Effects of Team-Based Learning on Self-Regulated Online Learning

Abstract: Online learning requires higher levels of self-regulation in order to achieve optimal learning outcomes. As nursing education moves further into the blended and online learning venue, new teaching/learning strategies will be required to develop and enhance self-regulated learning skills in nursing students. The purpose of this study was to compare the effectiveness of team-based learning (TBL) with traditional instructor-led (IL) learning, on self-regulated online learning outcomes, in a blended undergraduate research and evidence-based practice course. The nonrandomized sample consisted of 98 students enrolled in the IL control group and 86 students enrolled in the TBL intervention group. The percentage of total possible online viewing time was used as the measure of self-regulated online learning activity. The TBL group demonstrated a significantly higher percentage ($p < 0.001$) of self-regulated learning activities than the IL control group. The TBL group scored significantly higher on the course examinations ($p = 0.003$). The findings indicate that TBL is an effective instructional strategy that can be used to achieve the essential outcomes of baccalaureate nursing education by increasing self-regulated learning capabilities in nursing students.

Keywords: team-based learning, self-regulated learning, blended online courses, motivation for learning

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Introduction

One of the major goals of undergraduate baccalaureate nursing education is to prepare nursing students to be lifelong learners. Professional nurses must be able to think critically, engage in evidence-based practice, continuously assess their own learning needs, update their skills, and keep their knowledge current (American Association of Colleges of Nursing [AACN], 2008). These professional behaviors require highly developed self-regulated learning skills.

Rapid expansion of healthcare technology coupled with an explosion of knowledge has challenged the tradition of classroom-based courses in nursing education (Robert Wood Johnson Foundation, 2010). In the past decade, web-based instruction has significantly increased due to improved learning management systems, advances in computer technology, and financial constraints related to the rising cost of college education (Myers, Mixer, Wyatt, Paulus, & Lee, 2011). As online course work has become more established across nursing education, concerns have arisen related to whether nursing students possess adequate self-regulated learning abilities to benefit from online learning (Sowan & Jenkins, 2013).

Online learning offers students a significant amount of personal control over their own learning, which allows them to focus on their specific learning needs (Shea & Bidjerano, 2010). While this may be educationally beneficial, a number of authors indicate that online learning is only useful to students who choose to use it in a productive manner (Abrami, Bernard, Bures, Brorokhovski, & Tamim, 2010; Bandura, 2002; Liaw & Huang, 2013). Research across a number of disciplines and settings has demonstrated that online and blended forms of classes demand much higher levels of self-regulation than traditional classroom settings (Greene, Moos, & Azevedo, 2011; Sun & Rueda, 2012). In a review of two decades of online education research, however, Abrami et al. (2010) conclude that not all college students have developed the capability or desire to be productive, self-regulated online learners. Recent international research studies have identified motivational, metacognitive, and attitudinal factors that influence college students’ self-regulatory abilities and success in online and blended online courses. Lack of perceived usefulness of content (Liaw & Huang, 2013), media multi-tasking (Ophir, Nass, & Wagner, 2009; Wei, Wang, & Klausner, 2012), low learner self-efficacy (Shea & Bidjerano, 2010), and procrastination (Michinov, Brunot, Le Bohec, Juhel, & Delaval, 2011) have all been found to have a negative impact on successful self-regulation by students enrolled in online and blended courses. Overall, the literature
Team-based learning (TBL) is an instructional strategy that has been extensively tested in classroom learning and has demonstrated the potential to have a positive impact on self-regulation in the blended online learning environment. The goal of team-based learning is to promote active student learning through small group activities (Michaelsen & Sweet, 2008; Michaelsen, Fink, & Knight, 1997). The critical goal of student team assignment is to achieve diversity and equal distribution of student resources across teams. Teams are selected by the instructor, and work together throughout the entire semester.

