USE OF RESEARCH IN UNDERGRADUATE NURSING STUDENTS' THESES:

A MIXED METHODS STUDY

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ABSTRACT

Background: Health care personnel are expected to be familiar with evidence-based practice (EBP). Asking clinical questions, conducting systematic literature searches and conducting critical appraisal of research findings have been some of the barriers to EBP. To improve undergraduate nurses' research skills, a collaborative library-faculty teaching intervention was established in 2012.

Objectives: The aim of this study was to evaluate how the collaborative library-faculty teaching intervention affected the nursing students' research skills when writing their final theses.

Design and setting: Both quantitative and qualitative data collection and analysis were used. The study focused on a final year undergraduate nurse training programme in Norway.

Participants: 194 theses submitted between 2013 to 2015 were collected and assessed. The students were exposed to the intervention for respectively one, two and three years during this period.

Methods: Descriptive statistics were used to compare each year's output over the three-year period and to examine the frequency of the use of various databases, types of information and EBP-tools. Qualitative data was used to capture the students' reasoning behind their selection processes in their research.

Results: The research skills with regard to EBP have clearly improved over the three years. There was an increase in employing most EBP-tools and the justifications were connected to important EBP principles. The grades in the upper half of the grading scale increased from 66.7 to 82.1 percent over the period 2013 to 2015, and a correlation was found between grades and critical appraisal skills.

Conclusions: The collaborative library-faculty teaching intervention employed has been successful in the promotion of nursing student research skills as far as the EBP principles are concerned. Writing a thesis in the undergraduate nursing programme is important to develop and practice these research skills.

INTRODUCTION

This paper sets out to evaluate the outcomes of a collaborative library-faculty teaching intervention for research application as a part of evidence-based practice (EBP) in an undergraduate nurse training programme in Norway. EBP involves clinical decisions, which are founded on the best scientific evidence and clinical expertise alongside patients' preferences in a specific context (Straus et al, 2011). This implies that health care personnel have to be familiar with asking clinical questions, conducting systematic literature searches and conducting critical appraisal of the research findings, which have been some of the barriers to implementation of EBP (Straus et al., 2011). Research use is an essential aspect of EBP in health care, and therefore these skills need to be acquired in undergraduate health education.

Nursing education in Norway involves a three-year programme, including writing a thesis in the final term. This provides an opportunity to attain the research skills that are required in future professional practice. The thesis in Norway is afforded 15 ECTS (European Credit Transfer and Accumulation System), which in this specific programme is allotted 10 weeks full-time work and a written documentation of about 9000 words for an individual thesis and about 11.000 words for a joint thesis. The thesis is required to take the form of an extended literature review focusing on a nursing-related theme. It includes: 1) an introduction culminating in a precise research question, 2) a methods section describing the literature search by search terms and relevant databases; at least four peer reviewed journal articles have to be presented and critically appraised, 3) a theory section presenting relevant literature like government documents, guidelines, legislation and the like, 4) a discussion of the research question based on the selected literature, 5) a conclusion and 6) an accurate citation and reference list in APA style. Additionally, since 2014 the search strategy and a PICO framework is required when submitting the thesis. PICO is a categorisation of search terms into population, intervention, comparison and outcome. Beyond these criteria, EBP is not mentioned.

The requirement for research application in nursing is anchored in the International Ethical Guidelines for nurses and educational frameworks. The ICN Code of Ethics emphasises that nurses must determine and implement research-based standards in their clinical practice and should be "active in developing a core of research-based professional knowledge that supports evidence-based practice" (2012, p. 3). The Norwegian Qualifications Framework in Higher Education is based on the Bologna process, European Higher Education Area. Even this framework specifies expected learning outcomes for candidates with a Bachelor degree, which includes skills in finding, evaluating, referring and applying scholarly information (Ministry of Education and Research, 2012, pp. 7-8).

