Review

The evidence for 'flipping out': A systematic review of the flipped classroom in nursing education

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SUMMARY

Background: The flipped classroom has generated interest in higher education providing a student-centred approach to learning. This has the potential to engage nursing students in ways that address the needs of today's students and the complexity of contemporary healthcare. Calls for educational reform, particularly in healthcare programs such as nursing, highlight the need for students to problem-solve, reason and apply theory into practice. The drivers towards student-based learning have manifested in team, problem and case-based learning models. Though there has been a shift towards the flipped classroom, comparatively little is known about how it is used in nursing curricula.
Objectives: The aims of this systematic review were to examine how the flipped classroom has been applied in nursing education and outcomes associated with this style of teaching.
Data Sources: Five databases were searched and resulted in the retrieval of 21 papers: PubMed, CINAHL, EMBASE, Scopus and ERIC.
Review Methods: After screening for inclusion/exclusion criteria, each paper was evaluated using a critical appraisal tool. Data extraction and analysis were completed on all included studies.
Results: This systematic review screened 21 titles and abstracts resulting in nine included studies. All authors critically appraised the quality of the included studies. Five studies were identified and themes identified were: academic performance outcomes, and student satisfaction implementing the flipped classroom.
Conclusions: Use of the flipped classroom in higher education nursing programmes yielded neutral or positive academic outcomes and mixed results for satisfaction. Engagement of students in the flipped classroom model was achieved when academics informed and rationalised the purpose of the flipped classroom model to students. However, no studies in this review identified the evaluation of the process of implementing the flipped classroom. Studies examining the process and ongoing evaluation and refinement of the flipped classroom in higher education nursing programmes are warranted.

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Introduction

The flipped or inverted classroom has generated considerable interest in higher education. The flipped classroom provides a student-centred approach to learning that has the potential to engage nursing students in ways that address the needs of today's students and the complexity of contemporary health care. The need to reform the pedagogical approach in nursing education has been highlighted previously in nursing education. Benner calls for transformation, wherein students engage as active learners, content is taught in-context, and educators facilitate clinical reasoning and critical thinking rather than imparting factual information (Benner et al., 2009).

The flipped classroom involves a reversal of traditional teaching where:

> Students gain first exposure to new material outside of class, usually by reading or lecture videos, and then class time is used to do the harder work of assimilating that knowledge through strategies such as problem-solving, discussion or debates. (Brame, 2013, p. 1).

This paper examines the evidence for flipping the classroom in nursing programmes in higher education and the outcomes associated with this approach to teaching and learning.

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Background

For decades, universities have recognised that students undertaking higher education are adult learners and therefore require an andragogical approach. The core tenets of andragogy incorporate self-direction, self-motivation, and active learning (Knowles, 1975, 1990). Despite espousing an andragogical model, much nursing education pedagogy relies on a traditional didactic approach whereby academics transmit knowledge as expert teachers to students. The limitations of this transmittal model of teaching are that students are not actively engaged in processing information, developing understanding or translating knowledge into practice (King, 1993). Under this traditional pedagogy, students have been treated as empty vessels passively absorbing information; wherein their interests are diminished and diverse learning styles are disregarded (Lage et al., 2000). Calls for educational reform, particularly in healthcare programmes such as nursing, highlight the need for students to problem-solve, reason and apply theory into practice (Barnett et al., 2012; Martyn et al., 2014). Equipping students with the skills to critique information is viewed as paramount (Applin et al., 2011) and consistent with learning theorists including Biggs and Tang and Bloom's higher order learning (Anderson et al., 2001; Biggs and Tang, 2011).

To mitigate the limitations of the transmittal model of education, there has been a shift towards student-centred learning and engaging students as active learners (Applin et al., 2011; Della Ratta, 2015; Towle and Breda, 2014). The increasing fiscal pressures on higher education and parallel advancements in educational technology have spawned a push to flexible delivery, online delivery and blended learning (O'Flaherty and Phillips, 2015) which are consistent with a student-centred approach. These drivers towards student-based learning have developed in team, problem and case-based learning models (Applin et al., 2011; Martyn et al., 2014).

