Teaching Psychomotor Skills to Beginning Nursing Students Using a Web-Enhanced Approach: A Quasi-Experimental Study

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Abstract

To begin to address the problem of psychomotor skills deficiencies observed in many new graduate nurses, a skills laboratory course was developed using a web-enhanced approach. In this quasi-experimental study, the control group attended weekly lectures, observed skill demonstrations by faculty, practiced skills, and were evaluated on skill performance. The experimental group learned course content using a web-enhanced approach. This allowed students to learn course material outside of class at times convenient for them, thus they had more time during class to perfect psychomotor skills. The experimental group performed better on the final cognitive examination. Students in the traditional sections were more satisfied with the course, however. It was concluded that a web-enhanced approach for teaching psychomotor skills can provide a valid alternative to traditional skills laboratory formats.

KEYWORDS: psychomotor skills, web-enhanced, cognitive knowledge, skills acquisition, satisfaction
There is growing concern about newly-graduated registered nurses’ skill acquisition and their ability to transfer skills to the workplace (Gerrish, 2000; Heslop, McIntyre, & Ives, 2001; Neary, 1997; Packer, 1994; Stevenson, 1996). This may be due, in part, to inconsistent methods for teaching psychomotor skills in nursing programs and inconsistent expectations by students, faculty, and nursing staff regarding which skills are essential for practice and how to best develop these skills. More importantly, new graduates entering the workplace may indeed be unable to perform many essential nursing skills (Lofmark, Smide, & Wikblad, 2006; Myrick, 1991; Santucci, 2004).

Internationally, both students and educators have expressed concern about the inadequacy of skill development in nursing programs (Heslop et al., 2001; Holloway, 1999; Spitzer & Perrenoud, 2006). To add to this problem, few recent studies have been conducted to identify essential skills for new graduate nurses that could ensure adequate preparation for the first year of clinical practice (Boxer & Kluge, 2000). In light of the concern regarding skill acquisition in nursing programs and the need for new graduates with adequate psychomotor skill abilities, this study was undertaken to determine the influence of two instructional approaches on psychomotor skill acquisition.

BACKGROUND

In the traditional nursing skills classroom, the instructor lectures about theory and rationale for particular skills. Following an explanation of related theory, a skill is demonstrated (by faculty or instructional media) and students then practice the skill with feedback from faculty (Jeffries, 2000; Melby et al., 1997). After practicing the skill, each student is required to perform a return-demonstration to a designated level of competency (Keegan-Ferretti, 1991; Paulfrey, 1986). If the skill is demonstrated at an acceptable level of proficiency, the student is allowed to perform the procedure in the clinical area and begin learning a new skill.

With the advent of computer-assisted instruction (CAI), CD-ROM, and web technologies, nursing skills are being taught using web-enhanced formats. These formats may replace the need for in-class lectures (Salyers, 2005), since the ability of web-enhanced courses to supplement or even replace more traditional face-to-face instructional methods has been documented (Kearns, Shoafl, & Summey, 2004; Leasure, Davis, & Thievon, 2000; Salyers; Wheeler & Jarboe, 2001). More importantly, many researchers have concluded that there are no differences in learning outcomes for students being taught courses with a web-enhanced format (Halstead & Coudret, 2000; Kearns et al.; Rose, Frisby, Hamlin,
& Jones, 2000; Salyers). With web-enhanced formats, less time might be utilized for lecture, and more time provided for faculty demonstration of skills and student practice.

There is little nursing literature regarding the best method for teaching psychomotor nursing skills to students (Baldwin, Hill, & Hanson, 1991; Gomez & Gomez, 1987). Repeated literature searches revealed little or no investigation into the development of psychomotor skills or their retention (Knight, 1998). Many studies reported no significant differences in student cognitive or psychomotor ability when multiple teaching modalities were incorporated (Baldwin et al.; Hanson, 1991; Kinney, Keskula, & Perry, 1997; Leasure et al., 2000; Murray & Higgins, 1996; Powell, Canterbury, & McCoy, 1998; Woo & Kimmick, 2000; Yucha & Princen, 2000). Although traditional and web-enhanced formats are being utilized nationally and globally to teach theory courses, more information is needed about how these formats might be used to enhance psychomotor skill development in nursing students.

At the university where the study was conducted, skills were taught using a traditional classroom format. Students came to the skills laboratory for one, 3-hour session per week. During a regularly-scheduled class session, faculty spent approximately 1 to 2 hours lecturing about content specific to the skill being learned. Because faculty lectured for as much as one-half of the class session, little time was available for demonstration, practice, and return-demonstrations. This was problematic. Students frequently indicated that they did not feel adequately prepared because of the lack of practice time. Further, clinical faculty often stated that students were weak in their ability to perform basic psychomotor skills.

