The Impact of Blended Teaching on Knowledge, Satisfaction, and Self-Directed Learning in Nursing Undergraduates: A Randomized, Controlled Trial

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doi: 10.5480/10-459

Abstract

AIM This study aimed to assess the effectiveness of a blended-teaching intervention using Internet-based tutorials coupled with traditional lectures in an introduction to research undergraduate nursing course. Effects of the intervention were compared with conventional, face-to-face classroom teaching on three outcomes: knowledge, satisfaction, and self-learning readiness.

METHOD A two-group, randomized, controlled design was used, involving 112 participants. Descriptive statistics and analysis of covariance (ANCOVA) were performed.

RESULTS The teaching method was found to have no direct impact on knowledge acquisition, satisfaction, and self-learning readiness. However, motivation and teaching method had an interaction effect on knowledge acquisition by students. Among less motivated students, those in the intervention group performed better than those who received traditional training.

CONCLUSION These findings suggest that this blended-teaching method could better suit some students, depending on their degree of motivation and level of self-directed learning readiness.

Recent work in the educational sciences and advances in information and communications technology (ICT) have contributed to the transformation of learning environments. Although computer-based learning in nursing dates back to the 1960s (Lewis, Davies, Jenkins, & Tait, 2001), the advent of the Internet in the 1990s led to a greater use of online education for health professionals (Cook et al., 2008). The potential of the Internet as an instructional tool for the health professions was rapidly recognized (Curran, Lockyer, Sargeant, & Fleet, 2006; Friedman, 1996; Lam-Antoniades, Ratnapalan, & Tait, 2009; Wutoh, Boren, & Balas, 2004).

E-learning has many advantages, including increased accessibility to educational materials (at a time and place chosen by learners), personalized instruction (to tailor education to individual learners' needs), and standardization of content (Cook et al., 2008; Ruiz, Mintzer, & Leipzig, 2006). This study aimed to assess the effectiveness of a blended learning strategy in an introductory research course for nursing undergraduates. We sought to compare the effects of an intervention combining self-directed, Internet-based learning and conventional, face-to-face classroom teaching on three outcomes: students' knowledge, satisfaction, and self-directed learning.

LITERATURE REVIEW

As Internet-based learning (IBL) became increasingly popular in nursing education, concerns about its effectiveness stimulated a growing body of research. Thus, a number of nursing studies have compared the effects of computer-based learning and conventional teaching methods on knowledge acquisition (Lewis et al., 2001). A comprehensive review by Cook et al. (2008) summarized the evidence on the effectiveness of IBL in the health professions. In two systematic reviews (which included 201 studies), Cook and colleagues compared the effects of IBL to no intervention and to non-Internet interventions and found positive effects associated with IBL when compared with no intervention. Compared with non-Internet learning methods, effects were inconsistent across the studies and generally small, a finding that may be due to different learning contexts and objectives or to different methods of implementing an Internet-based course.

In a recent systematic review, Cook, Garside, Levinson, Dupras, and Montori...
Fisher et al. (2001) developed the Self-Directed Learning Readiness Scale for Nursing Education (SDLRSNE), which contains 40 items to assess the three underlying factors of SDLR in nursing students. Recently, Fisher and King (2010) reexamined the factor structure of the SDLRSNE subscales; their findings support the tool’s validity.

**METHOD**

The study employed a two-group, randomized, controlled design with participants recruited from a population of first-year nursing undergraduates at Laval University in the Province of Quebec, Canada. Students in the intervention group had blended instruction with Internet-based tutorials and in-class sessions; students in the control group had conventional, face-to-face classroom teaching. All students who registered for the mandatory course, “Introduction to the Research Process,” during the winter 2009 semester were eligible for inclusion. Approval for the study was obtained from the Ethics in Human Experimentation Committee of Laval University.

The study was based on three hypotheses: a) that students in both groups would obtain comparable examination scores, b) that level of satisfaction with the course would be similar in both groups, and c) that between the beginning and the end of the course, the level of SDLR would rise more significantly in students in the intervention group.

