How to Enhance Nursing Students’ Intention to Use Information Technology
The First Step Before Integrating It in Nursing Curriculum

AYALA GONEN, PHD, RN
DGANIT SHARON, PHD, RN
ANA OFFIR, PHD, RN
LILAC LEV-ARI, PHD

The behavior of health professionals concerning the use of information systems has been examined for over 50 years, and not in vain, because information is a valuable resource in the modern world, and our ability to locate and retrieve it is extremely significant.

The accelerated development of technology has led to the almost daily emergence of new versions of more computerized, smart, efficient, swift, friendly, and useful information systems—both software and hardware. The fields of commerce, banking, services, education, and health have quickly found and assessed the value of using computerized information systems, and today, most economic activities are performed via computers. This fact has prompted health centers to expand their use of computers into many areas such as human resources, finance, and logistics.

Computerization in the healthcare system is also gaining an important role in the clinical area, primarily in aspects concerned with providing appropriate solutions to problems of registration, follow-up, consulting, and training in the clinical-practical sphere. For instance, patient charts, decision-making support systems, central monitoring systems, and staff and patient supervision all undergo computerization these days.

The use of computers and information systems is expanding to nursing as well. Today, the nursing profession is increasingly based on knowledge and technology, and nurses function as coordinators to organize the large amount of information available. The combination of scientific knowledge and technology in nursing finds its expression in the development of an area called “nursing informatics,” originally defined by Graves and Corcoran.

Today, in the 21st century, information technology has an important and critical role in the healthcare delivery system. Nursing educators already know and understand that they should integrate nursing informatics into the nursing curriculum to prepare future nurses for the new world of information technology. However, as of now, the core program of nursing studies in Israel does not put an emphasis on the skills required to properly use nursing informatics. The present research is the first step toward achieving this target by recognizing the importance of the human factor. The main goal is to examine the correlation between nursing students’ attitudes and a number of variables: self-efficacy, threat, challenge, and innovativeness. This quantitative study used a convenience sample of nursing students in a bachelor’s degree program at a large academic center in central Israel. Results show significant positive correlations between nursing students’ attitudes to computer use and self-efficacy, a sense of challenge in using a computer, a sense of threat in using a computer, and previous experience with computers. The insights of these results will benefit nursing educators by helping them find creative ways to expose the students to the world of information technology and to improve the quality of future nurses.

KEY WORDS
Attitudes to computers/IT • experience with computers • innovativeness • nursing students • self-efficacy • threat and challenge from computers

Author Affiliations: Nursing Department, School of Social and Community Sciences (Drs Gonen, Sharon, and Offir); Behavioral Sciences Department, School of Social and Community Sciences (Dr Lev-Ari), Ruppin Academic Center, Emeq-Hefer, Israel.

The authors have disclosed that they have no significant relationship with, or financial interest in, any commercial companies pertaining to this article.

Corresponding author: Ayala Gonen, PhD, RN, Nursing Department, Ruppin Academic Center, Emeq Hefer, Israel 4025000 (Ayala.gonen@gmail.com).

DOI: 10.1097/CIN.0000000000000064
Nursing informatics integrates the use of computers, information, and nursing sciences to support nursing processes. This is done to facilitate the flow of information and improve the quality of treatment through an interaction between information systems in nursing and practical nursing. This, in turn, makes the nursing profession dynamic and open to changes.

Israeli healthcare services are considered to be among the most technically advanced and publicly accessible services in the world. Nevertheless, the field of nursing informatics is relatively new in Israel and has hardly ever been studied. Gonen’s doctoral thesis examined the attitudes of hospital nurses to computer use, but to the best of our knowledge, there has been no research in Israel that has examined the perceptions of nursing students regarding the use of computers in general and in the nursing profession in particular.

As part of the nursing training program, when they reach clinical training, students are required to integrate computerized work quickly. However, as of now, the core program of nursing studies in Israel does not put an emphasis on the skills required to properly use nursing informatics.