A number of studies have found that it is challenging to teach research skills to undergraduate nursing students (e.g. Duncan & Holtslander, 2012; Jacobsen & Andenæs, 2011; Ragneskog & Gerdner, 2006), and collaboration between faculty and library staff is essential to succeed (Bønløkke et al., 2015; Cader et al., 2006; Gannon-Leary et al., 2003; Nayda & Rankin, 2008). The library staff has to engage in the domain of nursing to fully understand and accommodate the specific information needs of nursing students (Sundin et al., 2008). The teaching content and the learning goals should be consistent. It is not enough to teach how to search for information; skills such as formulating a research question and critically appraising, analysing and synthesising the literature are also required. This requires boundary crossing and mutual learning between faculty and library staff (Limberg & Folkesson, 2006).

Moreover, it is recommended that teaching research skills should be systematically integrated into the nursing curriculum and closely related to course assignments (Barnard et

al., 2005; Duncan & Holtslander, 2012; Klem & Weiss, 2005). Several empirical research studies have explored a written thesis as a potential strategy for improving these skills (Friberg & Dahlborg Lyckhage, 2013; Kapborg & Berterö, 2002; Lundgren & Halvarsson, 2009; Lundgren et al., 2008; Lundgren & Robertsson, 2013; Mattila et al., 2005). However, these strategies have mainly been evaluated by questionnaires concerning the students' experiences, satisfaction and self-evaluation of skills, and not the process and product of the student thesis as a work assignment.

The aim of this study is to evaluate how a collaborative library-faculty teaching intervention affects the nursing students' research skills when writing their theses.

The research question focused upon is: How do the research skills of undergraduate nursing students evolve as a result of a collaborative library-faculty teaching intervention? This is assessed by examining theses submitted over the three-year implementation period, 2013-2015.

METHODS

This study uses mixed research methods. A quantitative data collection and analysis is supported by qualitative data to acquire a broader and deeper understanding of the outcomes of the teaching intervention applied (Johnson et al., 2007).

Teaching intervention

A new library-faculty teaching intervention was implemented to improve nursing students' research skills related to EBP in 2012, more thoroughly described in Nordsteien and colleagues (2013). The teaching intervention included the first four steps of the main EBP model: 1) cultivate a spirit of inquiry, 2) ask clinical questions in a PICO format, 3) search for the best evidence and 4) critically appraise the evidence (Melnyk et al., 2010). Additionally, the S-Pyramid was promoted, which is organising information sources into six levels to facilitate easy access to high quality research (Dicenso et al., 2009). A number of different small seminar groups were used for teaching, focusing, for example, on demonstrations of databases and practical exercises on computers; always linked directly to study assignments with relevant clinical application. A close collaboration between librarians and nurse educators was established to be able to teach the EBP-model effectively throughout all three years of the study programme. Representatives from both professions were involved in planning the course content together, attending the same classes and workshops, and sometimes, alternating teaching and giving feedback to the students. The librarians taught mainly steps 2 and 3 of the EBP-model, while the nurse educators focused on the other steps. However, there were no strict boundaries, since both members of teaching staff participated in each other's sessions. The students who graduated in 2013, were exposed to the new teaching intervention only during their final year, while the students who graduated in 2014 and 2015 were respectively exposed to the intervention for two and three years of their programme.

Sample

In total 194 electronic versions of Bachelor's theses were collected and assessed. 42 of these were from students who graduated in 2013, 74 from students who graduated in 2014 and 78 from students who graduated in 2015. This accounted for 76%, 94% and 98% of the total number of theses submitted of each respective year. Some of the students in each year chose not to participate. The increased number of participants between 2013 and 2014 may be due to increased knowledge among the students about the teaching intervention and this evaluation. Moreover, the regular teaching and a tighter relation between the 2014 and 2015

students and the librarians may have motivated more students to participate. The number of individual submitted theses increased from 64 percent in 2013 to 76 in 2014 and 77 percent in 2015.

