Keywords: computer attitudes, computer skills in nursing, information technology syllabus, nursing education.

Abstract
Background The need for addressing the issue of training nursing students in Health Informatics [the discipline dealing with the application of information and communications technology (ICT) to health care] and incorporating training in the basic information technology skills is becoming a matter for much discussion. Literature reports that the previous computer experience of nurses can generate a positive or negative attitude to a specific computer system and influence the motivation to acquire new computer knowledge. Attempts to address this matter in Ireland came with the recommendation by the Syllabus of Nurse Training 2000 that ICT be included as a taught component within the curriculum. The lack of emphasis on ICT being taught as a formal component with no guidelines as to what level this ICT component should reflect, do little to assist either nurse educators or programme developers. Literature on information and communications technology in health care generally, and in nursing and midwifery education specifically, is now expanding. Current literature on the subject addresses various issues including the applications of computers to nursing practice, approaches to teaching computer skills to nurses and midwives, and various studies dealing with computer literacy and attitudes. The purpose of this study was threefold:
1. To describe the self-reported experiences of nurses concerning their personal and professional use of computers.
2. To describe the attitudes that nurses have concerning their personal and professional use of computers.
3. To identify the computer training needs of students undertaking the Bachelor in Nursing Studies degree programme.

Method The study was designed as a descriptive survey using a modified three-part Questionnaire that collected self-reported information on the nurses’ experience and attitudes to using computers. The survey was carried out with a single cohort of registered nurses undertaking a Bachelor in Nursing Studies Degree during the year 2001.

Introduction
It is generally accepted that we live in a technological age. Information and Communications Technology (ICT) is all pervasive to the extent that our economy and quality of life depend on it. (1) The increase in availability and use of computer networks and the Internet are producing a changing climate in education as well as in health care. This increased use of computers in healthcare prompts a need to increase nurses’ computer knowledge.

Since the 1970s computers have revolutionised the way in which healthcare is delivered, practised and managed. Evaluating nurses’ attitudes towards computer use is an area that has received much attention in the literature (2,3 4,5,6,7).

Sinclair’s study of nurse teacher’s perceptions of information technology indicated that although some nurse teachers have had no formal training and lack basic computer skills themselves, they do recognise the need for computer competence among teachers and students. (8) The purpose of this study was to describe the self-reported experience and attitudes that nurses have concerning their personal and professional use of computers.
Literature Review

Although Knapp and Whiting-O’Keefe conclude that computer implementation enhances medical care there has been a history of non-use and resistance to computers by health care workers. Some of the causes of this negativity stem from technical, organisational, and lack of consultation in the change process leading to poorly designed systems and individual psychological factors such as attitudes. (9,10) Research has shown that nurses’ attitudes toward computerisation have been found to vary according to age, gender, level of education, level of job satisfaction, past experience with computers, clinical area of employment, geographic location and the number of years of employment in the health care field. (11,12,13,6)

Evaluating nurses attitudes towards computer use is an area which has received much attention in the literature (2,3,4,5,6,7). Birx et al. comment on nurses in practice settings being exposed to a variety of changes with responses to these changes varying from total lack of acceptance to full support. (14) The introduction of computers has the potential to evoke a variety of feelings in the users, remarks McBride in 1996. She further comments that student nurses are the ‘future caregivers in our new automated health care service’ and hence the need to explore the factors that may be contributing to their attitudes towards computers. (3)

Most authors use self developed instruments to measure nurses’ computer knowledge. The Staggers’ Nursing Computer Experience Questionnaire (SNCEQ) consists of sections on computer knowledge, computer application, participation in and knowledge about informatics role activities. (15) Birx et al. developed a 10 item multiple choice test based on computer orientation content to measure student’s understanding of basic computer terminology. (14) Burke developed a 13 item list of true, false or uncertain type of questions on computer knowledge for her Nurses’ Attitudes Toward Computer Use instrument. (16)

