would have a significant shift toward the introduction of a computer system, from initial ambivalent about computer system, through unfavorable after three months to felt comfortable using the system after six months to one year. In the present study, the investigation found that nurses had many complaints toward CHIS use in initial few months, which reflected negative attitudes. However, nurses' computer attitudes were still neutral after one year of CHIS use, this might be related to nurses' lack of enough computer knowledge and skills even one year has passed. Also it might

be because the CHIS is still at low level of functioning. The finding of this study was also inconsistent with most of the more recent studies in developed countries, including the United State, Canada and Australian which found that nurses had positive attitudes toward computers in general, and nurses overwhelmingly considered that the computer technology was capable of making their work easier (Abbott, 1993; Ngin, Simms, & Erbin, 1993; Rapko & Adaskin, 1993). These researchers explained that as the computer technology advanced, the attitudes of nurses were positive with respect to the computer's efficiency and importance in society. Today's nurses may have more exposure to the benefits of computer technology (Birx, Castleberry, & Perry, 1996). However, the situation in China is different from other developed countries in the extent of information technology applications, the functions and quality of HIS, education preparation for nurses, professional culture and some work practices. In China, the primary educational system for nurses is still certificate that has shorter education duration and limited knowledge level. Their abilities to understand and accept computer technology might be lower than that of nurses received bachelor degree education. Moreover, Chinese nurses may have not exposed to the

benefits of computer technology because of limited computer technology applications.

Computer skills of the subjects

The results demonstrated that the computer skills of the subjects varied from low to high with a mean score of 45.38 ± 3.94 and majority of the subjects rated their computer skills as moderate level. The skills in CHIS use included a series of operational skills to be used for order entry. These skills were most often applied by clinical nurses, and must be mastered so as to accomplish order entry task in limited time. Especially, these skills were the focuses of formal and informal computer training, as well as in later exercises and practices. In addition, nearly 52% of the subjects had served as Order Entry Nurses for 1 to 12 months. During that time, those nurses spent majority of time on the order entry and printing out patient's chart. So, nurses' skills in CHIS use could be improved generally. The basic computer skills included a series of common operational skills, such as typing, spelling, printing, using word processing (writing reports, papers, documents), using operating system (edit, copy, delete, insert, format and so forth), distinguishing and solving common error situations of computer or printer, and communicating with

other computer personnel using computer terminology. The results showed that more than 92% of the subjects' basic computer skills were at moderate level, only about 6% at high level. According to Ngin and Simms (1996), computer skill level was highly correlated with frequency, length and varieties of using computer systems. In the present study, the frequency of computer use was different among nurses from almost no opportunity to use to almost every day. Even after CHIS was used, there were still more than 31% of the subjects who rarely used computers, only 26% used computer every often in hospital and their homes. So, the basic computer skills of nurse with less opportunity to access computer were limited, whereas nurses with greater opportunity access to computers could have more computer skills.

The results of the present study also showed that nearly 67% of the subjects could not use word processing, more than 56% could not use common computer terminology, and more than 47% could not distinguishing and solving common error situations. This may be because of inadequate practicing. In People's Hospital, there were not enough computers for nurses to use. In each ward, there was only one computer terminal at nursing station which was used

mainly for order entry. Most nurses could not access to computers conveniently, especially, they had not enough opportunity to use computers for word processing and other operational programs. Because the most widespread computer application in this hospital only limited to CHIS, and there were not enough computers to be used by staff nurses. The study also found that nearly 90% of the subjects did not know how to detect computer viruses and cleans them. Since this hospital had sealed up all floppy disk drivers in CHIS network in order to prevent from computer viruses' infection, staff can not use personal floppy disk in network. Majority of nurses had not any experience for detecting and cleaning computer viruses. So, the skills of system security were low.

Comparison of computer knowledge, attitudes and skills of nurses receiving formal and those receiving informal computer training.