Quantitative method

The main intention of the study was to measure the effect of the teaching intervention by examining possible changes in the use of information sources, types of literature and EBP-tools across the three years. A coding scheme was developed following an initial cursory reading of a number of theses to get an understanding of what kinds of resources were being used. All databases, EBP-tools and information types, such as reviews, guidelines, point-of-care tools and legislation, were listed as variables. These variables were given the values 1 for yes and 0 for no. Additionally, variables regarding grading, the total number of databases employed and research articles were included in the scoring. Descriptions were made in the code scheme to guide coding.

The theses were divided between the two first authors of this paper for coding. Each author coded half of the theses submitted in each of the three years. The theses were given a reference number together with the graduation year. The theses were coded based on a read through of the methods sections, reference lists, PICO and search strategies. Values were assigned for each variable on a separate sheet for every thesis. The search function in Word was also used to double-check that everything was included. In cases of uncertainty, follow-up questions were noted on the thesis sheet. After coding, the authors exchanged every tenth thesis, in total 19 theses, to check for intercoder reliability, which proved to be 0.84. Three cases of disagreement related to categorisation of articles were resolved, and all the 194 code sheets were readjusted according to these agreements to improve the consistency of coding. The coding sheets were entered into SPSS version 24.0 and double-checked for possible errors.

Qualitative method

The supplementary qualitative data aimed to capture the students' rationale for selection and use of various databases, information types and tools within EBP. Having data source of approximately 6000 text pages, random sampling was applied to conduct qualitative analysis. 25% of the theses from each submission year were randomly selected. The qualitative data was acquired by digitally marking text containing explicative rationale while doing the quantitative coding of the theses. These 49 theses were imported into NVivo11, and a second reading was conducted, and the rationales were coded into the three main categories of interest (cf. Bazeley & Jackson, 2013). This generated a collection of different rationales for the information seeking related choices that provided illustrative examples of student's ways of reasoning upon information seeking for their thesis work.

Ethical considerations

Approval for this study was granted by the head of the Department of Nursing Science. The students were informed about the study prior to starting to write their thesis. They were informed that participation was voluntary, and that they could withdraw their consent at any time without any consequences. Anonymity was ensured, since the theses only contained a candidate number. Written consents were obtained from the participating students by the exam office when they submitted their thesis.

RESULTS

194 theses were analysed to better understand how undergraduate nursing students apply research after having attended teaching focusing on EBP. Descriptive statistics were used to examine the frequency of the use of various databases, types of information and EBP-tools. Qualitative data was used to capture the students' reasoning behind their selections.

The quantitative data will mainly be presented under the respective subheadings below, however, in certain contexts, qualitative and quantitative data will be mixed to substantiate each other.
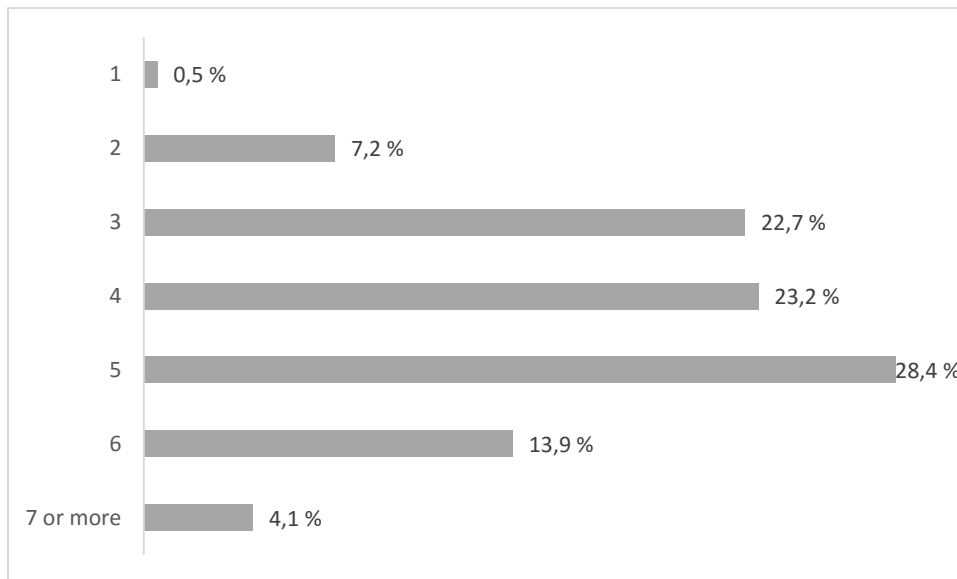
Selection of databases and search engines