As envisioned by Michaelsen and colleagues (1997), TBL classrooms utilize little face-to-face instructor lecture time. Pre-class assignments contain the foundational subject matter that the students are expected to learn prior to coming to class. Student accountability for class preparation is supported by the Readiness Assurance Process® (RAP) which includes a short pre-test, taken by individual students, at the beginning of class (Mennenga, 2013; Michaelsen & Sweet, 2008). The pre-test is in multiple choice format and covers only the most important content from the pre-class assignment (Chung, Rhee, Baik, & A, 2009; Michaelsen & Sweet, 2008). Directly following the individual readiness pre-test, the groups discuss each question on the pre-test and reach agreement on the correct answer. The group pre-test is on a scratch-off form. The groups scratch off their chosen answer and immediately receive feedback as to whether that answer is correct (Mennenga, 2013). The instructor then discusses pre-test questions with the entire class, providing feedback on the rationale for each correct response and answering any remaining questions students may have. This process allows students to assess their understanding of content immediately. TBL has been demonstrated to enhance self-monitoring of learning through the use of immediate instructor feedback, and more importantly, through group feedback during the group readiness assessment quizzes and group project discussions (Feingold et al., 2008; Parmelee, Michaelsen, Cook, & Hudes, 2012; Rawekar et al., 2013). The beneficial effect of immediate feedback during group testing provides accurate information necessary for metacognitive self-monitoring and self-evaluation (Koriat, Ma’ayan, & Nussinson, 2006).

The majority of TBL class time is spent in group problem solving discussions that apply the content that was learned prior to coming to class (Parmelee & Michaelsen, 2010). Group application problems require students to make specific choices related to the problem. Groups discuss the assigned problem, decide on the best solution, and present the rationale to the class.

Team-based learning has been extensively utilized and evaluated in medical education (Haidet et al., 2012; Parmelee et al., 2012). Medical students in TBL classes demonstrated consistently higher examination scores than their counterparts in traditional classrooms (Koles, Stolfi, Borges, Nelson, & Parmelee, 2010; Okubo et al., 2012). Studies of TBL in face-to-face nursing classrooms have reported equivalent or better outcomes than traditional classrooms (Cheng, Liou, Tsai, & Chang, 2013; Kniewel, 2012; Mennenga, 2013).

Conceptual framework

The conceptual framework guiding this study suggests that TBL can effectively be used to support and develop self-regulated learning in students enrolled in both traditional classroom and blended online classroom settings. Self-regulated learning is the process in which individual learners take responsibility for identifying their own learning needs, establishing learning goals, selecting and using appropriate learning strategies, and evaluating learning outcomes (Bandura, 1986, 2005). The conceptual framework (Figure 1) for this study was adapted from Bandura’s theoretical framework that explained the reciprocal nature of behavioral, personal, and environmental factors on human functioning and learning (Bandura, 1986). These processes are selectively used, dynamic in nature, and specific to individual learning contexts (Bandura, 1986; Zimmerman, 1998).

In order for students to self-regulate their learning, they must possess adequate self-efficacy to perform and utilize online learning applications (Shea & Bidjerano, 2010; Sun & Rueda, 2012). Students must also be motivated to learn, be able to monitor their learning behavior, evaluate their behavior, and modify their behavior (McCabe 2011; Zimmerman, 1998). Self-regulated learners have the ability to design and manage multiple cognitive strategies and available resources for learning. Resource management is conceptualized as the amount of effort, extent of effort, and intensity of effort that a student...
applies to a learning task (Zimmerman, 1998). The process of resource management includes the selection of the appropriate cognitive strategies, as well as incorporation of vicarious learning from observation and interaction with peers and instructors. Self-regulated students learn from their own successes and failures and from observing the behavior of others (Bandura, 1986, 2005; Schunk & Zimmerman, 2007; Shea & Bidjerano, 2010; Zimmerman & Shunk, 2001).

Self-regulated learners utilize metacognitive processes such as self-reflection as they are working toward learning goal achievement (Schunk & Zimmerman, 2007). Self-reflection prompts the learner to engage in self-monitoring, self-evaluation, and self-correction of their learning behaviors (Kuiper, Murdock, & Grant, 2010; Turan, Demirel, & Sayek, 2009; Winne, 1996). Metacognitive processes are used to select specific cognitive strategies to achieve a learning goal, evaluate the effectiveness of those strategies, and to retain or modify those strategies.