The notion of higher education being student-centred and students being actively engaged warrants a notable shift in roles and how time and space are utilised. First, this change requires a cultural shift in paradigm from academics being the facilitators of knowledge to the curators of knowledge (Brooks, 2015); and facilitators of knowledge translation. Second, a student-centred approach values and supports a diversity of learning styles (Lage et al., 2000; Towle and Breda, 2014). Third, students will be required to take a more active role and be accountable for their learning (Blaschke, 2012). Students, including the millennial generation are well situated to capitalise on flexible, multi-media learning opportunities (Kiteley and Ormrod, 2009; Towle and Breda, 2014).

The shift to providing student-centred learning has coincided with the recent surge in flipped classroom curricula in higher education (Bernard, 2015; O'Flaherty and Phillips, 2015). Despite the uptake of the flipped classrooms in other disciplines there is a dearth of evidence available about the use in nursing curricula (Bernard, 2015; Schlairet et al., 2014).

AIM

The aims of this systematic review are to examine the best possible evidence of how the flipped classroom has been applied in nursing education and outcomes associated with this style of teaching.

Methods

Search Strategy

In July 2015, a systematic search was conducted of the electronic databases PubMed, Excerpta Medica, (Embase), Cumulative Index to Nursing and Allied Health Literature (CINAHL), Educational Resources Information Center (ERIC) and Scopus. Boolean operators AND/OR/NOT were used to combine search terms including: nursing; nurse*;

flip*; curriculum; active learning; blended learning; classroom; problem-based learning; teaching and education.

The search strategy was limited to papers published in English. All search results including titles and abstracts were downloaded into Endnote X7 for review. Duplicates were removed. The references of potential papers were examined to identify additional papers fulfilling the inclusion criteria that may have been missed by the search strategy. Full texts of all potential papers were downloaded for review.

Inclusion and Exclusion Criteria

Studies included were peer reviewed reports of primary research that investigated the use of the flipped classroom for nursing students undertaking higher education. Studies were excluded if they involved nurses in clinical settings and professional development. Review articles, commentaries, editorials, grey literature and letters were also excluded.

Search Outcomes

Forty two references were downloaded into EndNote X7. After the removal of duplicates the 21 residual references were reviewed for relevance based on the title and abstract. In the case of any discrepancies concerning the inclusion of a paper, the full article was downloaded and assessed for suitability by all authors. Subsequently, 18 full text papers were retrieved and reviewed of which nine were excluded based on the inclusion/exclusion criteria.

Each of the nine remaining papers was then critically appraised utilising the 11 quality indicators (Table 1), specified by Buckley et al. (2009). These indicators relate to appropriateness of study designs, methods, analysis, results and conclusions. Studies that met seven or more of the 11 indicators were considered to be of higher quality and therefore included in the review (Buckley et al., 2009). All nine papers were scored individually by the authors and any discrepancies were discussed until consensus was attained. Based on the quality appraisal, four articles were further removed. On completion, five studies met the inclusion criteria and were of a suitable standard for this systematic review (Fig. 1).

Data Extraction

All authors contributed to the extraction and categorisation of data. Data included author(s)/year of publication, country of origin, aim of study, design, sample and study population, data collection, methods of analysis and reported outcomes (Table 2). Data describing the flipped classroom interventions were also captured including course type, frequency, pre-class preparatory strategies and within-class active learning strategies (Table 3). Patterns were identified, categorised into themes, summarised and systematically synthesised.

