

# Blended learning versus face-to-face learning in an undergraduate nursing health assessment course: A quasi-experimental study

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## ABSTRACT

**Background:** Blended learning, which integrates face-to-face and online instruction, is increasingly being adopted. A gap remains in the literature related to blended learning, self-efficacy, knowledge and perceptions in undergraduate nursing.

**Objectives:** To investigate outcomes of self-efficacy, knowledge and perceptions related to the implementation of a newly blended course.

**Design:** This was a quasi-experimental pre-post test design.

**Setting:** This study was conducted at an undergraduate university in Alberta, Canada.

**Participants:** A total of 217 second-year undergraduate nursing students participated and 187 participants completed all study components.

**Methods:** A convenience sampling method was used. Data were collected at the start and end of the semesters. Data were analyzed using descriptive and inferential statistics using R(3.4.3) and R-Studio(1.1.423).

**Results:** There were no significant differences in self-efficacy scores between groups or in the pre-post surveys ( $p > 0.100$ ) over time. There was no significant difference in knowledge between the blended online and face-to-face groups ( $p > 0.100$ ). For students in the blended course, perceptions of the online learning environment were positive.

**Conclusion:** Blended learning has the potential to foster innovative and flexible learning opportunities. This study supports continued use and evaluation of blended learning as a pedagogical approach.

## 1. Introduction

Blended learning (BL) allows educators to integrate elements of traditional face-to-face instruction with tailored online learning modalities (Garrison and Kanuka, 2004; Owston et al., 2013; McConville and Lane, 2006; Larson and Sung, 2009) and is broadly adopted in higher education for varied purposes, using diverse implementation strategies (Smith and Hill, 2019).

In undergraduate nursing education, BL can be used to respond to unique learner needs, such as motivation levels, learning styles, and abilities (Smith and Hill, 2019; Gagnon et al., 2013; Johnson et al., 2010). BL allows students scheduling flexibility, along with opportunities to repeat or review materials as needed (McConville and Lane,

2006; Kiviniemi, 2014; Shorey et al., 2018a), to receive immediate feedback (Salamonson and Lantz, 2005), and to participate in individualized knowledge-construction activities (Blissitt, 2016). Further, students in BL appreciate the cost savings, convenience, and ability to work at their own pace (Arving et al., 2014; Garrison and Kanuka, 2004; Crawford et al., 2013; Sherman et al., 2012; Coyne et al., 2018; Park et al., 2016; Hsu and Hsieh, 2014).

BL has potential for innovation in post-secondary settings (Garrison and Vaughan, 2008), particularly given the frequent need to balance classroom space and class size, and the drive for more flexible learning opportunities. In response to an institutional commitment to foster unique and flexible learning environments (MacEwan University, 2014), BL was used to redesign a second-year Bachelor of Science in

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Nursing (BScN) Health Assessment course, traditionally taught as a face-to-face course. The aim of this study was to evaluate the student learning experiences in the newly blended course, as compared to the traditional face-to-face course. Outcome measures under study included the impacts of BL on self-efficacy, student knowledge, and perceptions of the online learning environment.

## 2. Background

The effectiveness of BL in relation to learner performance, preference, and satisfaction is well established in the literature (Smith and Hill, 2019; Owston and York, 2018; McCutcheon et al., 2018; McCutcheon et al., 2015; Vo et al., 2017; Owston et al., 2013). In studies of learners in health professions, BL has been shown to be as or more effective than traditional face-to-face instruction, yielding similar or slightly improved results in terms of performance evaluations and appraisals (McCutcheon et al., 2015; Duque et al., 2013; Liu et al., 2016; Johnson et al., 2010; Salamonson and Lantz, 2005; Blissitt, 2016).

Review studies examining uses of BL in clinical education with health care students further point to positive effects relating to independent learning and autonomy (Coyne et al., 2018), development of clinical reasoning and reflective thinking ability (Rowe et al., 2012), and bridging of theory to clinical practice (Coyne et al., 2018; Rowe et al., 2012).

