

# Nursing Informatics Competencies of Graduate Nurse Educator Students: Descriptive Study

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**Abstract.** The advancement of technology and Artificial Intelligence applied health information systems demand high informatics competencies from nurses. To prepare nursing students to meet this demand, informatics courses are designed to increase informatics competencies. We offered an online informatics course to graduate students in a Nurse Educator program and assessed their informatics competency, including subdomains. Survey data were collected between Fall 2020 and Fall 2022 using an online Self-Assessment of Informatics Competency Scale for Health Professionals. We analyzed 109 responses and found that students were competent in overall informatics competency and the subdomains of “basic computer skills” and “applied computer skills (clinical informatics).” They were proficient in the ‘role’ subdomain. However, students reported less competency in managing data and incorporating standard terminology into practice. These findings provide detailed insights of the current nursing students’ informatics competencies and can guide informatics faculty in improving their courses.

**Keywords.** Informatics, Informatics competency, Online education, Online learning

## 1. Introduction

The rapid advancement of digital technology has led to the development of sophisticated health information systems[1, 2]. The recent flux of Artificial Intelligence (AI) revolutionizes many aspects of healthcare and changes the landscape of patient care[3]. AI technology is predicted to revamp clinical care, education, policy, and research in nursing[4, 5]. Modern nurses must be competent and comfortable using and managing these technologies and systems to provide safety and quality care because they often use informatics and technology to make critical decisions for patient care. Nurses’ informatics competency has become increasingly important in healthcare[6-8]. In 2021, the American Association of Colleges of Nursing (AACN) promoted informatics and healthcare technology as an essential component of professional nursing education[9].

In order to develop adequate informatics competency, nursing students require a well-structured informatics course, and iterative course improvement is inevitable.

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Establishing a baseline of informatics competencies is necessary to plan for course improvements. In 2017, an online graduate informatics course was developed for the Nurse Educator (NE) program at a university in North Carolina and has undergone improvements based on students' feedback since then. Despite positive feedback from students, there are concerns about whether the course effectively equips them with the necessary nursing informatics competencies.

The aim of this descriptive study was to assess nursing informatics competencies in an online graduate informatics course. The study had two research questions: (1) What are the Informatics Competency Scale scores? and (2) What recommendations will strengthen the informatics course and informatics-related content? Descriptive statistical analysis was conducted on data collected utilizing the online survey instrument, 'Self-Assessment of Informatics Competency Scale for Health Professionals (SICS)' [10], designed to measure health professionals' informatics competencies.

## 2. Methods

This study used a descriptive study design and obtained an exemption (No. 18-0102) from the University's Internal Review Board.

*2.1 Study setting:* The informatics course in the NE program is a 7-week course delivered through an Online Accelerated Program format and utilizes the Canvas platform, a cloud-based e-learning management system. It comprises seven modules, five interactive discussion forums that encourage collaboration and knowledge sharing, two exams that test students' understanding of the informatics material, and two written paper assignments that allow students to demonstrate their critical thinking and analytical skills. At the end of the 7-week, students were required to submit anonymous SICS, and each student provided consent for the use of their data in research.

*2.2 Study sample:* SICS data were completed by 109 nursing students enrolled in the online Health-IT course of the NE program between Fall 2020 and Fall 2022.

*2.3 Study instrument:* The SICS, Self-Assessment of Informatics Competency Scale consists of 18 items that use a 5-point Likert scale to assess three domains of informatics competency: basic computer skills, role, and applied computer skills (clinical informatics). Each item is scored on a scale of 1 to 5. The majority of the items on the SICS are relevant to healthcare professionals across various fields or specialties. The SICS has strong reliability, with a Cronbach's alpha of 0.93 [10].

*2.4 Data analysis:* IBM SPSS version 25 (IBM, Armonk, NY, USA) was used to perform statistical analyses. Students' informatics competencies and characteristics were summarized using descriptive statistics (means and SDs).

## 3. Results

The total number of completed surveys analyzed was 109 (N=109). Table 1 shows the characteristics of the students.

**Table 1.** Characteristics of students (N=109)

Variable	Frequency (%)	Variable	Frequency (%)
<b>Gender</b>		<b>Nursing Experience</b>	
Female	102 (93.6%)	Less than 2 years	3 (2.8%)
Male	7 (6.4%)	2-5 years	18 (16.5%)
		6-10 years	37 (33.9%)
		More than 10 years	50 (45.9%)
<b>Race/Ethnicity</b>		<b>Frequency of computer use</b>	
Asian/Pacific Islander	5 (4.6%)	Several times per day	
Black, not Hispanic	15 (13.8%)	Once per day	99 (90.8%)
Hispanic/Latino	3 (2.8%)	Several times per week	3 (2.8%)
White, not Hispanic	81 (74.3%)	Several times per month	7 (6.4%)
Mixed/ Other	5 (4.6%)		0 (0%)
<b>Age range (yrs)</b>		<b>Computer experience</b>	
20-29	24 (22%)	In the last 6 months	6 (5.5%)
30-39	38 (34.9%)	In the past 2 years	2 (1.8%)
40-49	31 (28.4%)	More than 2 years	101 (92.7%)
50 or older	15 (13.8%)		

**3.1 Informatics Competency:** Overall, the students rated their informatics competencies between competent and proficient ( $3.78 \pm 0.86$ ). The mean of the subdomain, role, was rated highest ( $4.33 \pm 0.73$ ), followed by basic skills domain ( $3.94 \pm 0.57$ ). The subdomain, applied computer skills (clinical informatics), was rated lowest ( $3.64 \pm 1.21$ ). Table 2 shows the SICS's mean and Standard Deviation (SD) scores.