Table 1
Quality indicators developed by Buckley et al. (2009).

| Quality indicator	Questions pertaining to rigor of study
Research question	Is the research question(s) or hypothesis clearly stated?
Study subjects	Is the subject group appropriate for the study being carried out?
Data collection methods	Are the methods used reliable and valid for the research question and context?
Completeness of data	Have subjects dropped out? Is the attrition rate less than 50%? Is the questionnaire response rate acceptable?
Control for confounding	Have multiple factors/variables been removed or accounted for where possible?
Analysis of results	Are the statistical or other methods of results analysis used appropriate?
Conclusions	Is it clear that the data justify the conclusions drawn?
Reproducibility	Could the study be repeated by other researchers?
Prospective	Does the study look forward in time rather than backward
Ethical issues	Were all relevant ethical issues addressed?
Triangulation	Were results supported by data from more than one source?
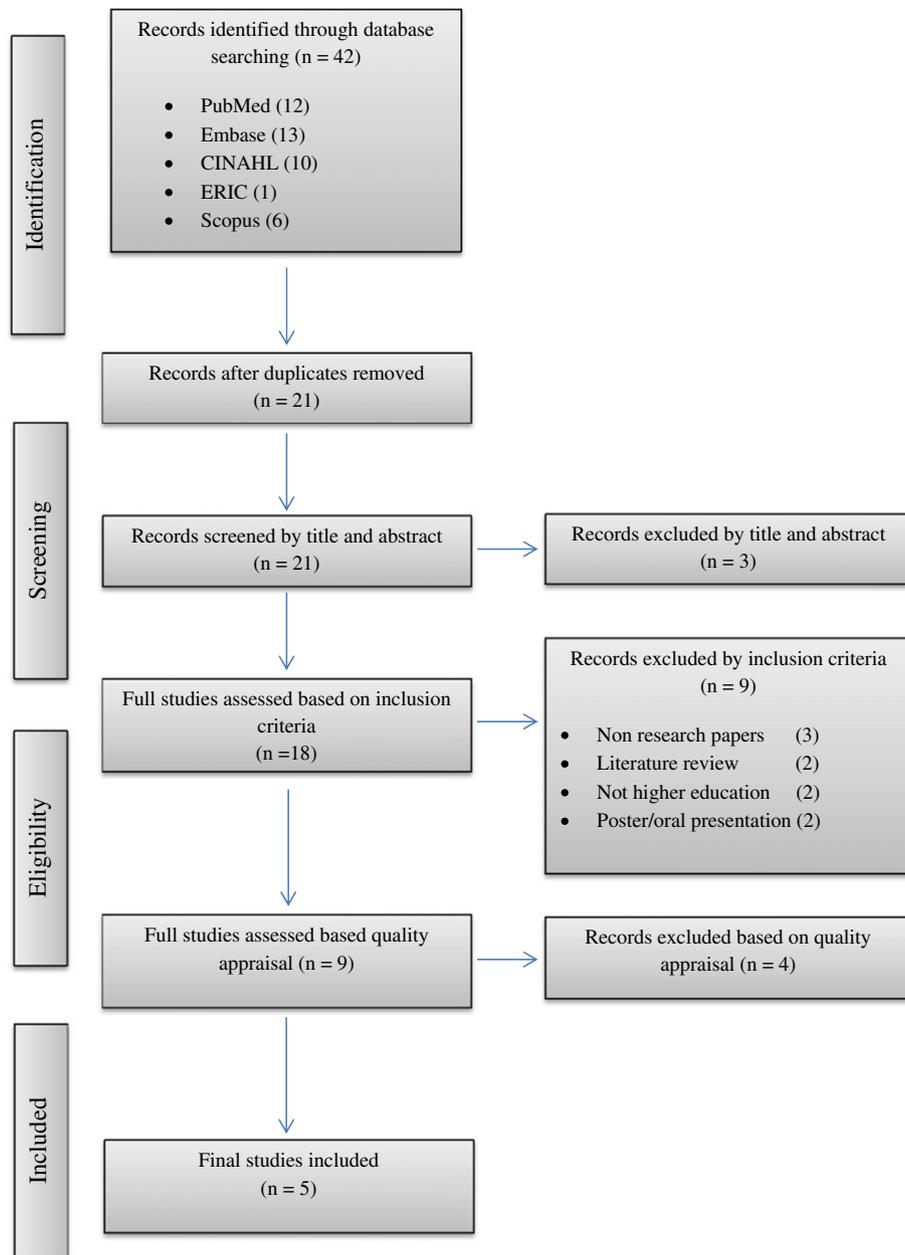
Fig. 1. Flow diagram of systematic review process.