**Recruitment and Stratified Randomization**

Before the semester began, students were stratified according to age, gender, study program (A = initial bachelor’s in nursing, B = bachelor’s in nursing after a nursing diploma, and C = combined nursing diploma and bachelor’s in nursing), and location of prior studies (Province of Quebec versus other). Of the 131 students randomized, nine withdrew prior to the first class (seven in the control group, two in the intervention group), and three from each group changed groups and were therefore excluded from the analyses. A computerized random number generator was used to assign students to one of two groups: 65 to the intervention group (Wednesday evening class) and 66 to the control group (Thursday afternoon class). A list with students’ names and group was sent to the registration service at the Faculty of Nursing, which was responsible for providing schedule information to the students.

During the first class, information about the study was provided by the two professors who taught the course, including an explanation of the purpose and design and what participation in this study entailed. The professors then left the classroom to avoid any undue pressure to participate in the study; a research assistant remained in the classroom. Students who agreed to participate were asked to sign a consent form. Students could refuse to participate or could change groups; these students were automatically excluded from the study. A total of 116 students were eligible for inclusion (60 in the intervention group, 56 in the control group). Of these, 112 students (56 in each group) consented to participate in the study.

**Teaching Interventions**

The research course aims to introduce students to the various steps of research and to train them in critical reading of scientific articles. Course content and evaluation methods were the same for both groups.

After the first class, students in the intervention group were given access to 11 interactive, Internet-based modules for self-study. These modules were combined with five traditional classroom sessions. The online modules were adapted from similar modules used with medical students and medical residents (Cauchon, Labrecque, Baillargeon, Légaré, & Frémont, 2002). Content was adapted to suit nursing undergraduates and was based on the same material taught to the control group.

The control group was instructed using traditional methods in 13 classroom sessions. The course offered an overview of the research process, with an emphasis on nursing research. Teaching methods included PowerPoint-assisted lectures, class discussion, small-group exercises, readings, and quizzes. The evaluation methods were
identical for both groups and included four separate group projects as well as two in-class exams. Group projects were not considered in the data collection as it would not have been possible to distinguish individual contributions. To diminish the potential impact of a particular instructor’s influence, the two professors took turns teaching each group.

Data Collection
The impact of the teaching methods was measured by examining three outcomes: students’ knowledge, satisfaction, and SDLR. Knowledge was assessed by students’ scores on the midterm and final exams, which consisted of multiple-choice questions and a few open-ended questions. Exams were graded by an assistant blinded to the research project.

Student satisfaction was evaluated through a standardized satisfaction questionnaire developed by Laval University. This questionnaire uses 21 structured items to measure satisfaction, as well as one item that measures motivation (in three degrees: unmotivated, more or less motivated, and motivated) and two items identifying the student’s profile: type of curriculum (initial bachelor’s in nursing or bachelor’s in nursing after a nursing diploma) and class attendance. The 21 items measuring satisfaction were four-point Likert-type statements (1 = totally agree; 4 = totally disagree) with a fifth stating not applicable. This instrument is mandatory for the evaluation of all courses at the university. The evaluation questionnaire was distributed in the classroom and completed by students during the last class, just before the final exam.

The SDLRSNE, designed to measure SDLR in nursing students (Fisher & King, 2010; Fisher et al., 2001), was developed and validated in three stages: a comprehensive literature search, a Delphi study, and a pilot study of items on a sample of 201 undergraduate nursing students (Fisher et al.). The final scale consists of 40 items in three subscales: self-management, desire for learning, and self-control. Several studies have demonstrated the reliability and the internal consistency of the SDLRSNE across various samples (Bridges, Bierema, & Valentine, 2007; Newman, 2004; Smedley, 2007). Fisher and King found support for the factorial validity of the tool; 11 of the 40 items had to be removed, as they failed to provide a good fit with the subscales. Despite the limitations of the study, especially its small sample size, the authors recommended the use of the 40-item SDLRSNE until further research into the instrument is conducted.

Translation of the SDLRSNE
We translated this instrument into French because we planned to use it with French-speaking students. To do so, we followed the steps proposed by Vallerand (1989) for transcultural validation. A French language version of the scale had been previously developed by other researchers at Laval University. We translated this version back into English in order to identify translation errors and correct them, back into French to ensure the correspondence of the two versions, and then into French again. We conducted a pretest among students to measure the tool’s ease of comprehension and the length of time taken to complete the questionnaire.