The conceptual framework also incorporates concepts that describe the relationships between technologic/environmental factors and self-regulated learning. The user friendliness of the learning management system and quality of programing are key technological components of online courses (Garrison, Anderson, & Archer, 2010; Shea & Bidjerano, 2010). Faculty factors include the adequacy and comprehensiveness of the content delivered online, the quality of the online presentation, and the adequacy and clarity of course information provided (Garrison et al., 2010). Finally, the student–faculty connection and interaction has consistently been associated with higher learning outcomes (Abrami et al., 2010; Shea & Bidjerano, 2010).

Self-regulated learners effectively utilize the peer group as a learning resource through the use of peer help-seeking activities, study partners, and peer project teams. The peer group or team is viewed as providing heightened motivation as well as being a critical component of resource management (Michaelsen et al., 1997; Parmelee & Michaelsen, 2010). For this reason, the peer-related component of environmental regulation has a close reciprocal relationship with both motivation and the cognitive strategy of resource management. Peer input and evaluation is also conceptualized as playing a dynamic role in the self-monitoring aspect of metacognition.
The conceptual framework proposes that the processes of self-regulation influence learning outcomes across a continuum of learning environments. Nursing education has traditionally been delivered by face-to-face classroom instruction. In the past two decades, online learning in higher education has rapidly expanded. Blended forms of nursing courses offer the interpersonal component of face-to-face classrooms in addition to self-directed technology-based learning (Hsu & Hsieh, 2011; Myers et al., 2011; Sowan & Jenkins, 2013).

In summary, the conceptual model proposes that team-based learning supports self-regulated learning activities and learning outcomes within both the classroom and blended online learning environments. Freeman, McGrath-Champ, Clark, and Taylor (2006) suggest that motivation to engage in pre-class preparation arises from the student’s desire to perform well on the individual pre-tests, as well as from group peer pressure that encourages group members to come prepared and contribute equally to group discussions. Nursing students who received lower midterm peer evaluations were motivated to improve their readiness and participation in group activities (Andersen, Strumpel, Fensom, & Andrews, 2011). Michaelsen et al. (1997) posit that group accountability increases individual student’s utilization and management of available learning resources. The effect of TBL on self-regulated online learning outcomes in nursing students has not been reported in the nursing education literature. Therefore, the purpose of this study was to evaluate the effects of TBL on self-regulated online learning outcomes in a blended undergraduate nursing research and evidence-based practice course.

Methods

A quasi-experimental, non-randomized, post-test only design was used to examine the effectiveness of the TBL in a junior level nursing research and evidence-based practice course. The traditional instructor-led (IL) control group (n = 98) completed the course in 2012, while the TBL intervention group (n = 86) were enrolled in the course in 2013. The study was approved as exempt by the University’s Institutional Review Board. Exclusion criteria included students enrolled in a second degree baccalaureate nursing program or a Registered Nurse completion program. Analysis of pilot data indicated a medium effect size (d = 0.50) as defined by Cohen (1988). A power analysis, based on an alpha level of .05, required 64 subjects per group to achieve 80% power to detect group differences in mean scores.

Instructional strategies

Table 1 presents a comparison of the educational strategies used in the IL control group and the TBL intervention group. The overall course structure was identical for both the TBL and the IL control semester. The course was divided into learning modules. Each learning module included 90 minutes of online lesson activities and 90 minutes of classroom instruction. The online lessons consisted of a variety of online instructional strategies including recorded voice-over-PowerPoint lectures, instructional music videos, and online database-search tutorials. The same online lessons were used for both the IL control semester and the TBL intervention semester. Students were expected to complete the weekly online content prior to coming to class.

As shown in Table 1, the classroom instruction varied between the two groups. In the IL control group, face-to-face classroom time consisted of 30–60 minutes of lecture and class discussion focused mainly on review and application of the online module content. The remaining class time consisted of IL small group discussion of topics relevant to research critique and work on the groups’ assigned evidence-based practice project. Historically, based on instructor preference, students in the IL course were randomly divided into groups of four. Students worked together in the same groups for the entire semester. Mastery of course content was measured by scores on two multiple-choice examinations.