Results

Study Characteristics

This systematic review of the flipped classroom in nursing programmes in higher education and the outcomes associated with this approach to teaching and learning include five studies. All five of the studies that met the inclusion criteria were conducted in the USA between 2013 and 2015. Each intervention lasted for the duration of the unit of the study (e.g. one semester). Two studies used quantitative approaches and three a mixed method design. Four studies focussed on undergraduate nursing students and one focussed on postgraduates. All studies used convenience samples, ranging in size from 20 to 589. In total, there were 934 participants. Researchers employed a diverse range of preparatory and in-class active learning strategies as part of the flipped classroom intervention (Table 3). Two studies used satisfaction scores only, one study used examination scores only and two

studies used both satisfaction and examination scores to compare or evaluate learning outcomes (Table 4).

Academic Performance Outcomes

Three of the studies compared the academic performance of students participating in the flipped classroom to traditional approaches. The studies by Geist et al. (2015) and Harrington et al. (2015) found that there were no differences in the final exam scores between students undertaking traditional lectures and those in the flipped classroom. Conversely, Missildine et al. (2013) reported that students participating in the flipped classroom achieved significantly higher exam scores compared to those undertaking traditional lectures or traditional lectures plus video lecture capture. Despite the lack of difference in final exam outcomes, Geist et al. (2015) reported that students in the flipped classroom group performed significantly better on tests throughout the course. Harrington et al.

Table 2
Summary of included nursing studies for the flipped classroom.

Author/s, year & country	Aim	Design	Sample and study population	Data collection	Methods of analysis	Reported outcomes
Critz and Knight (2013) USA	To test the flipped classroom model as a strategy to energise and engage nursing students in new and more meaningful ways	Cross sectional	$N = 20$ Graduate students in the Family Nurse Practitioner Program	10-item online student satisfaction survey using a 5-point Likert scale and open-ended questions, completed at the end of each of the two semesters	Descriptive frequencies	100% considered the content worthwhile or very worthwhile. Evidence-based articles and short lectures are particularly useful. 95% positive for out-of-class readings 85% felt that level of quizzes is appropriate. 85% positive for working through case-scenarios 85% positive for pre-recorded lectures 85% positive for student lectures, although noted student inconsistencies in abilities 40% wanted more online lectures. 75% felt that the number of assignments was right, 25% felt that there were too many assignments. Text responses were mixed but generally positive.
Geist et al. (2015) USA	To test the effects of the flipped classroom on knowledge acquisition	Pre-test–post-test non-equivalent control group quasi-experimental design	Control group (traditional teaching) $n = 40$ Treatment group (flipped classroom) $n = 46$ Undergraduate nursing students enrolled in consecutive semesters	Both groups' performance measured by three unit tests & 1 final exam Treatment group completed an informal questionnaire at the end of semester	Pre post-test and test for covariance	Flipped classroom group performed significantly better ($p < 0.001$) than traditionally taught group on all three unit tests. No significant difference in final exam performance between flipped class and traditionally taught control group Questionnaire data not reported
Harrington et al. (2015) USA	To objectively compare learning outcomes of two pedagogies	Experimental design using a randomised convenience sample	Control group (traditional teaching) $n = 41$ Treatment group (flipped classroom) $n = 41$ Undergraduate nursing students	Both groups' performance measured by t hree exam, 24 quizzes, and 1 written paper	Descriptive and inferential statistics (t-tests, confidence intervals, equivalence intervals, MANCOVA)	No significant differences between groups on any of the learning outcome measures
Missildine et al. (2013) USA	To determine the effects of a flipped classroom on academic success and satisfaction	Quasi-experimental design	Convenience sample $N = 589$ of undergraduate nursing students enrolled over three consecutive semesters Group 1 (lecture only) $n = 130$ Group 2 (lecture + lecture capture) $n = 129$ Group 3 (flipped classroom) $n = 186$	Average examination scores 16-item faculty developed satisfaction survey using a 4-point Likert scale (75.55% response rate)	ANOVA, Kruskal–Wallis test, z-score	Average grade scores are significantly higher ($p < 0.001$) for the flipped classroom group compared to the other two groups. Students were significantly less satisfied with the flipped classroom approach compared to the other two groups.
Simpson and Richards (2015) USA	To discuss the rationale for course revision, describe the flipped classroom and provide preliminary evaluation	Descriptive and exploratory	Convenience sample of $n = 64$ and $n = 93$ third year undergraduate nursing students	Six items from the online university sponsored course evaluation comparing the flipped classroom cohort to the previous cohort who participated in the traditional course the previous semester Faculty observations In-class paper satisfaction survey given to flipped classroom participants	Descriptive statistics and paired t-tests	No significant differences in university course evaluations between traditional and flipped approaches. Trend results: On average rated the flipped class more positively than traditional classroom. Increased practical application of content Greater variety of interactive learning methods Traditional class considered slightly more conducive to learning Faculty observed that students had a better grasp of population health issues compared to the previous cohort taught in the traditional manner. Satisfaction survey: Students perceived the flipped classroom to be a dynamic approach Greater flexibility and autonomy to pace their learning More responsibility for their learning More opportunities to develop critical thinking skills Supportive, active learning environment that enhanced interaction and engagement Good balance with in-class and online activities increased critical thinking 68% suggested that more courses should be flipped.