We evaluated SDLR using the 40 items of the SDLRSNE on a five-point Likert scale, with scores representing strongly disagree, disagree, uncertain, agree, and strongly agree. Two demographic items (age, gender) completed the questionnaire. It was distributed to students in the classroom during the first and last classes.

Data Analysis
Data were analyzed by taking into account the control variables described above (students’ gender, age, academic background, location of prior studies). Descriptive analyses were carried out first. The effect of the control variables on the three outcomes was also explored. Because the level of SDLR could both influence learning outcomes and be influenced by them, an analysis of covariance (ANCOVA) was performed to measure the association between teaching strategy and postintervention SDLR (controlling for preintervention SDLR and other covariates).

On the satisfaction measure, results were compared between groups using ANCOVA. Knowledge acquisition was measured by the scores students received on two exams, and these were analyzed using repeated measures analysis of variance. All analyses were performed using the SAS statistical package (SAS Institute, 2005).

RESULTS
The 112 students (56 in each group) completed the first SDLRSNE questionnaire at the end of the first class. Final exams were completed by 52 students in the intervention group and 50 in the control group. The analyses are thus based on 102 participants. As expected, no significant differences in demographics between the two groups were found. (See Table 1.)

Instrument Properties
Both the satisfaction and SDLRSNE scales used for assessing outcomes showed high internal consistency, with Cronbach’s alphas of .83 and .94 for satisfaction and SDLR, respectively. Furthermore, the temporal stability (also known as the test–retest reliability) of the SDLRSNE was acceptable (intraclass correlation: .67).

KNOWLEDGE Students in the two groups did not differ in their global results on both exams. For the global result, however, an interaction effect was seen between the students’ level of motivation and the teaching method. Unmotivated students in the intervention group performed significantly better than unmotivated students in the control group (17.2 ± 9 vs. 14.5 ± 6, p = .01). When the two exam scores were considered separately, a significant difference was found between groups for the first exam at mid-semester — the intervention group performed significantly better than the control group — but this difference was not observed for the second exam. (See Table 2.)

Satisfaction As shown in Table 2, there was no significant difference between groups regarding course satisfaction (the control group was slightly more satisfied, but not significantly). The only variable with a significant positive effect on satisfaction
was motivation ($p = .0005$); for both groups, students who were more motivated tended to show greater satisfaction.

**SDLR** There was no difference in the SDLR score between the two groups. However, after adjusting for motivation, which was incorporated in the model as a covariate, a significant difference on the SDLR score was found postintervention (Table 3). This difference depended on the SDLR score at baseline. To explore the effect of teaching method on SDLR, students in the two groups were assigned to three categories according to their SDLR score at baseline: low, medium, and high. Among students with a low SDLR score at baseline, the control group improved significantly more than the intervention group ($3.5 \pm .3$ vs. $1.9 \pm .6, p = .01$). Among those with a medium SDLR score at baseline, those in the control group showed significantly improved SDLR scores than those in the intervention group ($3.8 \pm .2$ vs. $3 \pm .3; p = .01$). Conversely, among students with a high SDLR score at baseline, the intervention group improved significantly, compared with the control group ($4.8 \pm .2$ vs. $4.3 \pm .1; p = .02$).

**Discussion**

The results show that teaching method had no direct impact on knowledge acquisition, satisfaction, and SDLR. Thus, our two first hypotheses were confirmed. However, motivation and teaching method had an interaction effect on knowledge acquisition. Students who were less motivated in the intervention group performed better than their counterparts in the control group, and motivation was positively associated with satisfaction in both groups. These findings are consistent with the literature on motivation and learning (Schiefele, 1991). Motivation influences what people learn, but also the intensity and duration of learning (Bandura, 1991). However, Siler and VanLehn (2009) found that computer-mediated learning did not change motivation, and Sankaran and Bui (2001) found that students with similar motivation performed equally well irrespective of teaching method.
(online or class lecture). Our study suggests that less motivated students might benefit from e-learning, although we used only a single item to assess motivation.