**3.2 Basic Computer Skills:** The students reported that “basic technology skills” and “use of e-mail” as above proficient ( $4.43 \pm 0.66$  and  $4.56 \pm 0.59$  respectively). The score of “conduct on-line literature searches” was competent ( $3.89 \pm 0.69$ ) and “use applications to manage aggregated data” was some what competent ( $2.91 \pm 1.03$ ). A Spearman’s rho indicated that the competency of managing aggregated data had a strong positive statistically significant correlation with the basic computer skill competencies ( $r=0.815$ ,  $p < 0.001$ ) and a significant moderate correlation with the role ( $r=0.284$ ,  $p < 0.003$ ) and applied computer skills (clinical informatics) ( $r=0.442$ ,  $p < 0.001$ ).

**3.3 Role:** The students rated that they were proficient in recognizing importance of computer as a tool and value of clinician involvement in developing systems in health care ( $4.33 \pm 0.73$ ).

**3.4 Applied Computer Skills (Clinical Informatics):** Among the 12 items, only the item of the “use application to document patient care” was rated as proficient ( $4.22 \pm 0.62$ ). In contrast, the item of “incorporate structured languages into practice” was rated lowest ( $2.18 \pm 1.03$ ), followed by the item of “extract data from clinical data sets” ( $2.57 \pm 1.11$ ). The rest items fell in ranges from competent to proficient ( $3.40 \pm 0.90 - 3.92 \pm 1.03$ ).

**Table 2.** Self-Assessment of Informatics Competency Scale for Health Professionals (SICS)

		Mean (SD)	
<b>Basic Computer Skills</b>	3.94±0.57	<b>Role</b>	4.33±0.73
<b>SICS Total</b>		<b>Applied Computer Skills (Clinical Informatics)</b>	3.64±1.21
			3.78±0.86

1 = not competent, 2 = somewhat competent, 3 = competent, 4 = proficient, 5 = expert

Gender was the only variable showing associations with the SICS total, overall nursing informatics competency. The *t*-value indicates that male students showed a significant higher score in SICS total as well as the subdomain of applied computer skills (clinical informatics) in Table 3.

**Table 3.** Comparison of mean scores by gender (N=109)

Subdomain	Male (n=7)	Female (n=102)	<i>t</i>	<i>p</i> value
Basic Computer Skills (4 items)	16.43±1.81	15.73±2.33	0.772	0.514
Role (2 items)	8.71±2.21	8.65±1.41	1.359	0.246
Applied Computer Skills: Clinical Informatics (12 items)	58.00±30.97	42.63±12.38	8.794	0.004**
Total (18 items)	83.14±27.92	67.02±13.95	4.144	0.044*

\*\* *p* is significant at the 0.01 level (2-tailed) and \**p* is significant at 0.05 level (2 tailed)

#### 4. Discussion

Graduate students in the NE program were generally competent in informatics. The results of the basic computer skills subdomain show that they were highly competent in basic computer skills. It implies that they are competent in basic technology skills ( $4.43 \pm 0.66$ ) and using email ( $4.56 \pm 0.59$ ). This may be due to their frequent use of computers and duration of using computers. These findings were similar with previous studies [8, 11, 12]. The score of “conduct on-line literature searches” indicates that students’ high competent ( $3.89 \pm 0.69$ ) as it is a part of their schoolwork. In contrast, the students were less competent using applications to manage aggregated data ( $2.91 \pm 1.03$ ). This suggests that the course should include the contents of data manage software such as excel, databases, statistical software to enhance the students’ basic computer skills. Since it is positively correlated with basic computer skills, role, and applied computer skills (clinical informatics), enhancing competency of managing aggregated data could enhance overall informatics competency.

Students are proficient in recognizing their roles. It could be due to 79.8% of students indicating they have more than 6 years of nursing experience. They are competent in applied computer skills (clinical informatics) subdomain. They especially show proficient in using application to document patient care. This may be due to the fact that EHR record is commonly used in hospital setting. Interestingly, they show less competent in incorporating structured languages into practice and extracting data from clinical data sets. This suggests that the course should include the contents of standard medical and nursing terminologies and data mining from clinical data warehouses or publicly available federal databases.

The generalizability of the study findings is limited due to the narrow scope of the data collection. The study was based on a single program within one university located in North Carolina, with a sample size of 109 students. The study sample was also predominantly composed of female students (93.6%) and White, non-Hispanic students (74.3%). Additionally, the study's measurement of informatics competencies relied solely on using the SICS instrument, and the course itself was offered over 7 weeks. As such, different measures or longer duration for the course may yield different results.

## 6. Conclusion

We successfully measured and analyzed nursing informatics competencies of graduate students in the NE program at the study university. Students reported that they are competent in overall informatics competency after taking an online informatics course. This implies that the informatics course developed for students in the NE program are delivering nursing informatics knowledge successfully. However, we also found areas requiring further development of informatics competencies. These areas are, “use applications to manage aggregated data,” “extract data from clinical data sets,” and “incorporate structured languages into practice”. Improvements in these competencies are important because of the growing reliance on AI applications in healthcare[3] that nurses need to master when managing and integrating accumulated data and in decision making[13]. Finally, studies recommend early adoption of AI content in the nursing curriculum so students can be prepared well before graduation[3-5, 14]. Informatics faculty can incorporate AI content in informatics courses to improve informatics competencies more effectively and facilitate students’ uses of AI application in practice.

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