**BACKGROUND—LITERATURE REVIEW**

Understanding nurses’ behavior concerning the use of computers is an important issue that is of interest to many scholars. During the 1960s and 1970s, when computers were first introduced into clinical hospital work, the first professional studies of nurse and physician attitudes appeared. It was understood at the time that studying attitudes toward computer use was important to the success of the change process. For instance, Rosenberg et al examined whether nursing students’ attitudes to computer use could change by exposing them to computers in the workplace. They examined 54 nursing students in five different programs, before and after a 3-month practical rotation in psychiatry, to assess the effect of computer use on their attitudes. Examination of the results revealed that the group that had gained experience with computer use showed a more significant level of positive attitudes toward computer use relative to the other group, which had no previous experience.

Many studies of nurses’/nursing students’ attitudes toward the use of computers have been conducted worldwide. A review of recent literature found positive attitudes of nursing students throughout the world to the use of information technologies and computers.

In Israel, Gonen studied the attitudes of hospital nurses to computer use in preparation for introducing new software into the healthcare system. The research examined six significant variables concerned with attitudes toward computer use, namely, behavioral intention, previous experience, efficacy, innovativeness, threat, and challenge. The sample included 411 registered nurses in a large medical center, and positive attitudes were found toward use of technology. A strong, positive relationship was found between the nurses’ attitudes, self-efficacy, innovativeness, and intention to use technology. Threat and challenge were found to be important mediating variables in predicting attitudes and behavioral intentions. Following are the main study variables, their definitions, and a summary of the relevant professional literature review.

Behavioral intentions: The assessment of nursing students’ behavioral intentions to use computers is somewhat tricky because students have not been exposed to use of computers in a clinical setting, as opposed to nurses who use computers in their work. Many nursing studies have also examined nurses’ behavioral intentions as a derivative of their behavior intentions regarding computer use, notable among them Chow et al., Shoham and Gonen, and Tung and Chang.

Previous experience using computers: There is a great deal of variance among nursing students, and the pertinent question is whether previous experience affects attitudes. Previous experience can be expressed in various ways such as the number of years that the student has worked with computers, access to computers, frequency of computer use, training sessions, and others. Indeed, many researchers have found a positive relationship between previous use of computers and attitudes toward using them.

Efficacy (the degree of student’s perception of self-control): Self-efficacy is the individual’s perception of his/her capacity to behave in a way that produces an effect. It is one’s belief (whether realistic or not) in one’s ability to perform a certain task. The term was coined by Bandura as part of his Social Learning Theory. This study examined whether the perception of the ease of or difficulty in using a computer would affect attitudes concerning computer use. Many studies emphasize the connection between these two variables and state that the greater the sense of self-efficacy, the more positive the attitudes toward computer use.

Innovativeness (the nursing student’s willingness to use new technology): Innovativeness can be expressed in various ways such as interest in technological innovation, intention to buy new gadgets, and others. A tendency to innovativeness should have a positive relationship with attitudes toward computer use, as was presented by Shoham and Gonen and by Hsu et al.

Threat: A nursing student who is afraid of technology and sees it as a threat will probably have negative attitudes toward computer use; and indeed, a negative relationship between feeling threatened by computer and technology and attitudes toward using computers was found by other researchers, such as Shoham and Gonen, and Caudle et al.

Challenge: A nursing student who likes challenges and views computer use as a challenge is expected to express positive attitudes toward computer use. Corroboration for this was found by Shoham and Gonen.
In summary, many studies have been conducted over the past 50 years worldwide concerning the attitudes of nurses and nursing students toward the use of computers. In general, it seems that attitudes have improved over the years, becoming more positive. One clear and recurring trend throughout the literature review is a significant positive relationship between previous experience with computers and attitudes toward computer use.

The theoretic basis of this research is Ajzen’s\textsuperscript{26,27} Planned Behavior Theory, which provides a general direction to measure attitudes and behavior intentions and has been examined and proven as a useful methodological tool among nursing professionals.\textsuperscript{14} The Planned Behavior Theory incorporates three independent components of behavior intentions:

- **Attitude toward behavior**: relates to the degree of an individual’s positive or negative assessment of behavior/planned behavior.
- **Social pressure (subjective norms)**: the pressure directed at an individual regarding the performance or nonperformance of a certain behavior.
- **Behavioral ability and control**: the individual’s perceived ease or difficulty in performing a certain action. Control usually reflects previous experience.