Table 3
Flipped learning strategies utilised pre-class and within-class.

Author/s & year	Course/Program	Frequency	Pre-class preparatory strategies	Within-class active learning strategies
Critz and Knight (2013)	Post graduate paediatric course	15 week semester	Minimum 10 h pre-class study; 11 pre-class modules including pre-reordered lectures (20–40 min); peer text books Review of 4–5 journal articles	10-item weekly quiz Case studies Role playing Group problem solving Simulation 10 min student and faculty lectures
Geist et al. (2015)	Undergraduate pharmacology course	Not reported	Viewing online lectures	Applied active learning strategies such as case studies and nursing intervention strategies; and Immediate feedback on skill development
Harrington et al. (2015)	Undergraduate medical–surgical nursing course	Weekly classes January–April	Not reported	Weekly quizzes Other strategies not reported
Missildine et al. (2013)	Undergraduate adult health course	Not reported	Pre-recorded lecture made available to students online	A range of small group activities Simulation case study games Other learning activities that linked the application of theory to practice
Simpson and Richards (2015)	Undergraduate public health science and population health courses	Fortnightly classes	Fortnightly online quizzes Voice over PowerPoints Teaching videos Interactive online modules Directed readings	Small group work Case studies Web quests Videos with response time Group developed presentations

(2015) concluded that the flipped classroom method was equally effective for student learning.

Student Satisfaction

Of the four studies that measured student satisfaction utilising the flipped classroom approach, three reported their findings. Critz and Knight (2013) reported positive feedback with a satisfaction rating of greater than 75% for content, out-of-class readings, level of quiz difficulty, case-scenarios, pre-recorded lectures and the number of assignments incorporated in the flipped classroom. Qualitative comments were generally positive. For example, "I enjoyed the pearls they give us [from the online lectures] to take into our practice." (Critz and Knight, 2013, p. 212). However, some comments were mixed concerning student led-presentations and the variability in presentation skills. A participant in the study by Critz and Knight (2013) commented, "…I would rather listen to the expert (instructor) who has the education and experience, not a peer who knows as little as I do." (p. 212).