PURPOSE

The purpose of this quasi-experimental study was to determine the effects of two instructional approaches, web-enhanced and traditional, on cognitive knowledge acquisition, psychomotor skill performance, and satisfaction with a psychomotor skills course. The research objectives were to (a) identify which was most effective in assisting sophomore nursing students to learn designated skills and retain the ability to perform the skills over time, and (b) determine whether web-enhanced instruction could correct the problem of nursing students who are unprepared to perform basic psychomotor skills due to lack of practice and guided-feedback by laboratory faculty. Specifically, the research questions were:
1. Will nursing students receiving web-enhanced instruction perform better on a final comprehensive cognitive examination than students receiving traditional instruction?

2. Will nursing students receiving web-enhanced instruction perform better on a final psychomotor skills examination than students receiving traditional instruction?

3. Will nursing students receiving web-enhanced instruction indicate a greater level of satisfaction with the course than students receiving traditional instruction?

**METHODS**

**Design**

Following approval from the university’s Institutional Review Board, the quasi-experimental study was undertaken. Two approaches for teaching a nursing skills laboratory were compared. The control group learned skills using a traditional lecture/demonstration approach, whereas the experimental group used a web-enhanced approach to learn skills. Three dependent variables, i.e., scores on a final cognitive comprehensive examination, scores on a final psychomotor skills examination, and satisfaction with the course, were compared to answer the three research questions. Although participation in the research study was voluntary, all students were required to attend one of the skills laboratory sections because the course was required. Two faculty who had previously taught the course participated in the study. Each taught a section of traditional students and a section of web-enhanced students, to help control for faculty bias.

**Sample**

A convenience sample of 36 students enrolled in a beginning nursing skills laboratory course participated in the study. The control group of 14 students received traditional instruction (2 class sections, each with 7 students). The experimental group of 22 students (2 class sections with 12 students in one and 10 in the other) received web-enhanced instruction. Approximately 40 students were admitted each semester to the nursing program and the small class size accounts for the small sample size. Random assignment of subjects to experimental and control groups was not possible because students could change sections due to schedule conflicts, instructor preferences, etc. Only students with computers that met the minimum specifications for the software used for the study could register for the experimental sections.
Demographic information was not collected from the sample. However, data collected the previous year about nursing majors included: average age is 30 years, with 12% males and 88% women. Approximately one-third self-identify as African-American, Latino, Asian, or Native American.

**Procedures for Course Content Delivery**

The control group proceeded through the course in a prescribed, sequenced fashion. During a 3-hour session each week, students received a lecture on relevant skill content, observed the instructor perform the skill, and then practiced the skill with limited guided feedback from the faculty. Lectures were supplemented by assigned reading and other assignments to be completed outside of class. Students were evaluated on their performance of each skill according to a checklist. If the student demonstrated mastery, s/he was “checked-off” on that particular skill.

The experimental group was also required to attend a 3-hour session each week to observe the instructor demonstrate psychomotor skills, and then practice and refine skills with increased opportunity for feedback. At periods throughout the semester, students were evaluated on their skill performance.

Course content was delivered to the experimental group with software developed by CONVENE™. This software was selected because, at the time, the University was not utilizing another platform for web-enhanced or online courses. Using the software and Internet access, students could access the course syllabus, lecture materials, and other support materials asynchronously.

The software package integrated all course materials into modules designed specifically for these students. The modules were supplemented by assigned reading material and other out-of-class assignments that included CAI, interactive videos, and other instructional media. Students in the experimental group could access course content at their convenience. The content was the same as that presented to the control group. Thus, the lecture component was entirely removed from the course and students were required to learn the material individually outside of class using a web-enhanced format. Students were required to complete 13 modules of course material in a sequenced fashion, but at their own pace.

**Procedures for Cognitive Examinations**

At four points during the semester, the control group completed cognitive unit exams related to the skills they learned. Each exam was composed of 25 to 30
multiple-choice questions. On the last day of class, students took a 60-item comprehensive final cognitive examination, composed of questions from each unit exam to assess retention of course content.

The experimental group completed an in-class quiz after each unit module. Each quiz was composed of approximately 10 multiple-choice questions. Questions were taken from the four unit exams administered to the control group. Quizzes #1-3 (30 questions total) were equivalent to the Unit 1 control group exam; quizzes #4-6 (30 questions total) were equivalent to the control group Unit 2, and so forth. Scores on the quizzes were collected as part of regular course grading. On the last day of class, the experimental group took the same 60-item comprehensive final cognitive examination as the control group.