The term *attitude* indicates an important concept in human behavior. It is one of the most common terms of social psychology and is used to explain various human behaviors, primarily social behaviors. A person learns from experience how the social environment reacts to his/her actions and behaves accordingly.

The behavioral control component is the individual’s resources and possibilities that dictate his/her tendency to behavioral achievement or, in other words, one’s perceived ease or difficulty to perform a certain behavior.

Innovativeness was defined by Agarwal and Prasad\textsuperscript{28} as an individual’s willingness to try new information technologies. They explained that innovativeness has an important place in the research of the behavior of informatics use. Rogers,\textsuperscript{29} the founder of the Diffusion of Innovation Theory, characterized five types of change efforts: (1) risk-takers—those who dare and are eager for any new technological adventure, comprising 2.5% of the population; (2) first adopters—public opinion leaders in an organization, about 13.5% of the population; (3) early maturity—the group that is considered more level headed, those who plan their moves ahead, comprising 34% of the population; (4) late maturity—the cautious group, those who tread carefully, about 34% of the population; and (5) opposers—the group that opposes innovation and might even thwart attempts to introduce change, about 16% of the population.

Ajzen\textsuperscript{30} claimed that behavioral intention is the degree to which people are willing to try, and the degree of effort they plan to invest, to perform a behavior, which is affected by attitudes, social influence, and behavioral control.

The threat and challenge of computer use are two basic components of the Coping with Stressogenic Decisions Model,\textsuperscript{31} which is the most common and famous model in the field of clinical psychology (Threat & Challenge Model). Lazarus\textsuperscript{32} defined stress as the link between the individual and his/her environment that is perceived by the individual by means of enhancing his/her resources and anxiety about endangering his/her sense of well-being.

**Aim of This Research**

Today, in the 21st century, information technology has an important and critical role in the healthcare delivery system. Nursing educators already know and understand that they should integrate nursing informatics into the nursing curriculum to prepare the future nurses for the new world of information technology. However, as of now, the core program of nursing studies in Israel does not put an emphasis on the skills required to properly use nursing informatics.

The authors wish to encourage nursing students to use information technology, and the present research is the first step toward achieving this target by understanding and recognizing the importance of the human factor.

The main goal was to examine the correlation between nursing students’ attitudes and a number of variables, such as self-efficacy, threat, challenge, and innovativeness. Attitudes should serve as predictors of behavior regarding work with informatics systems and should point to the characteristics of the relationship between attitudes and specific personal and professional factors.

The second step includes development of an advanced and tailored curriculum, based on the insights of this research.

The following seven research questions were derived from the aim of this research:

- Are nursing students’ attitudes to computer use positive or negative?
- Is there a correlation between the students’ behavior intention and their attitudes to computer use?
- Is there a correlation between the students’ self-efficacy and their attitudes to computer use?
- Is there a correlation between the students’ innovativeness and their attitudes to computer use?
- Is there a correlation between the students’ computer experience, access, and computer use frequency with their attitudes to computer use? And is there a difference between students who underwent a computer course in the past and those who did not?
- Is there a correlation between the students’ sense of threat in using a computer and their attitudes to computer use?
- Is there a correlation between the students’ sense of challenge in using a computer and their attitudes to computer use?
The importance of this research and its expected benefits are as follows:

Educational aspect: In the field of nursing education, the findings of this study contribute to expanding the knowledge base of nursing informatics, in the context of understanding the human factor involved in the intention to use computers. Analysis of the results can serve as a knowledge base to building a computer training program for nursing students. Activating this program could help provide students with the relevant skills that would help them to become more easily integrated in work with computerized clinical systems and act to improve the quality of treatment.

Qualitative aspect: Before changing behavior, one must understand it. This research helps to better understand behavior and, as such, helps to plan and implement a training program that is suited to the students’ needs.

Economic aspect: Understanding why people accept or reject computerized systems is one of the most challenging issues in the study of information systems. Analysis and development of this understanding could help directors to use informed judgment when assessing the financial investment required to implement an appropriate program.