Simpson and Richards (2015) found no differences in university course evaluations between the traditional and flipped classroom approach. However, when asking the flipped classroom participants for specific feedback using a customised survey, they rated the flipped course more positively compared to their previous experiences of attending traditional classes. In contrast, Missildine et al. (2013) found that students participating in the flipped classroom were less satisfied with this approach compared to the traditional lecture format or the traditional lecture plus lecture capture approaches.

Challenges of Implementing the Flipped Classroom

Though none of the five studies reviewed evaluated their implementation process, four identified challenges with implementing the flipped classroom approach. Four student-related challenges were identified. Simpson and Richards (2015) and Missildine et al. (2013) reported that students initially struggled to adjust to the flipped classroom and did not seem to perceive the value of interactive learning approaches. Negative comments by students were directed at the amount of out-of-class preparation time (Missildine et al., 2013; Simpson and Richards, 2015). Missildine et al. (2013) suggested that increased preparation time may have negatively influenced student satisfaction levels. Though some students reported difficulty staying organised without regular faculty contact and were dissatisfied being assigned to work groups, Simpson and Richards (2015) observed that these issues lessened over the course of the semester.

Faculty challenges were also identified. Harrington et al. (2015) expressed concern that faculty inexperience in teaching a flipped classroom could influence outcomes. Critz and Knight (2013) noted that more preparation time was needed to implement the flipped classroom. They also suggested that faculty members who prefer a more didactic approach would require mentoring to facilitate interaction in the flipped classroom setting.

Other operational challenges identified by Missildine et al. (2013) included infrastructure, classroom availability and limited high speed internet access for rural and remote students. Observing that the flipped classroom was heavily dependent on information technology (IT) support, Critz and Knight (2013) offered students access to the library and technology centre. Despite these challenges, three studies recommended the flipped classroom model (Critz and Knight, 2013; Geist et al., 2015; Simpson and Richards, 2015) and all studies proposed further research in the area.

Discussion

This systematic review examined how the flipped classroom has been applied in nursing education and the outcomes associated with

Table 4
Outcomes of students' satisfaction and performance.

Author	Satisfaction outcomes for the flipped classroom	Examination scores for the flipped classroom compared to traditional
Critz and Knight (2013)	Increased	Not measured
Geist et al. (2015)	Measured but not reported	Increase in interval scores No significant difference in final exam
Harrington et al. (2015)	Not measured	No significant difference in final exam
Simpson and Richards (2015)	Increased	Not measured
Missildine et al. (2013)	Decreased	Significant increase in exam scores

this style of teaching. Due to the recency of the flipped classroom phenomenon and the dearth of information available in nursing, we found no Level 1 evidence. The heterogeneity of the studies included in this review precluded a meta-analysis being undertaken. Despite the limited number and heterogeneity of studies included in this review, the results indicate the potential for the flipped classroom to transform nursing education, to provide a student-centred approach and better prepare nursing students to apply learning in practice.

The flipped classroom has been implemented and studied more widely in other health disciplines in particular, pharmacology and medicine. The inconsistencies in academic performance outcomes reported in our review reflect similar findings in the broader flipped classroom literature. The flipped classroom has been shown to significantly improve academic performance in other practice-based disciplines such as pharmacy (McLaughlin et al., 2014; Wong et al., 2014) medicine (Sharma et al., 2015; Tune et al., 2013) and dentistry (Park and Howell, 2015). Conversely, other studies have shown comparable academic outcomes, despite not showing any significant improvements in academic performance (Morgan et al., 2015; Murray et al., 2014; Whillier and Lystad, 2015). There is also corroborating evidence that flipped classrooms offer increased opportunities for students to develop critical thinking skills (Horn, 2013) and more efficient use of students' time during lessons (Morgan et al., 2015).