The TBL classroom sessions, in contrast, were taught using the principles of TBL (Michaelsen et al., 1997). Following completion of the RAP, the instructor assigned application problems to the groups. The remainder of the class time was spent in group discussion of the application problems. The instructor met briefly with each group providing feedback and answering questions related to the application problems. In order to provide for the greatest diversity of resources across all teams, and in keeping with the tenets of TBL, the size of the student teams was increased to six students. Research has demonstrated that teams of five to seven students provide optimal diversity and distribution of student demographic and academic achievement factors (Chung et al., 2009; Koles et al., 2010; Okubo et al., 2012). Students worked together in the same teams for the entire
semester. Mastery of course content was measured by multiple choice examinations equivalent to those utilized in the control semester.

The researcher taught both the IL and TBL semesters, therefore, blinding to the control and intervention condition was not possible. In order to decrease experimenter expectancy and maintain intervention fidelity, an external inquiry audit was performed by a doctorally prepared nursing faculty member. Podcasts of all classes were reviewed for consistency of content and presentation.

### Data collection

Self-regulated learning was measured by the amount of time that the student spent participating in pre-class online learning activities and by course examination scores. Self-regulated online activity was calculated, by the University Learning Management System, and included multiple viewing times. Because the online lessons varied from 169 seconds to 1,047 seconds and students viewed some lessons more than once, the composite viewing time was not completely reflective of the student’s viewing activity. Therefore, the composite viewing time was adjusted to correct for multiple viewings. The total viewing time and percentage of total possible viewing time were analyzed for each individual student in both groups.

Although limited in scope, the time spent participating in online course activities is recognized as one measure of self-regulated learning (Rosen, Carrier, & Cheever, 2013; Shea & Bidjerano, 2010). Students self-regulate the amount of time and attention given to the online lessons. Research has consistently demonstrated that greater time spent in online lessons results in improved learning outcomes (Burnette, Ramundo, Stevenson, & Beeson, 2009; Hershkovitz & Nachmias, 2012; Michinov et al., 2011; Rodgers, 2008; Ryabov, 2012).

Course examination scores were utilized as a measure of cognitive learning outcomes. Mean scores from two 50-question multiple choice examinations were collected from the course learning management system for both the IL and TBL groups. Testing was identical for both groups. Examinations were administered to individual students in a proctored classroom. The examination questions were selected because they had previously demonstrated content validity and reliability with Kuder–Richardson coefficients of 0.52 and 0.75. Ninety percent of the examination questions had point biserial correlations of greater than 0.20.

### Table 1: Comparison of educational strategies used in control and intervention groups.

<table>
<thead>
<tr>
<th>Educational strategy</th>
<th>Instructor-led control group</th>
<th>Team-based learning intervention group</th>
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<tbody>
<tr>
<td>Content</td>
<td>Clinical problem/literature</td>
<td>Clinical problem/literature</td>
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<tr>
<td>Modules</td>
<td>Purpose/Research questions/</td>
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<td>Data quality</td>
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<td></td>
<td>Qualitative designs</td>
<td>Qualitative designs</td>
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<tr>
<td>Content delivery</td>
<td>2–4 online learning activities/week</td>
<td>2–4 online learning activities/week</td>
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<td></td>
<td>Equivalent to 90 minutes of classroom time</td>
<td>Equivalent to 90 minutes of classroom time</td>
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<tr>
<td>Group formation</td>
<td>Randomized into groups of 4</td>
<td>Randomized into groups of 6†</td>
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<tr>
<td>Accountability for online learning</td>
<td>2 multiple-choice examinations</td>
<td>Individual/group readiness pre-tests for each module†</td>
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<tr>
<td></td>
<td></td>
<td>2 multiple-choice examinations</td>
</tr>
<tr>
<td>Face-to-face classroom</td>
<td>90 minutes total</td>
<td>90 minutes total</td>
</tr>
<tr>
<td>Lecture</td>
<td>30–60 minutes</td>
<td>No formal lecture†</td>
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<tr>
<td></td>
<td>Focused on review and application of online content</td>
<td>Instructor lecture focused on unclear content areas identified by pre-test†</td>
</tr>
<tr>
<td>Group application activities</td>
<td>Related to research critique and group evidence-based practice project</td>
<td>Related to individual research critique and group evidence-based practice project</td>
</tr>
<tr>
<td>Group evaluation</td>
<td>Likert-type scale at the end of semester</td>
<td>Likert-type scale at mid-term and end of semester†</td>
</tr>
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</table>