In studies of undergraduate nursing learners, BL has been shown to yield either no statistical difference or slightly higher results in achievement measures when compared to traditional face-to-face instruction (Johnson et al., 2010; Salamonson and Lantz, 2005; Blissitt, 2016; McCutcheon et al., 2015; Hsu and Hsieh, 2011; Li et al., 2019). In their randomized controlled trial of undergraduate nursing students comparing BL to online-only, McCutcheon et al. (2018) found that the BL group demonstrated a slight increase in knowledge scores, as well as a significantly higher satisfaction rating and improvement in terms of motivation and attitudes. These findings are consistent with the results of a recent meta-analysis by Li et al. (2019) of studies comparing blended to face-to-face learning in undergraduate nursing, with results showing a positive impact of BL on knowledge and student satisfaction, yet no significant difference in relation to skills development (Li et al., 2019).

The literature pertaining to BL in undergraduate nursing suggests additional benefits for learners, including increased critical thinking (Larson and Sung, 2009), metacognition and self-regulation (Hsu and Hsieh, 2011), skill or knowledge retention (Blissitt, 2016; Terry et al., 2018), and independent learning (Rigby et al., 2012).

Much of the literature on BL in higher education has focused on assessments of learner performance outcomes and satisfaction (Smith and Hill, 2019; Owston et al., 2019; Zhang and Zhu, 2017; Owston and York, 2018; Vo et al., 2017). While an increasing number of reported studies compare outcomes between BL and traditional face-to-face classrooms (Smith and Hill, 2019; Zhang and Zhu, 2017; Larson and Sung, 2009), only a small number of these comparative studies focus on undergraduate nursing education specifically. In their meta-analysis of BL in undergraduate nursing education, Li et al. (2019) identified only eight studies comparing BL to traditional face-to-face learning that met their inclusion criteria.

Self-efficacy has been identified as a key aspect of self-regulated learner motivation in the online learning environment (Shea and Bidjerano, 2010). Since self-efficacy, as an assessment of one's own capability in a given context, is known to influence learner behaviour (Bandura, 1986; Bandura, 2006), it is a helpful measure within the context of self-directed BL. Enhancing face-to-face lectures with supplemental video content has been found to improve self-efficacy (Sung et al., 2008; McConville and Lane, 2006), yet there is limited published research regarding BL interventions and effects on undergraduate nursing student self-efficacy. In two pre-post test studies on the effect of

a single BL intervention on self-efficacy in undergraduate nursing students, an increase in student self-efficacy scores were observed (Shorey et al., 2018a; Park et al., 2016). A qualitative study of student learner experience with BL in an undergraduate nursing module also identified themes relating to improved self-efficacy (Shorey et al., 2018b). Neither Shorey et al. (2018a, 2018b) nor Park et al. (2016) examined self-efficacy in relation to a full-semester blended course. The eight studies included in the meta-analysis by Li et al. (2019), examined either student knowledge alone, or knowledge in addition to skill, satisfaction, or both.

A systematic review conducted by McCutcheon et al. (2015) emphasized the lack of sufficient evidence relating to the implementation of BL in nursing education, a finding echoed by Li et al. (2019), who identified a need for more high-quality research studies comparing BL to traditional face-to-face in undergraduate nursing (Li et al., 2019). This research aims to fill the gap in the published literature relating to studies comparing BL and face-to-face learning. To the best of our knowledge, there are no existing comparative studies that address self-efficacy and knowledge between BL and face-to-face learners in an undergraduate nursing health assessment semester course. Results of this study will contribute to the body of literature on BL in undergraduate nursing in relation to self-efficacy, student knowledge, and perceptions in a full semester course.

## 3. Methods

### 3.1. Aim

The aim of the study was to explore knowledge, self-efficacy, and student perceptions of BL in undergraduate nursing education, through a comparison of six student groups over three semesters. Students were enrolled in either a BL or a traditional face-to-face health assessment in nursing course at an accredited Canadian undergraduate University.

### 3.2. Study design

The study used a quasi-experimental pre-post test study design to compare outcomes of knowledge, as measured by examination marks and final grades, and self-efficacy, as measured by a self-efficacy scale, for the blended and face-to-face student groups. In the blended group, perceptions of the online learning environment were examined.