Implications for Nursing Education

The flipped classroom provides a student-centred framework for assisting students to apply theory into practice, become accountable for their learning and prepares them for the challenges likely to be encountered in health care. Through the delivery of the flipped classroom, students learn how to learn, apply information and acquire capabilities and competencies rather than to simply accumulate knowledge. The dynamic and rapidly changing nature of healthcare requires nurses to be equipped with skills in clinical reasoning, problem-solving, critical thinking, information technology and information literacy (Benner et al., 2009; Yuan et al., 2008). To achieve these outcomes curricula need to shift from a pedagogical foundation to one that supports higher order learning and student-centred self-determination. Such higher order learning (Bloom's Taxonomy) is best addressed by being embedded within a student-centred blended learning framework in the context of discipline-based learning where it is perceived to be meaningful (Kiteley and Ormrod, 2009). The flipped classroom extends the andragogical approach which considers student adult learners, to a heutagogical paradigm that values student-centeredness, accountability and self-determination (Blaschke, 2012). The transformational potential of the flipped classroom extends learning beyond the factual content traditionally taught within the classroom setting and assessed by written examinations. However, most studies in this review evaluated the effectiveness of the flipped classroom on academic performance in final exams. To effectively measure the learning associated with the flipped classroom, assessment needs to be realigned to capture higher level learning outcomes (McLaughlin et al., 2014).

From this review, some students were satisfied with the flipped model approach, however it is unknown if this translated to improved final examination scores (Critz and Knight, 2013; Simpson and Richards, 2015). Others were less enthusiastic about the flipped classroom, but performed better (Missildine et al., 2013). This tension between academic performance and satisfaction has been reported in other studies (Horn, 2013; Tune et al., 2013) and could potentially be explained by an apparent increase in workload (Tune et al., 2013) or other features of the flipped classroom such as group-based activities (Horn, 2013).

Implementing the Flipped Classroom

The literature on flipped classrooms provides numerous suggestions for transitioning to this student-centred model. Though unable to make generalised conclusions on the basis of these five studies, this review highlights the need for time and resources (including educational technology and expertise) to be allocated to develop unit content and facilitate the flipped classroom. McLaughlin et al. (2014) estimated that faculty required 127% more preparatory time, but like Della Ratta (2015) estimated that this would decrease in the future due to resources being reused.

Though the flipped classroom requires students to invest time upfront, McLaughlin et al. (2014) suggest that the ongoing learning and the interval testing means that less time is spent studying for final exams. Hawks (2014) and McLaughlin et al. (2014) also highlight the need for students to be given a detailed rationale and the motivation for the implementation of the flipped classroom as it facilitates students' engagement in the process. Four of the studies in this review highlighted the necessity for cultural and pedagogical changes within academia to enable the implementation of the flipped classroom. Gilboy et al. (2015) and Park and Howell (2015) also called for mentoring and ongoing support to assist faculty to adjust to the flipped classroom paradigm.

Limitations

Although the search strategy was extensive and inclusive, some relevant studies may have been missed. To alleviate the risk of oversight and ensure that the review was rigorous and comprehensive, logic tables were developed and the search strategy applied to five major relevant databases including an educational resource information database (ERIC). This review was limited by the small number of studies that met the inclusion and quality criteria. However, the use of 11 quality indicators enhanced the assessment of the strengths and limitations of the available evidence. Limitations were mitigated by involving the four reviewers independently during the selection and extraction stages.

Conclusion

This systematic review, limited to five studies involving 934 participants, provides insight into the implementation and outcomes of the flipped classroom in higher education nursing programmes. The findings could be useful to others considering this approach. The review highlights the lack of evidence about flipped classrooms in nursing compared to other health disciplines. The student-centeredness of the flipped classroom provides flexibility and the potential to increase opportunities for students to develop and apply the critical thinking skills pre-requisite for contemporary nursing practise. The use of the flipped classroom in higher education nursing programmes has either increased or had no significant effect on student's academic performance. This finding is also reflected in the broader literature. Variations in the relationship between student satisfaction and academic performance with the flipped classroom model require further research. Further research is needed to examine the implementation process, value of pre- and within-class active learning strategies and the outcomes of the flipped classroom using alternative measures. Notwithstanding the need for further evidence, the flipped classroom offers transformative potential to reform nursing education.

Conflict of interests

None.

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