Instruments used to measure attitudes include Brondt and Stronge’s Nurses’ Attitudes Toward Computers Questionnaire, a 20 item Likert-type instrument consisting of 6 positively worded and 14 negatively worded items rated on a five point scale. This questionnaire mainly measures nurses’ beliefs and concerns regarding computers in general and not specific computer applications. (12) Thomas in 1990 developed the ‘Attitudes Toward Computing in Nursing’ a parallel measure instrument used to assess change in attitudes among nurses and nursing students. (17) Burkes Nurses’ Computer-Use Attitude Questionnaire measures nurses computer attitudes on satisfaction, beliefs and motivation. (16)

Scarpa et al. survey of 136 nurses employed in a non-computerised hospital showed the only significant contributor to a positive attitude was previous experience with computers. (18) Ball et al. demonstrated that nurses’ attitudes toward computers could be positively influenced by a computer literacy course emphasising the responsibilities of nursing and the way in which computer technology is functionally relevant for nurses and their work. (19) Schwirian et al. compared attitudes of nurses (n=358) and nursing students (n=353) toward computer use in nursing practice and examined factors contributing to these attitudes. Student nurses were found to have more positive attitudes toward computers than registered nurses. Owning a computer, intending to buy a computer, having a computer in the home, working in a computerised environment, and using computers in school all contributed to a more positive attitude. (20)

The degree to which computers impact on nurses’ day-to-day lives varies dramatically from hospital to hospital. Van Bemmel et al. remarks that health care professionals often lack knowledge of the possibilities and limitations of systematically processing data, information and knowledge and of the resulting impact on quality decision-making. (21)

Recommendations have been published over the past ten years for teaching Health Informatics and in parallel for nursing training in nursing informatics (22,23,24). All agree that Health Informatics, but more specifically Nursing Informatics should be integrated into the nursing curriculum.

Bryson’s study of the perceptions of nurse educators found that nurses should acquire skills in using the computer as a tool in nursing, for example word
processing for preparing nursing care plans, using computer-aided instruction as a learning tool, using a hospital computer information system, using a computerised library database, and using software for statistical computations. (2)

Research describes the various computer literacy objectives for nursing. McGonigle and Eggars stress nursing informatics courses must prepare student nurses to manage information, enter into research and communicate via computers. (24) Specific requirements for nurses outlined in the United States in 1988 by the National League of Nursing (NLN) suggested four informatics competencies, 1) documenting nursing practice; 2) accessing information; 3) using the data and information from a computer system; and 4) coordinating information flow. (25) From these requirements Liu et al. concluded that nurses’ computer knowledge should include a basic understanding of the following: Computer hardware and software; The concept of a computer program; Computer applications in nursing; How a computer system operates; Word processing; Computer aided instruction for continuing education, and finally, nurses should also be aware of system security and the limitations of the computer. (7)

Some experimental methods of improving computer skills among nurses include Birx and Castleberry’s evaluative study, which integrated the use of laptop computers into student coursework. The outcomes showed improved skills for those with the lap top computers while both groups retained a positive attitude towards computers. (14) Fullerton’s study introduced self-paced tutorials developed specifically for use by graduate students in an effort to improve skills such as use of e-mail, world wide web, file transfer protocol, eXcel and PowerPoint presentation software – skills, that would help students succeed in their course of studies. (5)

Developing the information and communications syllabus in nursing education has become the subject of a number of studies (26,8,13). In Ireland, An Bord Altranais’ Requirements and Standards for Nurse Registration Education Programmes (2000) includes “Information/communication systems and technology” as a topic in their syllabus/indicative content of each nursing speciality. (27) The lack of emphasis on ICT being taught as a formal component with no guidelines as to what level this ICT component should reflect, do little to assist either nurse educators or programme developers.

**Purpose of Study**

The lack of knowledge and insight that nurse educators have concerning the experience and attitudes of nurses about computers provided the background for this empirical study. The purpose of this study was threefold:

1. To describe the self-reported experiences of nurses concerning their personal and professional use of computers.
2. To describe the attitudes that nurses have concerning their personal and professional use of computers.
3. To identify the computer training needs of students undertaking the Bachelor in Nursing Studies degree programme.