**Procedures for Psychomotor Examinations**

During final examination week, students were re-evaluated on their skill performance. They were told in advance that a return-demonstration of any skill learned during the course could be required. Nasopharyngeal suctioning, catheter insertion, and wet-to-dry dressing changes were selected for testing because they required the most application of theory and demonstration of psychomotor ability.

Each student had 15 minutes to complete 2 of the 3 skills; the skills were selected randomly by each student. A panel of 3 faculty experts evaluated the skill performance according to a checklist of predetermined critical elements. Interrater reliability of skills evaluation was not established due to time constraints. After students had completed the skills evaluation, they were given feedback about their performance so they could correct any deficiencies.

**Procedures for Measuring Satisfaction**

One week before the last class session, both groups completed a survey regarding their satisfaction with the course. One item, *Overall Satisfaction with the Course*, was used to measure satisfaction with the teaching method. This item was obtained from a standardized university course evaluation tool.

**Measures**

Measures of the three dependent variables were scores on a sixty-item multiple-choice comprehensive cognitive final exam, scores assigned to the performance of 2 skills during a final psychomotor skills evaluation, and, scores regarding overall satisfaction with the course. All exams, skills checklists, critical
element scoring sheets and course evaluations were those previously used in the course.

Issues of validity for each of the dependent variables were informally assessed. Non-standardized, multiple-choice exams were composed of items from quizzes and exams used in previous semesters. To determine validity of the final cognitive comprehensive exam, questions were presented to a panel of faculty experts for review and were deemed to measure knowledge related to the skills being taught and evaluated. Similarly, the critical elements checklists were presented to the same panel were approved as essential elements that must be accomplished to successfully perform the skill.

RESULTS

To answer the three research questions, group mean scores for each of the dependent variables were analyzed using analysis of variance (ANOVA) techniques. Results of the analysis are presented in Table 1. The maximum score on the cognitive and psychomotor tests was 100, and on the satisfaction item, 5.

For each research question, a test of differences between sections within a treatment, and a test of differences between treatments, is reported. In addition, when F-tests were significant, $\eta^2$ is also reported as an indicator of effect size, the magnitude or strength of the relationship between variables. For purposes of this study, $\eta^2$ at or above .01 was considered to be a small effect, scores at or above .06 were considered a medium effect, and scores at or above .14 a large effect (Cohen, 1988).

Research Question One

Will nursing students receiving web-enhanced instruction perform better on a final comprehensive cognitive examination than students receiving traditional instruction? The experimental group (M=92.68; SD=5.93) performed significantly better on the comprehensive cognitive final examination than the control group (M= 82.21, SD=7.05).

When scores within the control group on the final comprehensive cognitive exam were compared, F observed was .00 (p=ns). For the experimental group, F observed was 14.10 (p<.01) indicating a significant difference between experimental sections. Therefore, the two sections of the experimental group were treated as two different groups (experimental group 1 and experimental group 2) and were compared separately with scores generated by the control group. This F
observed was 18.99 (p<.05). A Scheffé test was conducted using a significance level of .05 to determine if there were significant differences among the three groups. There were significant differences among the three groups. This suggested that both experimental sections were significantly different from the control group, and they were significantly different from one another. ANOVA yielded an eta² equal to .54, which indicated a large practical difference between groups within a treatment in favor of the experimental treatment.

Table 1

ANOVA for Final Cognitive and Psychomotor Exams, and Satisfaction

<table>
<thead>
<tr>
<th>Variable</th>
<th>M (SD)</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control (n=14)</td>
<td>Experimental (n=22)</td>
<td></td>
</tr>
<tr>
<td>Final Cognitive Exam</td>
<td>82.21(7.05)</td>
<td>92.68(5.93)</td>
</tr>
<tr>
<td>Final Psychomotor Exam</td>
<td>87.93(7.10)</td>
<td>90.91(6.85)</td>
</tr>
<tr>
<td>Satisfaction</td>
<td>3.5(0.65)</td>
<td>2.96(0.84)</td>
</tr>
</tbody>
</table>

* α = .05
** α = .01

Finally, after determining that there were significant differences between experimental 1, experimental 2, and the control group, experimental 1 and 2 were treated as the same group and between treatment scores were compared. A comparison of scores between treatments yielded F observed of 23.01 (p<.01). Scores indicated that differences between mean scores for the control and experimental groups were significant. Between treatment scores yielded an effect size equal to .40, which indicated more than a large difference between treatments, in favor of the experimental treatment.

Research Question Two

Will nursing students receiving web-enhanced instruction perform better on the final psychomotor skills examination than students receiving traditional instruction? The experimental group (M=90.91, SD=6.85) performed better on the final psychomotor skills examination than the control group (M=87.93, SD=7.10), although not significantly better.
When scores within the control group on the final psychomotor skills exam were compared, F observed was .49 (p=ns), while F observed for the experimental group was .00 (p=ns). Thus, there were no significant differences between scores within a treatment. When comparing scores between treatments, F observed was 1.58 (p=ns) and therefore, eta² was not reported.