Table 1 shows the most frequently selected databases and search engines used to find research studies for these theses. The students were instructed to use several databases to locate literature, due to the different content of the databases. PubMed/ Medline and Cinahl were most extensively employed, since they are the largest medical databases, and therefore promoted in library classes throughout the nurse training programme. McMasterPLUS is a frequently used EBP tool based on the S-Pyramid. This search engine was also being recommended throughout the three years, while the other databases were promoted to a lesser degree.

Table 1: Selected databases and search engines (N = 194)

Databases/ search engines	Frequency	Percentage
PubMed or Medline	186	96
Cinahl	155	80
McMasterPLUS	131	68
Library catalogue	94	48
SveMed +	82	42
Cochrane	62	32
Ovid Nursing	48	25
PsycInfo	17	9
Google or Google Scholar	11	6

Chart 1 illustrates the number of resources that were used in each thesis. The majority searched for research in three to five resources. There was no statistical significance between the submission year and the number of selected search engines or databases (significance level p<0.05 in chi-square tests).

Chart 1: Sum of search engines and databases used in each thesis (N = 194)

Several of the students justified their selection of databases and search engines by their familiarity and easiness:

> "The databases I employed are databases I got to know through my programme. I think they are easy to search and comprehensible".

Few students reported the use of Google/ Google scholar. The students were told that they have to search systematically in relevant medical databases and cannot rely on Google alone, but that Google may be used as a supplement. Google and other search engines like YouTube were in these cases used to find information about the subject and experts in the field as illustrated in the cases below:

> "I have found an important researcher on delirium through my database search. She is one of the pioneers within the Confusion Assessment Method, thus, I have used both Google Scholar and Google to find more research that she has done".

> "We also searched YouTube to find lectures about ADHD. That led us to the name of an expert in this research field".

Selection of information types

Table 2 summarises what types of information the theses were based on. According to the table, ethical guidelines for nurses and relevant legislation were used in nearly all theses. Reviews, research syntheses, guidelines, point-of-care tools and official government documents were frequently used.

Table 2: Selected information types (N = 194)

Information types	Frequency	Percentage
Original research articles	194	100
Legislation	174	90
Ethical guidelines for nurses	170	88
Reviews and other research syntheses	151	78
Guidelines	126	65
White papers/ Official documents	87	45
Point-of-care tools (UpToDate/ Best Practice)	85	44