**Method**

This study was designed as a descriptive survey using a modified three-part questionnaire. The unit of analysis was the individual nurses attending a Bachelor in Nursing Studies (BNS) degree programme in 2001.

**Sampling Procedure & Sample Size**

The sample used in this study was the single cohort of students attending the BNS Programme 2001. This approach restricts researchers from making generalisations about the findings beyond the sample group, and is commonly used in nursing studies. (28,29) Because the accessible population was quite small the entire cohort of students on this degree programme was invited to participate in the study. The total number of students on the BNS programme was 130, of which 10 were included in the pilot study. The total size of the sample for the main study was 120 students and the response rate was 74 (61.7%).

**Description of Sample**
All subjects were qualified nurses and were registered with An Bord Altranais (Irish Nursing Board). Subjects had completed successfully either the (a) Diploma in Nursing, (b) Higher Diploma in Nursing (UK) or (c) Access to Degree Programme. All were undertaking a one-year BNS programme.

**Study Setting**

The study was undertaken in The School of Nursing & Midwifery Studies, The University of Dublin Trinity College.

**Data Collection**

A survey using a questionnaire was the choice of method of data collection. Data were collected on two days by two of the researchers. A covering letter outlining the purpose of the study and how anonymity and confidentiality would be maintained was attached to each questionnaire. Students were informed of this research project at the beginning of their BNS programme and prior to the pilot study. The reasons for using a questionnaire include (a) suitable for a descriptive cross-sectional study, (b) time constraints, (c) greater assurance of anonymity and (d) less expensive than other methods. (30). Questionnaires were distributed to all students at the end of a lecture. Information regarding the collection of data is given in Table 1 This cohort of BNS students attended lectures in two separate groups on two different study days during each week. Group one consisted of 67 students and group two of 63.

**Questionnaire**

The title of the questionnaire was “A Survey of Nursing Students’ Experience and Attitudes to Computers” which collected self-reported information on nurses’ experiences and attitudes to computers. The questionnaire consisted of a total of fifty items and took approximately twenty minutes to complete. These fifty questions were divided as follows: (a) five biographic questions (b) twenty-two questions on experience of computers and (c) an attitudinal scale of eighteen questions. The questionnaire was developed by Sinclair & Gardner, (1997) and permission was obtained to use it for the present study. (8) The questionnaire was amended for use in the present study following review by two statisticians at Trinity College, Dublin.

**Validity Assessment**

This refers to the ability of the instrument to measure what it is supposed to measure. (31) The questionnaire used in this study was examined by two statisticians and an independent IT consultant. All comments received were examined by the researchers and changes were made to the instrument before undertaking the pilot study.

**Ethical Issues**

Research that violates the rights of respondents is unethical. To prevent this, codes of ethics for human subject research have been developed to ensure the protection of respondents’ safety and dignity. (29,31). According to Burns &

<table>
<thead>
<tr>
<th>Instrument</th>
<th>No of Subjects</th>
<th>How</th>
<th>Data Collection</th>
<th>Where</th>
<th>By Whom</th>
</tr>
</thead>
<tbody>
<tr>
<td>Questionnaire</td>
<td>N = 67 Group 1</td>
<td>Researchers distributed questionnaire following a lecture</td>
<td>Date: 10.04.01, Time: 12.30-13.00</td>
<td>Lecture Theatre, Trinity College</td>
<td>Researchers</td>
</tr>
<tr>
<td>Questionnaire</td>
<td>N = 63 Group 2</td>
<td>Researchers distributed questionnaire following a lecture</td>
<td>Date: 11.04.01, Time: 12.30-13.00</td>
<td>Lecture Theatre, Trinity College</td>
<td>Researchers</td>
</tr>
</tbody>
</table>
Grove the attitudes, beliefs, opinions and records of anyone is regarded as private information and therefore must be protected. The right to privacy also means that the respondents have the right to anonymity and confidentiality. In this study privacy was protected in several ways. First, anonymity was assured because no names were used and responses could not be linked to specific individuals. Second, only the researchers involved in this project had access to the data collected which ensured greater confidentiality. Third, all data was stored securely either in a locked cabinet or computer file. In addition, all questionnaires were destroyed when the data was analysed.