### 3.3. Sample and recruitment

A convenience sampling method was used. Students enrolled in blended or face-to-face sections of the second-year BScN health assessment course were invited to participate. Participants were recruited over three different semesters from three different cohorts of students.

The pre-test surveys were completed by 217 students. The post-test surveys were completed by 187 students. Not all participants answered all survey questions which has resulted in sample size differences.

### 3.4. Intervention

Over three academic semesters (Winter 2017; Fall 2017; Winter 2018), the newly redesigned BL course was offered alongside the traditional face-to-face course.

The face-to-face version of the course consisted of three theory hours per week delivered via traditional lecture, as well as a mandatory three-hour weekly lab component.

The BL version of the course incorporated paced, asynchronous online learning modules and scheduled online activities with strategic face-to-face lectures offered at set points during the semester. Interactive online learning modules were developed with various authoring software tools and screen-casted (pre-recorded) lectures, which were accessible through a Learning Management system. Students had

autonomy and flexibility in accessing online course content, except for intermittently scheduled face-to-face classes (seven in total over the semester). The students in the BL course had the same in-class three-hour mandatory weekly lab and required readings as the face-to-face group.

Students in the blended cohort were encouraged to complete the online component prior to attending the lab, to be prepared for hands-on practice. Graded online bi-weekly assignments (quizzes, discussion board posts and case studies) facilitated content review and lab preparation for the blended cohort. In the face-to-face cohort, in-class demonstrations and interactive activities facilitated content review and lab preparation. The face-to-face cohort had one graded assignment due at the end of the semester.

Over the Winter 2017 and Winter 2018 semesters of the study, the same instructor taught both the blended and the face-to-face courses. In Fall 2017, the same instructor taught the blended course, while a different instructor taught the face-to-face course.

The midterm and final examination questions were pulled from a shared examination question bank. Multiple choice questions were identical in some cases, however, they varied semester to semester, to maintain academic integrity. All examination items tested the same concepts and taxonomy levels to measure student success in meeting the course learning objectives. Exam analysis for test reliability is completed on all multiple examinations at the University with a minimum requirement for a Kuder Richardson formula 20 (KR-20) score of 0.60 (range of 0–1). The KR-20 ranged from 0.65 up to 0.95 for the mid-term and final exams. Examination blueprints included similar topics and number of questions during each semester tested. Final course grades were based on multiple choice exam scores (midterm and final), lab examination scores and assignments. Final course grades were obtained from the university's official records.

### 3.5. Ethical considerations

Ethics approval was obtained from the MacEwan University and University of Alberta research ethics boards. Written consent was obtained from each participant before data collection. Student numbers were coded to ensure confidentiality and data were not analyzed until after final semester marks were submitted to the MacEwan University Registrar.

#### 3.5.1. Data collection

A survey was developed that consisted of three sections: demographic data, a self-efficacy scale and the Web-Based Learning Environment Instrument (WEBLEI) (Chang and Fisher, 2003). Section one incorporated demographic data, including age, gender and first language spoken. Using Bandura's theory of self-efficacy as a guide to self-efficacy scale construction (Bandura, 1986, 2006), a scale was created using a 100-point Likert scale ranging in 10-unit intervals (see

**Table 1**

Sample self-efficacy questions from the 0–100 Likert scale (0 = Least confident, 100 = Most confident).

Self-efficacy questions
1. How confident are you that you are able to Integrate components of a health assessment to promote health (using the nursing process)?
2. How confident are you that you are able to demonstrate professional, relational and ethical competencies while conducting and reporting a health assessment?
3. How confident are you that you are able to conduct health assessments using a relational practice approach?
4. How confident are you in obtaining objective data from your health assessment?
5. How confident are you in asking subjective questions related to a focused assessment (i.e. cardiovascular system)?
6. How confident are you that you are able to demonstrate safe and appropriate use of health assessment techniques with consideration of the age and developmental stage of the individual and/or family?

**Table 2**

Exploratory factor analysis with Varimax Rotation for the self-efficacy scale.