Managerial aspect: The target population of this research is nursing students—a significant quantitative and qualitative population. As the future generation, they could be the ones to lead processes of computer technology integration within the healthcare system.

**METHODS**

**Type of Research**

This is a quantitative study, which includes an attitudes survey. The research focuses on the bachelor’s degree program in nursing at an academic center.

**Sample**

The research population is a convenience sample of 70 nursing students in their first and second years of a bachelor’s degree program at a large academic center in central Israel. With regard to age, 72% of the respondents are between the ages of 21 and 30 years, and 28% are younger than 21 years. Forty-four percent of the students are Jewish, 50% are Muslim Arabs, and 5% are Christian Arabs. Of the students, 83% are first year students and 17% are second year students.

**Tools**

The research questionnaire was a closed questionnaire consisting of a few chapters, based on Gonen’s doctoral dissertation. At the time, the questionnaire was tested for consistency and validity (experts’ opinions and high α scores for the various measures, in both the original and the present versions).

The questionnaire included the following chapters:

Nurses’ Attitudes Towards Computerization questionnaire, which was first described by Stronge and Brodt, who developed the tool. The questionnaire has been acclaimed among the nursing community for its focus on nursing, simplicity, and ease of use. Many scholars in the field of nursing have used and still use this tool.

Cronbach’s α for the 2003 version was .73.

Questions to examine the students’ willingness to make an effort and assimilate innovations. Cronbach’s α for the 2003 version was .67.

Questions to assess self-efficacy (in 2003, r = 0.7). Demographic details, previous experience using a computer, access to a computer, and participation/nonparticipation in a computer course.

Of the 70 questionnaires that were distributed, 59 were returned (49 were filled out by first year students, and 10, by second year students). The response rate was 84.2%.

**Ethical Considerations**

The research was approved by the Ethics Committee of Ruppin Academic Center. The researchers distributed the questionnaires to the first and second year students of the bachelor’s degree in nursing program. The students who consented to participate were briefed about the study’s aim and importance and were requested to fill out the questionnaire. The questionnaire forms were anonymous.

**Data Analysis**

The statistical tools used in this research were chosen according to the nature of the study and the characteristics of the variables and included the following:

To assess the students’ attitude to the issue of computerizing hospital procedures, descriptive statistics was used, that is, means and standard deviations of sequential variables and frequencies of categorical variables.

To examine the research hypotheses regarding relationships between variables, Pearson correlations were used to measure the relationships between sequential variables, such as the relationship between attitude and behavior intention.

To examine the research hypotheses regarding differences between groups, independent t tests were used.
To measure the categorical variables such as field of specialization and job, variance tests between means were used.

To test our model, we used structural equation modeling and accepted goodness-of-fit indices.

## RESULTS

The internal consistencies of the six measures were very good and similar to those obtained in 2003: measure of nursing students’ attitudes, Cronbach’s $\alpha = .92$ (range of possible answers, 1–5); measure of the nurses’ sense of threat or challenge to use a computer at work: threat, Cronbach’s $\alpha = .89$ (range of possible answers, 1–7), and challenge, Cronbach’s $\alpha = .84$ (range of possible answers, 1–7); measure of behavioral intention to use a computer, Cronbach’s $\alpha = .68$ (range of possible answers, 1–5); measure of the students’ willingness to invest and assimilate innovations, Cronbach’s $\alpha = .78$ (range of possible answers, 1–5); and measure of self-efficacy, Cronbach’s $\alpha = .82$ (range of possible answers, 1–7).

In addition, data were obtained about participation in computer courses, experience using a computer, access to a computer at home, and computer use frequency. Of the students, 58% had not previously participated in a basic computer course, and 71.2% stated that they had less than 4 years of experience using a computer. A little more than half the students (52.5%) stated that they had access to a computer at home.

### Findings Regarding the Students’ Attitudes to Assimilation of Informatics, Perception of Their Abilities, and Behavioral Intentions

Regarding nurses’ attitude toward computer use, the findings indicate that the attitude to computer use was not positive, nor was it negative: mean (SD), 2.99 (0.73) (on a scale of 1–5). The mean that was obtained was close to 3, “difficult to decide.”