Informed consent is crucial to the right to self-determination and is protected when consent is obtained. The purpose of this study was discussed with respondents several weeks prior to its commencement and an opportunity for respondents to ask questions was also provided. Respondents were informed that consenting to participate in the study did not in any way preclude them from withdrawing at any time if they so wished. Moreover, at no time was any respondent compelled or coerced by any of the researchers to participate in this study. These assurances were further emphasised in a letter that accompanied all questionnaires.

Pilot Study
In keeping with survey research methods, a pilot study was conducted on a small sample of the cohort of students. Ten students made up the sample for the pilot study and they were precluded from participating in the main study. All respondents completed the questionnaire. Following review of the questionnaires no modifications were made prior to the main study.

Results
Data were prepared and entered into a spreadsheet using SPSS. The findings are presented in both tabular and graphic format.

Biographic:
The response rate was 74 (61.7%) of which 4% were male. Fifty six (75.7%) of the respondents belonged to the age range 20-25 while 14 (18.9%) were between 26-30 years of age. These findings were not surprising since most of this cohort of students had only just completed their Diploma in Nursing. The majority of this sample reported that they were currently working in general nursing. Figure 1 summarises the percentage of the sample working in the various nursing disciplines. Seventy (94.6%) of the respondents commenced their nurse training as school leavers, only four (5.4%) entered nurse training as mature students (i.e. over the age of 23).

Experience of Computers:
This section of the questionnaire was made up of three questions relating to prior computer training, four questions on determining levels of skill and computer usage and sixteen multiple choice questions.

In response to the question on prior computer training, forty seven (63.5%, n=74) reported to have completed some form of training. Eighteen (37.5%) of the 47 who had received training gained this training at school. Twenty seven (57.5%) of the forty seven who had some form of computer training received training in word processing, nineteen (40.4%) in spreadsheets and sixteen (34%) in Internet use.

Students were then asked to estimate their level of skill with various computer packages based on a four level scale (None/Low, Medium, High and Expert). Results showed identical numbers for general use of computers and Internet use, sixty three students (85.1%) declaring a medium or high level of skill and one respondent (1.4%) reporting an expert level of skill in these two categories. Fifty five (75.3%) reported a medium or high level of skill in using hospital based systems with two (2.7%) respondents declaring an expert level of skill in this category. Fifty two (71.2%) reported a medium or high level of skill in word processing. Slightly over 1/3 of the cohort responded to using a computer at least once a week. Figure 2 shows the variety of activities included in this question and the range and level of skill reported by the respondents.
Respondents were asked a variety of questions in relation to computer knowledge and computer

One of these questions required a yes/no answer to specific computer tasks such as saving a file and deleting a file. Figure 3 shows the distribution of reported answers.

The final section on experience of computers consisted of sixteen multiple choice questions. Correct responses varied across the questions and are summarised in Table 2.

As can be seen in Table 2, overall results showed that responses varied, but a moderate to high percentage of students reported a good knowledge of computers. Of the sixteen questions, thirteen were answered particularly well. The range of knowledge varied considerably between the questions answered correctly by the largest and lowest number of respondents, i.e. sixty seven (90.5%) knew what a cursor does, in contrast only 19 (25.7%) knew what was meant by the term debugging. Correct answers ranged from 19 (25.7%) to 67 (90.5%) and the mean of correct answers was 44.

Attitudes to Computers

A four part Likert type scale ranging from Strongly Disagree to Strongly Agree was used to determine attitudes to computers. This scale contained ten positive and ten negative statements which were presented in mixed order. Respondents were asked to indicate the degree to which they agreed or disagreed with the statements. Below are examples of five positive and five negative statements from the attitudinal scale.

Positive statements included

- Learning about computers is essential for nurses working in today’s health service.
- I am generally quite proficient with computers.
- 98.6% of respondents reported that they agree or strongly agree and 37.8% of respondents reported that they agreed or strongly agreed with these statements respectively.