	Percentage of the variance explained	Factor loadings
Pre-term BL	59.5%	0.648–0.898
Post-term BL	60.5%	0.623–0.877
Pre-term face-to-face	67%	0.573–0.910
Post-term Face-to-face	63%	0.532–0.888

Table 1). No previously validated tool could be located that examined the use of blended online learning and self-efficacy, therefore the scale was created based on course outcomes from the course syllabus.

Reliability and validity of the scale were studied. Reliability results, confirmed using Chronbach's alpha, were above 0.94 for all preterm BL, post-term BL, preterm F2F, and post-term F2F classes. Construct validity was confirmed by exploratory factor analysis. The single factor with 12 items reported on a 100-point Likert scale explained 59.5%–67% of the variance with factor loadings higher than 0.532 (see Table 2).

The WEBLEI, developed by Chang and Fisher (2003), was used to investigate students' perceptions of their online learning environment activities (Chang, 1999). The WEBLEI, which is in part built upon the work of Tobin (1998), has "acceptable reliability and discriminant validity from a statistical perspective" (Chang and Fisher 2003, p. 17). Responses are based on a 5-point Likert scale. The authors were granted permission to use this tool.

Data was collected over three semesters from January 2017 to April 2018. Pre and post surveys were administered electronically through a secure online survey platform to both groups during the first ten minutes of a face-to-face class. The initial pre-survey was administered at the beginning of the semester, and the final post-survey was administered at the end of the semester.

### 3.6. Data analysis

Data analysis was performed using R(3.4.3) and R-Studio (1.1.423) to produce descriptive and inferential statistics. Descriptive statistics such as median was used as a measure of central tendency, Interquartile range (IQR) was collected as measures of dispersion. Confidence intervals of 95% were used for the means to reflect precision in estimation of the population means. These statistics provided sample information pertaining to the WEBLEI, as well as grades and self-efficacy. In order to check for a difference in median grades between groups, the Mann-Whitney test was used. A significance level of 5% is assumed to indicate significant effects in all tests conducted.

## 4. Results

### 4.1. Demographics

Participants were mainly female (84%) between the ages of 18 to 24 years old (83%) whose first language was English (87%) (Table 3).

**Table 3**

Demographic characteristics for the post BL and post face-to-face participants (n = 187).

	Gender	Age	English as first language
Post BL	F: 72 M:9	18–24: 66 25–31: 13 32–38: 2 39+: 0	Yes: 73 No: 4 Missing Value:4
Post F2F	F:62 M: 16	18–24: 66 25–31: 9 32–38: 3 39+: 0	Yes:62 No: 16

**Table 4**  
Comparing knowledge scores between BL and face-to-face groups.

	BL			face-to-face		
	Midterm	Final	Final Grade	Midterm	Final	Final Grade
Number of Students	84	84	84	104	104	104
Mean	79.61	75.59	83.08	80.01	75.66	83.58
Median	81.15	76.66	84.52	80.65	76.67	84.61
SD	10.09	12.14	8.54	8.62	9.70	5.89
IQR	11.96	11.10	7.46	15.12	13.76	8.07
Min	51.59	0	29.97	58.73	35	68.71
Max	100	92.5	95	95.38	93.33	95.96

#### 4.2. Knowledge

The Mann-Whitney test was conducted to test for a significant difference in the median grades for students in the face-to-face and BL groups (Table 4). Results show no significant difference between the two groups in their midterm marks ( $U = 4350.5$ ,  $p > 0.100$ ), final marks ( $U = 4480$ ,  $p > 0.100$ ) or final course grades ( $U = 4407$ ,  $p > 0.100$ ).

#### 4.3. Self-efficacy

Results from the paired-samples sign test indicate that the median self-efficacy scores at the start of the semester are significantly less than the median self-efficacy scores at the end of the semester in both BL ( $S = 13$ ,  $p < 0.001$ ) and face-to-face groups ( $S = 12$ ,  $p < 0.001$ ). Fig. 1 shows the side-by-side box-plots of the self-efficacy scores at the start and end of the semesters for BL and face-to-face classes.