Note. †These reflect essential components of team-based learning (Michaelsen et al., 1997).
Data analysis

Data were analyzed using IBM SPSS Statistics® version 21. Descriptive statistics were used to describe differences in demographic characteristics, and online viewing times between the groups. Differences in categorical variables were analyzed using non-parametric statistics. An independent t-test was utilized to test the differences in online participation time between the IL control and the TBL intervention groups. The level of significance was set at $p \leq 0.05$.

Results

The statistical comparison of the two groups of students is presented in Table 2. No significant differences were found between the groups in either the demographic characteristics or the academic achievement characteristics. Both groups were predominately Caucasian females aged 20 to 21.

Students in the TBL group demonstrated higher levels of self-regulated online learning activities. As shown in Table 3, the team-based learning group had a
significantly greater percentage of time viewing the online lessons, \( t = -6.125, df = 182, p < 0.001 \), than did the IL control group. In the IL control group, 13% (\( n = 13 \)) of the students recorded no time spent viewing the online learning activities across the entire semester. Twelve percent (\( n = 12 \)) of the IL class viewed 90%–100% of the online learning activities. In contrast, fifty percent (\( n = 43 \)) of the TBL group viewed 90%–100% of the online lessons. Overall, there were 62% fewer students in the TBL group who had no self-regulated online viewing activity.

The TBL group scored significantly higher on the course examinations, \( t = -2.961, df = 182, p = 0.003 \). The mean examination score for the TBL group was 3.32 percentage points higher than the mean examination score for the IL group. Seventeen (17.35%) of the IL group had a mean examination score below 70%, as compared to 9 (9.56%) of the TBL group.

**Discussion**

The results of this study are in agreement with previous research findings that demonstrate that TBL provides motivation for students to increase self-regulated learning behaviors (Feingold et al., 2008; Gomez, Wu, & Passerini, 2010; Gopalan, Fox, & Gaebelein, 2013). In the current study, students in the TBL intervention group viewed more of the online lessons than did their counterparts in the traditional IL group. The findings indicate that the TBL students utilized more online learning resources and used them to a fuller extent than did their IL counterparts. This is consistent with Schunk and Zimmerman’s (2007) premise that use of the cognitive strategy of resource management plays a key role in self-regulated learning.

The findings of this study are also consistent with the results of previous medical education studies that have demonstrated beneficial increases in academic learning outcomes for students enrolled in TBL courses (Koles et al., 2010; Rawekar et al., 2013). Academic improvement is thought be the result of a combination of increased motivation to prepare for class, peer group pressure, and the power of group discussion (Freeman et al., 2006; Gopalan et al., 2013; Koles et al., 2010). Weaker students benefit from the critical thinking skills and positive study habits modeled by higher performing student peers. These findings are also supported by Peck, Werner, and Raleigh (2013) who demonstrated evidence of enhanced self-regulated preparation and improved exam performance in senior nursing students who participated in group testing and received immediate feedback.

The current research study augments the emerging literature related to the effectiveness of TBL in nursing education. The current nursing literature demonstrates that learning outcomes in TBL classes are equivalent to (Kniewel, 2012; Mennenga, 2013) or better than (Cheng, Liou, Tsai, & Chang, 2013; Cheng et al., 2014) learning outcomes in traditional face-to-face classrooms. The findings of improved student learning outcomes in the current study suggest that TBL is effective in the blended online learning environment, as well as in the traditional face-to-face classroom.

**Implications and recommendations for nursing education**

The findings of the current research study suggest a number of implications for nursing education. The study provides support for the use of TBL as an instructional strategy to achieve the AACN (2008) essential outcomes for baccalaureate nursing education. Specifically, TBL encourages students to become self-regulated learners as they function within teams (Clark, Nguyen, Bray, & Levine, 2008; Michaelsen et al., 1997).