The only criterion given regarding information types was the inclusion of at least four research articles. Chart 2 illustrates how many research articles each thesis included cross the three years. The most frequent number was four in 2014 and 2015, the minimum requirement. However, in 2013 the most frequent number was eight to ten research articles, and a large proportion even included eleven or more.
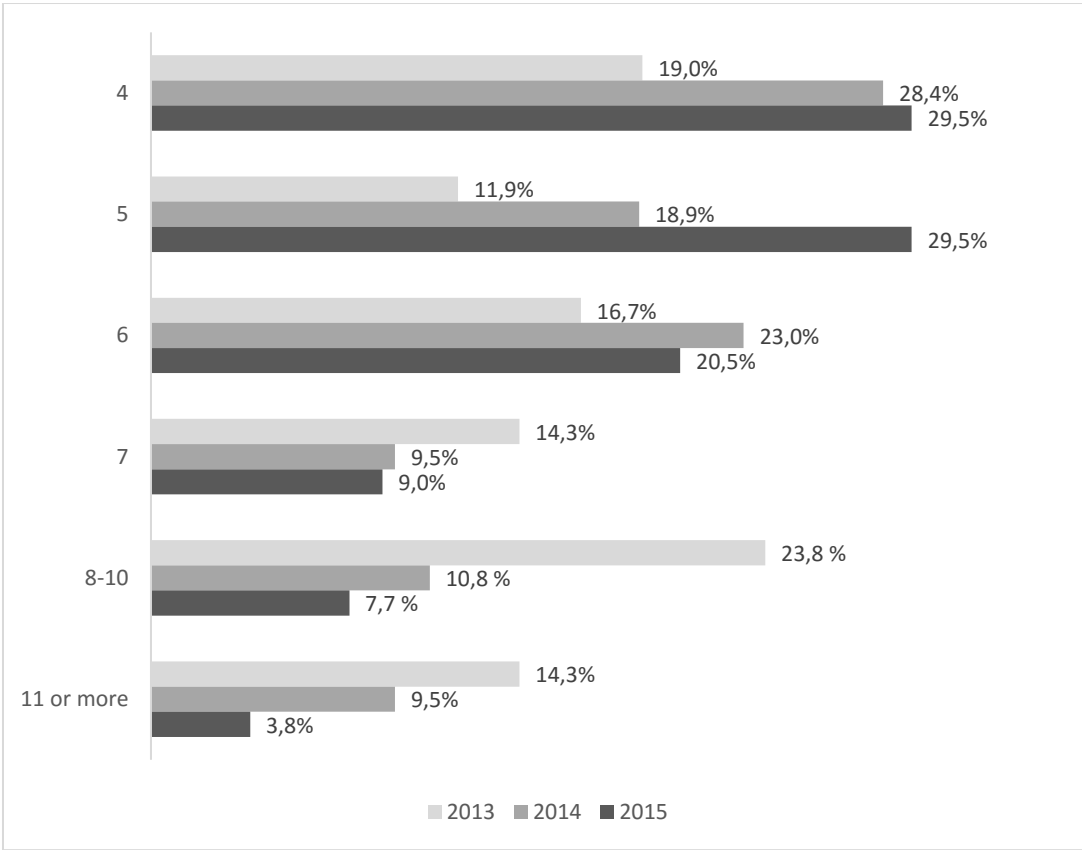
Chart 2: Sum of included research articles

The total number of selected articles declined steadily from 2013 to 2015.

Use of EBP tools

EBP-related tools mainly included the use of the S-Pyramid and its resources on higher levels (point-of-care tools, guidelines and Cochrane reviews) and critical appraisal checklists. Table 3 shows how the use of different EBP-related tools changed in theses submitted in 2013, 2014 and 2015. There was a significant increase in the use of McMasterPLUS and point-of-care tools from 2013 to 2014. Justification for the selection of information types by reference to the S-Pyramid increased clearly over the three years, and the use of checklists for critical appraisal improved slightly over the same period. Cochrane library searches increased significantly from 2014 to 2015. However, the use of guidelines decreased slightly over the three-year period.

Table 3: Development in use of EBP-tools in theses submitted from 2013 to 2015

EPB-tools	2013 (%)	2014 (%)	2015 (%)	p-values 2013-14	p-values 2014-15	p-values all three years
McMasterPLUS search	40.5	75.7	74.4	<.001	.853	<.001
Referring to S-Pyramid	19.0	32.4	82.1	.123	.001	<.001
Use of Point-of-care tools	21.4	54.1	46.2	<.001	.333	.003
Use of guidelines	71.4	66.2	60.3	.567	.450	.454
Cochrane search	23.8	24.3	43.6	.951	.012	.017
Checklist appraisal	40.5	44.6	55.1	.670	.197	.236

A requirement for the thesis was to critically appraise research articles used. Some of the students reported appraising the research by basic characteristics such as peer reviews, publication year, journal, authors, IMRAD structure, ethical considerations, relevance etc.

There was a slight increase of use of checklists over the three years. The use of checklists as a tool was justified in the following way:

> "Original research studies from Medline, PubMed and Cinahl require a close critical appraisal, since the articles have not undergone the same critical appraisal as the articles from McMasterPLUS and Cochrane library".