- Figuring out computer problems appeals to me,
- only 22 (29.7%) agreed with this statement.

In response to I would consider buying a home computer, the majority of respondents, 63 (85.1%) agreed or strongly agreed with this statement. The majority of respondents, 60 (81%) said they agreed or strongly agreed with the statement I expect to use computers in many ways in nursing practice.

Examples of the nature of the negative statements
are, I feel intimidated if a conversation turns to computers and, I do not understand how people can enjoy working with computers. 44.5% of respondents agreed or strongly agreed with the first statement and 8% of respondents agreed or strongly agreed with the second statement. This means that 92% disagreed and strongly disagreed with the last statement.

Table 2: Summary of correct responses to questions 16-28

<table>
<thead>
<tr>
<th>Question</th>
<th>Correct Answers</th>
<th>Percentage (n=74)</th>
</tr>
</thead>
<tbody>
<tr>
<td>What does a cursor do?</td>
<td>67</td>
<td>90.5%</td>
</tr>
<tr>
<td>What device converts computer signals to telephone tones?</td>
<td>63</td>
<td>85.1%</td>
</tr>
<tr>
<td>Why make a back-up copy on another disk?</td>
<td>57</td>
<td>77%</td>
</tr>
<tr>
<td>What is RAM?</td>
<td>56</td>
<td>75.7%</td>
</tr>
<tr>
<td>A file can be stored permanently on….</td>
<td>56</td>
<td>75.7%</td>
</tr>
<tr>
<td>Computer software refers to….</td>
<td>51</td>
<td>68.9%</td>
</tr>
<tr>
<td>Physical parts of a computer are called?</td>
<td>50</td>
<td>67.7%</td>
</tr>
<tr>
<td>What is the purpose of directories?</td>
<td>50</td>
<td>67.6%</td>
</tr>
<tr>
<td>Spreadsheets are best used for?</td>
<td>45</td>
<td>60.8%</td>
</tr>
<tr>
<td>Best method for correcting multiple spelling errors……</td>
<td>44</td>
<td>59.5%</td>
</tr>
<tr>
<td>Formatting a floppy disk is…..</td>
<td>37</td>
<td>50%</td>
</tr>
<tr>
<td>What is a computer program?</td>
<td>36</td>
<td>48.6%</td>
</tr>
<tr>
<td>Which of the following is an application……</td>
<td>31</td>
<td>41.9%</td>
</tr>
<tr>
<td>Data accessed on networked PC’s is through….</td>
<td>25</td>
<td>33.8%</td>
</tr>
<tr>
<td>In a database data is stored as….</td>
<td>23</td>
<td>31.1%</td>
</tr>
<tr>
<td>What is meant by the term ‘debugging’……</td>
<td>19</td>
<td>25.7%</td>
</tr>
</tbody>
</table>
negative statements include *I avoid using computers whenever I can*, only 22 (29.7%) agreed or strongly agreed with this statement. *I feel threatened by the thought of having to use a computer*, only 14 (18.9%) agreed with this statement and in response to the statement *I find computers boring*, only 10 (13.5%) agreed or strongly agreed.

The last two questions on the questionnaire asked respondents to suggest what computer training they would consider useful to the BNS Programme and to comment on the use of computers in Nursing Practice.

With regard to training that would be useful to the BNS Programme, the majority of students, fifty two (72.8%) requested training in basic computer skills, to include general use of computers, word processing, spreadsheets and presentation software. Other main requirements for students included bibliographic retrieval systems and electronic library catalogues and internet use 15 (21%).

When asked to comment on computers in nursing practice an overall majority commented on the importance of the use of computers in the future. Other comments include, “not widely used in nursing” and “not encouraged”. In general, the overall feeling among students was that computers are useful in nursing practice, for example, for producing care plans. However, participants felt that enough encouragement and training was not provided.