Mann-Whitney tests were performed to compare self-efficacy median scores between the BL and face-to-face groups. Results show that the BL group self-efficacy median scores were not significantly different from the face-to-face group at the beginning of the semester ( $U = 2686.5$ ,  $p > 0.100$ ). Similarly, at the end of the semester, the self-efficacy median scores in the BL group were also not significantly different from the face-to-face group ( $U = 2736.5$ ,  $p > 0.100$ ).

#### 4.4. WEBLEI outcome measures

Data were grouped and analyzed according to the following 4 categories: Access, Response, Interaction and Results. Results received the highest median scores ( $n = 80$ ,  $mdn = 4.857$ ,  $IQR = 1$ ) of the four scales. This indicated that 50% of participants had a relatively high

**Table 5**  
WEBLEI outcome measures.

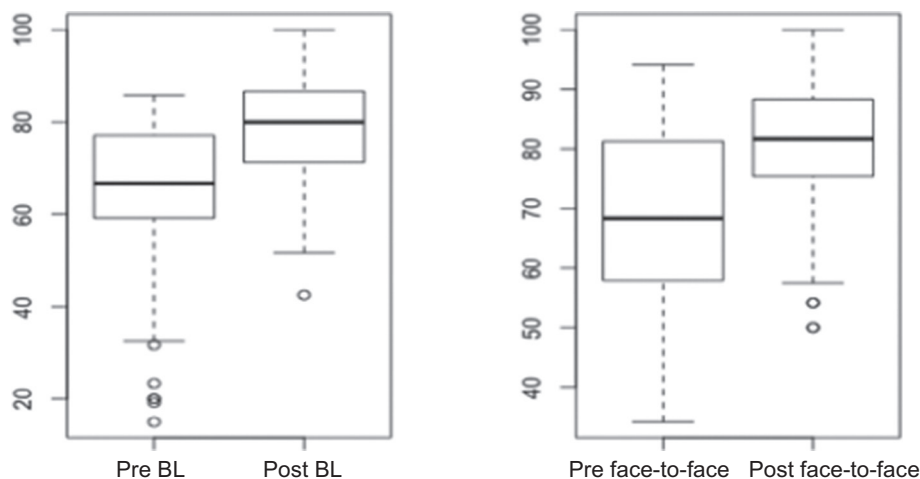
	Access	Response	Results	Interaction
Mean	4.394	3.281	4.434	3.194
Median	4.714	3.5	4.857	3.286
SD	0.687	0.958	0.743	0.638
Min	2.143	1.125	1.875	1.143
Max	5	4.875	5	4.571
1st Quartile	4	2.625	4	2.857
3rd Quartile	5	4	5	3.571

level of satisfaction with their online experience. Access median scores were high ( $n = 79$ ,  $mdn = 4.714$ ,  $IQR = 1$ ), indicating that 50% of participants often agreed with the statements about flexibility and convenience. Response median scores ( $n = 80$ ,  $mdn = 3.5$ ,  $IQR = 1.375$ ) indicate that students felt a sense of achievement and satisfaction with the BL course. Interaction median score ( $n = 81$ ,  $mdn = 3.286$ ,  $IQR = 0.71$ ) (peer and instructor interactions) was the lowest of the 4 categories. The data for the 4 categories are summarized in Table 5.

#### 5. Discussion

This research aimed to examine outcomes related to BL in an undergraduate nursing course. When comparing self-efficacy, knowledge and perceptions outcomes of the online learning environment with face-to-face teaching environments, this study found that at the end of the course self-efficacy scores increased in both the face-to-face and BL groups as compared to the beginning of the course. The participants in this study showed no statistically significant differences in self-efficacy between groups. Similar to other studies which showed enhanced self-efficacy with a BL methodology (Shorey et al., 2018a; Shorey et al., 2018b; Park et al., 2016) this study demonstrated that self-efficacy scores improved equally between BL and face-to-face groups from the start of the term to the end. This research is unique in that it directly compared self-efficacy between the BL and face-to-face groups, suggesting that BL offers pedagogical benefits in terms of improving students' confidence in applying key concepts of health assessment that are similar to a face-to-face teaching method.