Another aspect of critical appraisal may be to justify the selection of information resources and types of information related to the S-Pyramid. References to the S-Pyramid increased significantly over the three years (p<0.001). The following examples illustrate these justifications:

> "I have selected articles from the different layers of the S-Pyramid. I have consciously excluded articles from the lowest level, because the articles on higher levels are critically appraised, comprehensible and applicable".

> "An important principle in EBP is to use research syntheses, such as systematic reviews. Thus, I decided to start my search in McMasterPLUS, which is inspired by the principles behind the S-Pyramid".

> "The following databases are slightly different, and were chosen to complement each other. They have content on different levels of the S-Pyramid".

Several students connected their thesis writing to EBP generally:

"By carrying out a literature review I can, as a student, develop my skills to critically appraise and reflect upon research content and its relevance to my practice. I think that through using literature review as a method, I will become familiar with how I can acquire research-based knowledge as a step of working in an evidence-based manner".

Assessment of the theses is based on the ECTS grading scale ranging from A to F. In Norway, A, B and C are characterised respectively as 'excellent', 'very good' and 'good' performance. These grades regard the student's judgement and independent thinking, and form the basis for admission to graduate education. The grades D, E and F respectively represent 'limited', 'very limited' and 'an absence of judgement and independent thinking'. The number of theses awarded A, B or C, during the three year intervention, increased from 66.7 percent in 2013 to 74.3 in 2014 and 82.1 percent in 2015. A correlation was found between grading and critical appraisal. The p-value was 0.015 between grading and providing justification related to the S-pyramid, and 0.004 between grading and using checklists for critical appraisal.

DISCUSSION

The aim of this study was to evaluate a collaborative library-faculty teaching intervention by examining nursing students' theses submitted between 2013 and 2015 in a Norwegian undergraduate nurse training programme. The teaching intervention was intended to enhance the students' research skills according to EBP.

The main findings demonstrate that research use according to EBP has improved during the course of the three years of library teaching transformation. There is an increase in employing most EBP-tools; some tools use only slightly increased over the three years, and the use of others was more extensive. According to Dicenso et al. (2009), a literature search should begin at the highest possible level of the S-pyramid. McMasterPLUS enables the students to do a quick search at all levels of the S-pyramid simultaneously. Table 3 shows almost a twofold increase in the use of this tool from 2013 to 2014. Nearly three quarters of the theses submitted made use of this search engine in 2014 and 2015. This indicates a broad awareness of one of the most important principles in EBP. Over the same period there is also a doubling in reference to Point-of-care tools, which are at the top of the pyramid. Searching the Cochrane database also increased significantly from 2014 to 2015. This equally reflects a raised awareness of the research sources. Surprisingly, the use of guidelines slightly dropped over the same period, possibly in favour of the increased use of McMasterPLUS and the other databases. Guidelines are considered as substantiating information for theses, however, they do not count as research articles.

As highlighted by Dicenso et al. (2009), Straus et al. (2011) and Limberg and Folkesson (2006), critical appraisal skills are required alongside the capacity to select and search the most relevant databases. In this study, critical appraisal was evaluated through student's use of checklists and justifications for the selection of literature, for example, with references to the S-pyramid. While checklist appraisal increased only slightly over the three years, making references to the S-pyramid increased considerably (table 3).

A positive correlation was found between grading and these critical appraisal skills. The relationship between grades and specific variables is complicated, but it may be reasonable to assume that critical appraisal skills can be considered part of good judgement and independent thinking, which are the characteristics of the A-C grades. An important aspect here was a clear tendency that the theses from 2013 only mentioned that checklists had

been used, while more of the 2014 and 2015 theses additionally demonstrated ***how*** the checklists had been used. The students not only knew that they should use checklists, but they were additionally demonstrating judgement and independent thinking related to critical appraisal.