Mean (SD) score for perception of self-efficacy was 3.18 (1.94) (on a scale of 1–5). The mean of the nurses’ self-efficacy regarding computer use indicates that it is possible (1 = very possible; 7 = totally impossible).

Mean (SD) score for behavior intention to use a computer was 3.86 (0.75) (on a scale of 1–5). When the respondents were asked about their future intention to use a computer as a support tool at work, the mean (3.86) was between “difficult to decide” (3) and “agree” (4).

### Findings With a Focus on the Relationships Between the Variables

Table 1 presents the Pearson correlations between the research variables.

### IS THERE A CORRELATION BETWEEN THE STUDENTS’ BEHAVIORAL INTENTION AND THEIR ATTITUDES TO COMPUTER USE?

A linear relationship was not proven, but nevertheless, the mean of attitudes was 2.99 (on a scale of 1–5) and the mean of intention was 3.86 (on a scale of 1–5), which can be explained by the fact that sometimes, a linear connection is not found between two variables because of the different distribution within the variables.

### IS THERE A CORRELATION BETWEEN THE STUDENTS’ SELF-EFFICACY AND THEIR ATTITUDES TO COMPUTER USE?

A significant, positive relationship was found between the students’ self-efficacy and their attitude ($r = 0.60, P < .001$). Namely, the higher the students’ self-efficacy was, the more positive were their attitudes to computer use.

### IS THERE A CORRELATION BETWEEN THE STUDENTS’ INNOVATIVENESS AND THEIR ATTITUDES TO COMPUTER USE?

A significant, positive relationship was found between the students’ innovativeness and their intention to use computers ($r = 0.61, P < .001$). Specifically, the higher the students’ innovativeness was, the greater was their intention to use computers.

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Pearson Correlations Between the Research Variables</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intention to Use</td>
<td>Innovativeness</td>
</tr>
<tr>
<td>Attitudes</td>
<td>NS</td>
</tr>
<tr>
<td>Intention to use</td>
<td>0.61$^a$</td>
</tr>
<tr>
<td>Innovativeness</td>
<td>NS</td>
</tr>
<tr>
<td>Threat</td>
<td></td>
</tr>
<tr>
<td>Challenge</td>
<td></td>
</tr>
</tbody>
</table>

Abbreviation: NS, not significant.

$^a$Significant at the .001 level (two tailed).
IS THERE A CORRELATION BETWEEN THE STUDENTS’ COMPUTERS EXPERIENCE, ACCESS, AND COMPUTER USE FREQUENCY AND THEIR ATTITUDES TO COMPUTER USE, AND IS THERE A DIFFERENCE BETWEEN STUDENTS WHO UNDERWENT A COMPUTER COURSE IN THE PAST AND THOSE WHO DID NOT?

No differences between those who had taken a computer course in the past and those who had not were found on any of the research indices.

Students with more than 4 years of experience with computers had a more positive attitude (mean [SD], 3.69 [0.58]) than did students with less than 4 years of experience (mean [SD], 2.75 [0.62]; $t_{56} = -5.26, P < .001$).

Students with home access to a computer had more positive attitudes (mean [SD], 3.21 [0.74]) than did those who do not have access (mean [SD], 2.79 [0.70]; $t_{57} = 2.24, P < .05$).

There was a positive correlation between students’ attitudes and frequency of computer use ($r = 0.54, P < .001$).

IS THERE A CORRELATION BETWEEN THE STUDENTS’ SENSE OF THREAT IN USING COMPUTERS AND THEIR ATTITUDES?

A significant, negative correlation was found between a sense of threat and attitude to computer use ($r = -0.76, P < .001$). Namely, the greater the students’ perception of threat was, the more negative were their attitudes to computer use.

IS THERE A CORRELATION BETWEEN THE STUDENTS’ SENSE OF CHALLENGE IN USING COMPUTERS AND THEIR ATTITUDES?

A significant, positive correlation was found between a perception of challenge and attitude to computer use ($r = 0.58, P < .001$). Specifically, the greater the students’ perception of challenge was, the more positive were their attitudes to computer use.