The results indicated that there was not any significant difference of computer knowledge, attitudes and skills of nurses receiving formal and those receiving informal computer training. This result seems to be reasonable. Since some of the nurses attended two-week

formal computer training, and others received informal computer training from the nurses receiving formal·computer training, all of them had received computer training. Even though nurses have achieved the similar levels in computer knowledge, attitudes and skills, but all those still need to be improved. According to literature review, it was necessary to provide a computer training opportunity for nurse to obtain computer knowledge and skills (Ngin, Simms, & Erbin-Roesemann, 1993; Sullivan & Decker, 1985). Computer training was the most effective method of increasing nurses' computer knowledge and skills (Ball, Snelbecher, & Schechter, 1985; Lange, 1988; Marr, 1988). The training method has to depend on the complexity of the system, it can be as brief as two-hour orientation at a terminal, or two-week formal training for more complex skills (Ford, 1990; Marr, 1988). Since all nurses have been trained either formally or informally, they had similar knowledge and skills levels.

Computer attitudes included nurses' beliefs, satisfaction and motivation toward computers (Burkes, 1991). In the present study, the computer attitudes of the two groups also had no significant difference. Both groups had neutral attitudes toward computers. This may be explained

that the general information regarding the benefits of implementation CHIS and computers application in nursing had not been introduced in detail in both formal and informal computer training. Therefore, the subjects had not strong beliefs on the benefits of CHIS use. Satisfaction of the subjects was neutral because some of them might lack of enough computer knowledge and skills, some of them might recognize that using CHIS had not improved nursing efficiency. Motivation of the subjects was positive because they might generally have recognized that the nursing work environment will be computer-based in this hospital, and the computers would play an important role in many aspects of social life in future.

Relationships among computer knowledge, computer attitudes and computer skills.

In the present study, the positive association between computer knowledge and computer skills as well as between computer attitudes and computer skills had been identified, whereas the relationship between computer knowledge and computer attitudes had not been found. These findings partly support the conceptual framework. According to learning theory and the conceptual framework of this

study, knowledge, attitudes and skills are interdependent. Knowledge can be used to build attitudes and develop skills; attitudes can develop interest or motivation to learn knowledge and skills; as the skills increase, the knowledge and more positive attitudes will be increased by practice (Festinger, 1957 cited in Krathwohl, Bloom, & Masia, 1974; Reilly, 1975). In the present study, the results demonstrated that there was significantly positive correlation between computer attitudes and computer skills. Among three aspects of attitudes, both beliefs and motivation were related to computer skills, but satisfaction was not related to computer skills. This may be explained that with the strong beliefs that using CHIS will lead to benefits for nursing, nurses will have motivation to use CHIS, therefore, their computer skills can be improved by more practicing. Since computer skills will increase by practicing, even nurses were satisfaction with CHIS use, if they had not enough opportunities to practice because of only one terminal in each nursing station, they could not increase their computer skills. If the nurses were dissatisfaction with CHIS use, while they had many opportunities to use CHIS serving as Order Entry Nurses, they might be also obtain high computer skills. This might

be a reason that satisfaction was not significantly related to computer skills.

In the present study, the relationship between computer knowledge and attitudes either overall or subparts had not been found. The reason for this finding is that the computer knowledge was relative abstract, and will be obtained mainly from the formal computer course or computer training (Bryson, 1991; Saranto, 1997). The computer knowledge of the subjects in the present study were still limited, they had not achieved the level of having self-learning ability (Sweeney, 1985). According to Sweeney (1985), to acquire computer knowledge self-learning ability and effectively use computers can be implemented only from an adequate computer knowledge base, that is, understand some basic facts about computers and the way they operate. In the present study, the subjects had not been designed to learn in areas the computer course during their certificate or diploma education system, and computer basic knowledge was not been taught in both formal and informal computer training before and after CHIS use. Furthermore, there were not enough computer equipment, tutors and appropriate reading materials or books for nurses. That is, it was very difficult for nurses to improve their computer knowledge

through self-learning even they have motivation. Therefore, there was no significant correlation between computer knowledge and attitudes. In addition, the general similar level of the subjects' beliefs and satisfaction toward CHIS use, as well as general lower level of computer knowledge might also be the reason that the relationship between computer knowledge and attitudes had not been found. The findings of this study were similar to Marasovic, Kenney, Elliott and Sindhusake' (1997) study which found that there was not significant relationship between computer knowledge and beliefs, satisfaction and motivation toward computer use, therefore, they considered that nurses' computer knowledge did not directly influence their computer attitudes. However, Burkes' study found that ICU nurses' computer knowledge was positively related to their beliefs toward computer use (Burkes, 1991). The inconsistency between the present study and Burkes' might be due to different population or different instrument.