The overall grades were very good in all three years, and the number of A-C grades progressively improved from 66.7 to 82.1 percent over the three years. Getting a good grade is important for these students to be accepted to do further education, which is a career goal for many students these days. However, there was no statistical significance between grading and other variables than critical appraisal in this study, neither the number or the kind of research articles. According to Chart 2, most theses included four to six research articles, the minimum requirement, however, the most frequent number research articles included in 2013 was eight to ten. The number articles referenced was even decreasing from 2013 to 2014 and 2015. The explanation may be the new thesis requirements; to properly describe and appraise each selected article, which is very time consuming and requires use of many words. Moreover, the students are used to including a defined number of research articles in other assignments, and may also in this case have considered four referenced articles as the "right" number. Using EBP-tools and sources are not requirements for the thesis, and it is possible that a reasonable content, demonstration of critical appraisal skills and compliance with the minimum requirements results in a good grade.

The extracted quotes in the results section illustrate that the different rationale made for many of the choices are clearly connected to EBP. There are examples of searching for experts in Google and YouTube to find the best information. Often, even the patient perspective is included in the thesis introduction as a patient case. This makes both patients, experts and researchers visible in the spirit of EBP (cf. Straus et al., 2011). The EBP reasoning was found to a much greater extent in the 2014 and 2015 theses. The qualitative results also demonstrate that the nursing students seem to put great efforts into their theses. PICO, search history and referencing were, in general, managed correctly. This indicates that the library teaching content, the learning goals and thesis requirements are consistent in this case (cf. Limberg & Folkesson, 2006).

The overall results of this study demonstrate the students' ability to practice in their thesis writing what they have learnt about research application in EBP. The findings are related to the previous research findings about the importance of strong library-faculty collaboration and the engagement in each other's professional domain (Bønløkke et al., 2015; Cader et al., 2006; Friberg et al., 2013; Nayda & Rankin, 2008; Sundin et al., 2008). Additionally, the suitability of practising research skills while writing a thesis over some weeks, is probably an important explanation for the success of this intervention (Friberg & Dahlborg Lyckhage, 2013; Lundgren & Robertsson, 2013; Mattila et al., 2005). However, while some of the previous research claims that it is challenging to teach research skills to nursing students, the present study finds that it is possible to accomplish good results by systematic and collaborative library-faculty teaching throughout the three-year nurse training programme. Timing and integration of this teaching with respect to curriculum assignments are believed to be essential (cf. Barnard et al., 2005; Duncan & Holtslander, 2012; Klem & Weiss, 2005).

Methodological considerations

The only new requirements during the three years were inclusion of the search strategy and PICO. The information in these forms is additionally included in the methods section of the thesis in all three years, thus, the new requirements are not likely to influence the results. There are no known differences between the students in the three graduation years due to qualifications, and they were offered the same guidance from librarians and nurse

educators. The theses were collected from three final years of only one nurse training programme, thus, it is not possible to generalise the findings of this study.

CONCLUSION

This study concludes that the collaborative library-faculty teaching intervention employed has been successful in the promotion of nursing student research skills according to the EBP principles. One indication of this is the increase of the upper grades from 66.7 to 82.1 percent and the correlation between grades and critical appraisal skills. Additionally, more students wrote an individual thesis in 2014 and 2015, which may indicate a greater confidence in this regard. Writing a thesis in the undergraduate nursing programme is important to develop and practice research skills. From the teaching side, the development of a systematic library-faculty collaboration is crucial. This ensures that library teaching input is directly applicable and accommodates the student's needs at the right time. A strong library-faculty collaboration may additionally contribute to professional development of both, which is essential to improve teaching and supervision of the students. However, there are still some remaining issues relating to the implementation of EBP in clinical nursing. For instance, even if these students have the research skills, will they be able to transfer them to their workplace? How will these skills be encouraged in everyday clinical nursing practice, and how can the gap between theory and practice be reduced? These are questions that need further investigation. This study can contribute to improvements in teaching research skills for EBP, and emphasises the value of library-faculty collaboration and thesis writing in this regard.

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