Furthermore, contrary to our third hypothesis, the teaching method was not directly associated with students’ SDLR score. Indeed, we found that motivation influenced the relationship between teaching method and SDLR. When controlling for motivation, students with a higher SDLR score at baseline significantly improved their score in the intervention group, whereas students with a lower SDLR score at baseline significantly improved their score in the control group. These findings are consistent with the review by Jennings (2007) that concluded that SDL is not suitable for every learner.

This study presents a pragmatic evaluation of an innovative teaching strategy based on online self-learning tutorials coupled with a few in-class sessions. The results add to the knowledge of the effectiveness of different forms of e-learning for students in the health professions (Cook et al., 2008), but also provide evidence to support the use of blended teaching methods, as suggested by Ruiz et al. (2006). This study’s findings could be transferable to similar student populations, but more research is needed to evaluate the effects of a blended-teaching method on other nursing student populations.

This research also contributes to the knowledge of e-learning in the nursing curriculum by providing an example of ICT use as well as a specific method for the evaluation of an Internet-based teaching technique. This research has resulted in a French language adaptation of the SDLRSNE, which seems to be a promising tool for the assessment of learning readiness in nursing students. Given the new developments regarding this scale (Fisher & King, 2010), it would be important to test the revised version of the scale in future studies.

**LIMITATIONS**

Despite efforts to limit biases in this study, it was conducted with real teachers and students, and some biases may have influenced the results. First, students were not blinded to the intervention and, given that both groups studied at the same institution and in the same program, a possible contamination may have occurred. The e-learning modules were only accessible to the students in the intervention group who had a username and password, but it is possible that some students in the control group could have accessed it through their classmates.

Second, the classes for both groups were offered at different times of day (an afternoon class for the control group and an evening class for the intervention group). This may have affected certain aspects of this study, such as motivation, although students in the intervention group could access the Internet learning modules at any time.

Third, co-teaching could have influenced the results of the study as a co-intervention. However, this influence was the same for both study groups, and co-teaching is common for undergraduate nursing courses at our institution.

Fourth, students in the control group had to buy the course notes at the beginning of the semester, while students in the intervention group had electronic access to the course notes and were invited to print them themselves. Some students found it unfair that the intervention group did not have to buy their notes and raised this issue when the study was explained to them during the first class. Nonetheless, no difference was seen between groups on student satisfaction, which leads us to conclude that this element did not affect outcomes. The instrument used for measuring satisfaction was a generic scale used in the evaluation of all of our university’s courses. To assess satisfaction, it might have been fruitful to use instruments developed specifically for e-learning (Wang, 2003). Finally, because we based our assessment of motivation on a single item, results from this variable should be interpreted with caution. Future studies should use a validated instrument for assessing motivation because of its potential relationship with e-learning success.

**CONCLUSIONS**

The findings of this randomized, controlled study conducted in an educational setting indicate that a blended-teaching method, one combining Internet-based tutorials and in-class sessions, is comparable to traditional teaching in an introductory research course for nursing undergraduates. This study also suggests that blended-teaching better suits some students, depending on their degree of motivation and their SDLR. For faculty planning an e-learning course, these findings may be useful in choosing the best teaching method to suit students’ needs and learning styles.

**ABOUT THE AUTHORS**

Marie-Pierre Gagnon, PhD, and Johanne Gagnon, PhD, are professors at the Faculty of Nursing of Laval University and at the Quebec University Hospital Research Centre. Marie Desmartis, MA, is research assistant at the Quebec University Hospital Research Centre. At the time of the study, Merlin Njouya, MSc, was biostatistician at the Quebec University Hospital Research Centre. The authors acknowledge the contributions of Professor M. Fisher for giving permission to use the SDLR instrument she developed, and of Dr. M. Lacasse and her collaborators for access to the French language version of the SDLR instrument. We are also grateful to the colleagues and students that helped us with the translation and validation of this instrument. A special thanks to Mr. S. Turcotte, biostatistician, for his help with the data analysis. This study did not receive external funding. Marie-Pierre Gagnon holds a New Investigator Career Grant from the Canadian Institutes of Health Research (grant #200609MSH-167016-HAS-CFBA-111141). Write to Marie-Pierre. Gagnon@fsi.ulaval.ca for more information.

**KEY WORDS**

Computer-Based Learning – Nursing Education – Randomized Controlled Design – Self-Directed Learning Readiness – Satisfaction
REFERENCES