Successful application of TBL to an entire nursing course is challenging and requires faculty time and commitment (Andersen et al., 2011; Mennenga, 2013). Time and expertise is required for development of the RAP individual/group pre-tests as well as the group application problems. This may be an intimidating task for faculty new to the team-based instructional strategy. Despite the challenge, the present study and other research studies support the importance of the group pre-test and application discussion activities on self-regulated learning outcomes (Mennenga, 2013, Kniewel, 2012; Koles et al., 2010, Rawekar et al., 2013). Careful thought must be given to developing meaningful pre-test and application questions which will stimulate robust group discussion and critical thinking.

Particular consideration needs to be given to how TBL is implemented within a nursing course. The inconsistent use of TBL throughout a course may have negative student consequences. As Kniewel (2012) and Mennenga (2013) point out, students become confused and uncertain of the course expectations when they are exposed to numerous instructional strategies within one nursing course. The nursing education literature describes the implementation of TBL in a variety of courses, using a number of implementation models (Cheng et al. 2013,
Kniewel, 2012; Mennenga, 2013). These studies indicate that multiple faculty members, some of whom were inexperienced in teaching with TBL, were involved in teaching the courses. One strength of the present research study is that the course was taught by only one instructor who had prior experience using TBL as an instructional strategy. Consistency in implementation and instructor experience may have contributed to the significantly better self-regulated learning outcomes compared to the results of previously cited nursing studies.

Regardless of the variations in implementation, the research literature demonstrates that team-based student learning is an effective instructional strategy. Prior studies in the nursing and medical education literature demonstrate the beneficial effects of TBL in traditional face-to-face classrooms (Cheng et al. 2013; Koles et al., 2010; Mennenga, 2013). The present research study is the first to demonstrate that TBL can be successfully used in a blended online nursing course.

Limitations

There are several limitations noted in this research study. Differences in the number of group members between the IL control group and the TBL intervention group may have resulted in disparities in the distribution of student resources and abilities which could have influenced the study’s findings. Although the sample size was adequately powered, generalizability of the findings is limited by the homogeneity of the student sample. The great majority of the students were young Caucasian females from upper middle class families. Further research on TBL in nursing education needs to be conducted across a broad range of didactic and clinical nursing courses. In addition, the effectiveness of TBL needs to be investigated in nursing student populations from different racial, ethnic, and sociocultural backgrounds.

The present study has also identified limitations associated with measurement of self-regulated learning. The data mining techniques of current learning management systems are capable of capturing both log-in and time on task activity. They cannot, however, account for available learning resources. Group accountability promotes increased motivation, metacognition, and heightened use of peer resources. As the use of blended online learning rapidly expands in nursing education, nurse educators need to evaluate and implement varied instructional strategies that develop and support self-regulated learning. The current study extends the body of knowledge related to TBL in nursing education to include blended online courses. The results should encourage nurse educators to implement TBL in a variety of both face-to-face classroom and blended online nursing courses.

Finally, further research should be done to investigate the impact of each component of TBL on self-regulated learning. Students report decreased stress and increased satisfaction with individual testing followed by group testing (Parsons & Teel, 2013). Research, however, has not specifically reported the effect of individual versus group testing on self-regulated preparation for class. Self-regulated students may be motivated to prepare for individual/group readiness pre-tests, while students with fewer self-regulatory learning skills may depend on the group to provide test answers. It would be useful to understand how each component contributes to self-regulated online learning and other learning outcomes.

Conclusion

This study evaluated the effect of TBL on self-regulated online learning outcomes in junior baccalaureate nursing students enrolled in a nursing research and evidence-based practice course. The findings supported the conceptual framework’s depiction of self-regulated learning as being a dynamic, cyclical process. Team-based learning fosters development of self-regulated learning by increasing individual student’s utilization and management of available learning resources. Group accountability promotes increased motivation, metacognition, and heightened use of peer resources. As the use of blended online learning rapidly expands in nursing education, nurse educators need to evaluate and implement varied instructional strategies that develop and support self-regulated learning. The current study extends the body of knowledge related to TBL in nursing education to include blended online courses. The results should encourage nurse educators to implement TBL in a variety of both face-to-face classroom and blended online nursing courses.

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