Research Model

We examined the extent to which threat and challenge affect behavior intentions, mediated by attitudes, self-efficacy, and innovativeness (Figure 1).

The $\chi^2$ goodness-of-fit index presented an excellent fit for the data ($\chi^2 = 4.32; P = .74$; Normed Fit Index = 0.98; root mean square error of approximation = 0.00). The statistically significant path coefficients are provided as standardized estimates in Figure 1. Threat was found to negatively predict attitudes, meaning that the more a person feels threatened by information technology, the less favorable his/her attitudes toward using computers in a nursing environment would be. Threat also negatively predicted self-efficacy. The greater the threat people felt, the less confident they felt in dealing with problems in day-to-day practices. Challenge positively predicted self-efficacy, meaning that the more challenged people felt, the more they felt they could cope with these challenges. Of all the mediating variables (attitudes toward use of computers in the nursing profession, self-efficacy, and innovativeness), only innovativeness was found to predict behavior intentions. The higher the innovation was, the more likely they were to want to work with computers. The paths leading from threat and challenge through self-efficacy and attitudes did not predict behavior intentions.

DISCUSSION

Four variables that are linked to and affect nursing students’ attitude to computer use were found: self-efficacy, a sense of challenge, innovativeness, and previous experience with computers.

Self-efficacy

This study has shown that there is a significant connection between the two variables nurses’ attitudes toward computers and students’ feeling of self-efficacy. Several researchers in the world have investigated this subject and found positive connections. It is important for us, educators in nursing, to train a new generation of students who have high self-esteem/self-efficacy, which could contribute greatly to the advancement of the nursing profession, both technologically and in other ways. Graduates of such quality, who work in various health centers, would make their contribution directly there and to the profession in general.

Sense of Challenge and and Sense of Threat in Using a Computer

The variables threat and challenge regarding the use of computers were found to have a significant relationship with attitudes toward computers, as has been shown in previous studies. Our mission as nursing educators is to increase the sense of challenge in using information technology and computers and to reduce fears and concerns among nursing students. Structured and systemic work with nursing students to increase and strengthen the sense of challenge and to reduce the sense of threat can contribute greatly to the quality of the new nurse.
Innovativeness

A significant link was found between the student’s innovativeness and the intention to use a computer; that is, a student who is interested in technological innovations would exhibit higher intention to use a computer anywhere, including in a hospital. The interviewed students are at the beginning of their journey and have yet to be exposed to clinical practice and thus do not know enough about using informatics in a hospital. Therefore, it is difficult to find a significant relationship between their positive attitudes to using a computer and their intention to actually use one within the framework of hospital work.

Previous Experience With Computers

The results show the significant connection between the two variables nurses’ attitudes toward computers and the use of computers. It is clear that we, educators in the nursing profession, must invest time and effort to expose students to the many uses of information technology and computing, as well as its different capabilities and benefits, all to prepare the students to integrate and handle the “reality shock” when they become professional nurses. This relationship was investigated in the past, and these authors reinforce it and also recommend investing in improving the information technology and computer competencies among the nursing students.

CONCLUSIONS

In summary, this research is very important in various aspects: educational, qualitative, economic, and managerial.

From a nursing educational aspect is an understanding of the human factor is fundamentally important. Knowledge and experience, high sense of self-efficacy, and high innovation challenge can contribute greatly to students’ positive attitudes toward working with computers, expose them to the world of technology and improve their computer competencies, and help in their integration in healthcare centers.

There is a great need to integrate informatics into the nursing curriculum, as was also recommended by Hwang and Park, to improve nurses’ competencies.

It is clear that these conclusions, or rather benefits, have an impact on qualitative, economic, and managerial aspects.

A unique curriculum for students will be constructed, based on the findings of the current study. Later on, additional research is planned to monitor, improve, and streamline the process of nursing education and prepare the graduates for successful integration in healthcare practice.

Acknowledgments

We are grateful to the nursing students who participated in this study.

REFERENCES

20. Wu YT, Tsai CC. University students’ Internet attitudes and Internet self-efficacy: a study at three universities in Taiwan. Cyberpsychol Behav. 2006;9(4):441-450.