There were expected demographic similarities between BL and face to face groups. The majority of participants, second-year nursing students, would have little to no prior experience in learning health assessment and only limited exposure to clinical settings. This may account for the lower self-efficacy scores for both groups at the start of the semester. The course was purposefully designed for increasing



**Fig. 1.** The pre-test and post-test scores of the BL and face-to-face groups.



complexity, moving from simple to more complex concepts throughout the term. Similar to the work done by McMahon and Christopher (2011), which supports a pedagogical model of progressive complexity, this course balanced complexity with structure. This strategy, which utilized a weekly three-hour lab, may have provided students with the conceptualization of knowledge to aid in increasing self-efficacy. Further research would be needed to determine the full impact of this BL strategy on student self-efficacy.

Results from this study are in alignment with the literature reporting that student achievement is as high in the BL environment as it is when delivered in a traditional face-to-face classroom (Smith and Hill, 2019; Zhang and Zhu, 2017; Larson and Sung, 2009). This study is unique and augments prior reported research as it specifically examined a health assessment in nursing course and results support a BL methodology as being as effective for student achievement as traditional face-to-face methods. Since health assessment is typically a compulsory component in Canadian BScN programs, these results could be valuable for many nursing programs looking for innovative curriculum redesign strategies.

Our study is consistent with other research which suggests that students enrolled in a BL course had a high level of satisfaction with this approach (Owston et al., 2013; Larson and Sung, 2009; Johnson et al., 2010). Results of this study support findings of previous studies in identifying access, convenience and flexibility as being important factors in learning for some students (McConville and Lane, 2006; Kiviniemi, 2014; Shorey et al., 2018b; Hsu and Hsieh, 2014).

Results of this study indicate that interaction among students in this course was low. This may be a result of the course design, computer literacy, and a balance of intrinsic and extrinsic motivation factors. Positive correlations have been found between learner motivation and metacognitive qualities and frequency of online interactions in BL contexts (Hsu and Hsieh, 2014). Further research is needed to examine the relationship between online interactivity, course achievement and satisfaction.

## 6. Limitations

There are limitations to this research that should be acknowledged. Randomization and pure experimental design were not possible in these university courses. Course changes were made from semester to semester based on student feedback, course evaluations, and to maintain academic integrity. The BL groups had slightly different assignments than the face-to-face group, due to the nature of online learning pedagogies. Despite similar exams and identical course syllabi, minor differences could potentially impact findings and might also account for at least a portion of the difference in learning outcomes, self-efficacy scores and perceptions across semesters.

Although the curriculum was identical, one of the face-to-face courses was taught by a different instructor who was not involved in the research project. Participants in this cohort were recruited to facilitate the continued comparison of BL with face-to-face learning. There are possible implications that unmeasured differences in instructional approach and teaching style, which may impact results.

## 7. Conclusion

This was the first study comparing outcomes of self-efficacy, knowledge between BL and face-to-face groups of learners in a full semester health assessment course. The findings of this study revealed that there was no difference in self-efficacy between groups and self-efficacy increased similarly in both groups, over time. There was no significant difference in knowledge, as measured by exam marks and final grades. Perceptions of the BL experience were positive. The overall conclusions reached by this study support the use of BL as a pedagogical approach. BL has the potential to be efficacious on a larger scale. Further research is needed to examine long-term outcomes of

innovative BL pedagogical approaches in nursing education.

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## CRediT authorship contribution statement

**Keri-Ann Berga:** Conceptualization, Methodology, Investigation, Data Curation, Resources, Writing - Original Draft, Writing - Review and Editing, Supervision, Project Administration, Visualization, Funding Acquisition.

**Elisha Vadnais:** Conceptualization, Methodology, Formal Analysis, Investigation, Data Curation, Resources, Writing-Original Draft, Writing-Review and Editing, Visualization, Funding Acquisition.

**Jody Nelson:** Literature Review, Methodology, Investigation, Data Curation, Writing - Original Draft, Writing-Reviewing and Editing.

**Sharon Johnston:** Methodology, Investigation, Resources, Writing - Review and Editing, Funding Acquisition.

**Karen Buro:** Methodology, Formal Analysis, Writing- Review, Supervision.

**Rui Hu:** Methodology, Formal Analysis, Writing - Review, Supervision.

**Bo Olaiya:** Formal Analysis.

## Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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