**Discussion of the results**

The positive attitudes reported by respondents would suggest an interest in learning about computers and an understanding of the importance the role ICT will play in the future of Health care. Schwirian et al. (1989) states that ‘nurses constitute the larg-
The limited experience of the respondents in this study reflects on the lack of use of ICT in healthcare and emphasises the importance of integrating computer teaching at nursing undergraduate level. These students will be working in an ever advancing technological world and their attitudes and acceptance of computers is essential. Over the next few years the numbers of students who receive computer training at school will certainly increase thereby filling the gap in the lack of basic level of skills of incoming students to the BNS.

Defining the idea of computer literacy itself is difficult. McGonigle (1991) and Liu et al. (2000) have endeavoured to tackle this issue in relation to nursing students, but the diversity in the level of skills of incoming students continues to make this a difficult task. (24, 7)

Saranto (1997), Sinclair (1997) and Sinclair (1999) have stated that it is important in developing any curriculum to have information on the cohort of students. (26, 8,13) This survey has given some baseline information on the computer skills, and attitudes of this group of students and can act as a guide for developing any future curricula. A recent initiative in the National Health Service (UK) offers free IT training for all staff using the European Computer Driving Licence (ECDL) model and level of standard. The ECDL is a Europe wide recognised standard of basic computer skills and competence with computers.

Given that almost one hundred percent of respondents felt that learning about computers was essential for nurses, and the fact that the majority were under the age of thirty years, the researchers do not know if nurses from an older age group would share such a positive attitude to computers.

Whereas eighty five percent of respondents reported having a moderate to high level of general computer skills, we can only speculate about whether this is due to prior training where nearly two thirds reported having prior training in computers.

Of interest is the observation that while almost all respondents felt nurses should learn about computers and the majority said they had moderate to high levels of computer skills, just under half the respondents (44.5%) said they felt intimidated if the conversation turns to computers.

Limitations of this study
Limitations are restrictions within a study that may restrict researchers from generalising the findings. (29,31) According to Dempsey & Dempsey (1996) all studies have limitations but suggest that in quantitative studies limitations are usually due to the use of small unrepresentative samples and inadequate methodology. (31) The researchers have identified the following methodological limitations.

- The sample used in this study was fairly small and was not selected randomly. This means that the sample was not representative of the total population of nurses undertaking BNS programmes and will restrict the generalisation of the findings.
- A second weakness relates to the single cohort of students used in this study. Inclusion of additional cohorts of students would overcome this limitation.
- Another weakness identified by the researchers relates to the use of a single setting. This could be avoided by including subjects from other institutions.
- While the instrument was used by other researchers for a similar study and pretested for the current study, extensive reliability and validity data are lacking.
- Using a single cohort of students has to some extent restricted the researchers in the choice of statistical tests.
Implications and recommendations
Despite the small sample the researchers believe that the findings from this study have implications for nurse education and further research.

- These findings demonstrated a positive attitude to computers in general and a need for additional training in the use of computers. In view of these results the researchers plan to make recommendations to their own school to initiate computer training programmes for incoming students. The authors’ own institution provides facilities for students to avail themselves of ECDL e-learning tool.

- Further research using a larger sample is recommended. The use of only one cohort of students indicates the need for additional cohorts and if possible including cohorts from other institutions.

- Additional research that will encompass practical computer activities to verify the nature and level of computer skills.

Conclusion
The literature reveals that there is a need to improve computer skills amongst nursing students, and highlights the dilemmas that face course developers in attempting to address this situation.

This study attempted to establish the experience and attitudes of one cohort of nurses. While respondents reported a medium to high level of skill and positive attitudes to computers generally, 72.8% requested training in basic computer skills when asked to comment on what skills they would find useful on the BNS programme. Despite this, little can be verified in terms of the actual practical skills of this sample. The authors believe that it is important to encourage students to develop further their basic computer skills and that students should avail themselves of opportunities to advance these skills, such as the ECDL e-learning tool available on campus.

Acknowledgements
The authors would like to thank the following for their co-operation and assistance in preparing this study Marlene Sinclair MEd, BSc, DASE, RNT, RM, RN., John Gardner PhD, MSc, BSc, PGCE C. Eng., , Mary Sharp, B.Sc. (comp.), M.A., C. Eng., FICS, MIEI, Colin Kirkham, B.Sc.

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