**Research Question Three**

*Will nursing students receiving web-enhanced instruction indicate a greater level of satisfaction with the course than students receiving traditional instruction?* Satisfaction was measured using a 5-point Likert scale, where 1 was *low satisfaction* and 5 was *high satisfaction*. The experimental group’s mean score was 2.96 (SD=.84), indicating that students were somewhat dissatisfied to neutral about their overall satisfaction with the course. In contrast, the mean score for the control group was 3.50 (SD=.65), indicating that students were somewhat satisfied with the course.

When scores for overall satisfaction with the course were compared within the control group, F observed was .16 (p=ns) while F observed for the experimental group was 1.73 (p=ns). In both groups, there were no significant differences within sections of a treatment. When scores between treatments were compared, F observed was 4.23 (p<.05). Between treatment scores yielded an effect size equal to .11, which indicated a moderate difference between treatments in favor of the control (traditional) treatment.

**Correlational Analysis**

To determine if significant relationships existed between the dependent variables, correlation coefficients were calculated with significance set at the .05 level. There were small and statistically insignificant correlations between all variables, indicating that the three dependent variables were independent of one another.

**DISCUSSION**

The experimental group scored significantly (p<.01) higher on the final comprehensive cognitive exam than did students in the control group. The experimental group could complete the course more quickly than the control group, and this may have provided more time to study for the final cognitive exam. While no data were collected to substantiate this explanation, the two
faculty teaching the course indicated that several students in the web-enhanced sections did complete the modules more quickly than students in the traditional sections. Perhaps learning the material in smaller units (modules) facilitated a better understanding of course content and provided for greater retention of the material for students in the web-enhanced group. Finally, the experimental group received course content and information online and this may have motivated them to study more diligently because of the realization that they could not rely on lectures for learning the material.

Not surprising, the experimental group had more class time to observe skill demonstrations, practice the skills, and receive guided feedback because no time was spent listening to lectures. While the web-enhanced sections had nearly 36 hours to learn psychomotor skills, students in traditional sections had approximately 18 hours to learn the same skills. Although students in the web-enhanced sections were provided with more time to learn the skills and did perform better on the final psychomotor skills exam, they did not perform significantly better. While there are no clear explanations for these results, faculty teaching the course suggested that all students may have been distracted and/or uncomfortable with demonstrating skills to 3 faculty experts, since this had not occurred during regularly-scheduled check-offs.

There are a few explanations for why the control group was significantly more satisfied with the course. First, the experimental group experienced many problems with the technology and cited software and hardware incompatibilities. Although students were told prior to registering for web-enhanced sections of the course that they must be able to deal with software problems and function in Windows-based environments, many did not possess the prerequisite knowledge to function in the web-enhanced course. Second, there were problems with downloading PowerPoint® files from the electronic bulletin board. To add to the difficulty, technical support for CONVENE™ was not sufficient to meet students’ needs.

**Limitations & Research Recommendations**

Although results from this study are encouraging regarding the use of a web-enhanced format to teach psychomotor skills to nursing students, there are some study limitations. Because of the small convenience sample, results cannot be generalized. Efforts should be made to measure similar variables and consider time to complete the learning modules used by students in the experimental group. Demographic factors, such as previous experience with nursing psychomotor skills, previous experience with technology, and preferred method
of learning, should be compared for students receiving both traditional and web-enhanced instruction. Finally, the instruments used may not have been sensitive enough to identify differences between groups. Standardized instruments might be a more powerful means of determining differences. Further, it is recommended that a more sensitive tool to measure satisfaction with the course be developed. Finally, newer technologies have emerged since this study was conducted, and studies are required to assess their advantages for teaching psychomotor skills.

**CONCLUSION**

Results from this study provide information about a practical solution to the problem of students lacking sufficient time to acquire psychomotor skills. Technology is an excellent means for creating learning environments that appeal to students from diverse educational, developmental, and economic backgrounds. More importantly, the problem of students who cannot perform essential psychomotor skills upon graduation may be improved by using the web-enhanced feature of this course.

Students who took the course using a web-enhanced format did perform better than students in the traditional sections on the final cognitive examination. Imagine the possibilities if technological problems could be eliminated so that students could learn psychomotor skills at a higher level of proficiency and be more satisfied with the learning experience that web-enhanced classrooms might provide. As technology becomes more common in the classroom, it has the potential for providing invaluable learning environments that may exceed traditional nursing skills laboratories.

**REFERENCES**


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