TO EMBED OR NOT TO EMBED? A LONGITUDINAL STUDY EXPLORING THE IMPACT OF CURRICULUM DESIGN ON THE EVIDENCE-BASED PRACTICE PROFILES OF UK PRE-REGISTRATION NURSING STUDENTS.

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Abstract

Background

The use of Evidence-Based Practice (EBP) is increasingly emphasised within healthcare. However, little research has focused on nurses' pre-registration training; particularly regarding the impact of curriculum-design on learning EBP.

Objectives

This study compared the impact of embedding EBP throughout the curriculum, with modular-based teaching, on pre-registration nursing students' EBP profiles.

Design

A longitudinal panel study.

Settings and participants

A convenience sample of fifty-six pre-registration nursing students (55.4% studying an embedded EBP-curriculum and 44.6% studying a modular EBP-curriculum), were recruited from a UK University between 2011 and 2014.

Methods

Participants completed the Student Evidence-Based Practice Questionnaire (S-EBPQ) in the first, second and third year of their course. This questionnaire measures

four EBP domains: frequency of use, attitude, knowledge and skills in retrieving and reviewing evidence, and knowledge and skills in applying and sharing evidence.

Results

Two-way mixed between-within Analyses of Variance revealed significant improvements across all domains, except attitude (which remained broadly positive across all years), for both curriculum-groups.

No significant differences in this improvement were identified between the two curricula overall. However, the direction and rate of change of scores on the retrieving and applying subscales (but not frequency of use) for the two groups differed across time; specifically those on the embedded curriculum showed a dip in scores on these subscales in year 2. This appeared to be related to associated features of the course such as the timing of placements and delivery of theory.

Conclusions

Taking a modular or embedded approach to EBP may have little impact on students' final EBP profiles. However, careful consideration should be given to the timing of related course features which may play a key role in students' perceptions of their knowledge and skills in its application. Further research should explore how curriculum-design might build on students' initial positive attitudes towards EBP and its use in their practice.

Keywords

Evidence-Based Practice; curriculum development; S-EBPQ; undergraduate education; constructivism.

Introduction

Evidence-Based Practice (EBP) skills, such as being able to locate, appraise, interpret and apply knowledge, are recognised as crucial competencies for the 21st century healthcare professional (Young, Rohwer, van Schalkwyk, Volmink & Clarke, 2015). However it has been noted that the frequency with which nurses use research evidence in their practice needs to be increased if it is to have a more substantive impact (Christie, Hamill & Power, 2012). One significant predictor of the future use of evidence-based practice is the confidence and preparedness for clinical decision-making of student nurses (Brown and Kim 2010). Furthermore, given that the culture of the educational environment reflects expectations about how the nurse should act in the clinic (Warne and McAndrew, 2009; White and Winstanley, 2010), it stands to reason that better training in EBP at undergraduate level will lead to improved implementation in clinical practice.

Research examining the effectiveness of strategies to enhance EBP use through educational curriculum design, albeit limited, suggests that there are many challenges to incorporating EBP education in nursing curriculum design and implementation (Rolloff, 2010). These challenges include decisions such as the point at which EBP concepts should be introduced into a program of study; how much emphasis should be placed on research concepts and methodologies versus EBP skills and methods; whether EBP should be taught as a standalone topic, or integrated into other subject units; (Malik, McKenna & Griffiths, 2015). Difficulties teaching EBP can also stem from ambiguity in the definition, description and conceptualisation of the EBP model (Young, Rohwer, van Schalkwyk, Volmink, & Clarke, 2015).

Research exploring student nurses' perspectives on EBP frequently identifies barriers to its use, including: not seeing the value of research skills for practice, low uptake of EBP in practice and inconsistencies in information- and research literacy skills (Leach, Hofmeyer & Bobridge 2015; Rolloff, 2010). This suggests that the challenges of teaching EBP may be undermining the development of the skills necessary for EBP, which highlights the value of, and need for further research exploring the impact of curriculum design on the learning of EBP.

Background

EBP is commonly conceptualised as comprising five steps: acknowledging uncertainty and phrasing clear questions, searching for research evidence, critically appraising and interpreting evidence, considering applications and evaluation (Young et al., 2015). These steps are mirrored in nursing competency standards and are usually emphasized in the content of Evidence-Based Health Care (EBHC) curricula (Young et al., 2015).

Although there are many strategies for teaching EBP, there is scant literature addressing how EBP should be incorporated into undergraduate nursing education programmes (Malik et al., 2015). In a review of 32 Australian Universities' Bachelor of Nursing curricula, Malik et al. (2015) found substantial differences between programs, including: whether or not specific units relating to EBP or research were offered; the degree of emphasis placed on research concepts and methodologies; extent to which EBP related objectives were woven throughout units of study, and; time-point at which research and EBP units were introduced in the program of study. Although restricted to undergraduate nursing provision in Australia, this evokes the diversity in curriculum design that may be expected in the UK. For example, in a review of pedagogical

principles underpinning undergraduate nursing curricula in the UK, Mackintosh-Franklin (2016) identified that curricula were designed around acquisition of knowledge, skills, and fitness to practice rather than specific pedagogies. Of the 17 Higher Education Institutes that did refer to pedagogy, two indicated that their curricula were informed by constructivist principles.

Constructivism is an educational theory that views learning as an active, context-based process. Thus knowledge is not simply something that is passed on from teacher to student as proposed by traditional didactic teaching methods. Instead, each student constructs their own knowledge and understanding of the world from repeated experience, practice, critical examination and reflection on core topics. Iterative revisiting of key themes or topics are central to this process of knowledge acquisition. Each successive encounter builds on the previous one by reinforcing prior learning, and presenting the topic in increasing complexity as the learners' critical thinking skills develop (Coelho & Moles, 2015). In this model learning is therefore underpinned by the development of skills in critical thinking and personal enquiry, both of which are also essential components of EBP. It is therefore perhaps not surprising that constructivism has been suggested as a potential framework for integrating the core steps of EBP into nursing educational curricula (Rolloff, 2010).

Curricula that embed EBP in this way are typically referred to as *Spiral* curricula and involve two forms of integration of topics. The first is horizontal, meaning that topics of increasing complexity are studied across the years. The second is vertical meaning that previous topics in the curriculum are explored in light of learning of more complex topics. In this way learners are provided with multiple opportunities to engage with the cycle of experience, reflection, thinking and planning that is typically associated with effective learning (Coelho & Moles, 2015).

Although the body of research evaluating the effectiveness of spiral curricula on EBP learning in nursing is small, it highlights a number of potential advantages. In a review of literature between 1980 and 2011, Christie et al. (2012) suggest that student nurses can best be supported to value the relevance, importance and utility of research evidence for patient care, if research learning is embedded in both academic and practice settings. This means weaving the learning of research skills across the nursing curricula and beyond the confines of "research classes" (Christie et al., p.278). Indeed, interventions that integrate information-literacy skills have been associated with better performance (as measured through objective skills tests) than stand-alone, discrete modules (Shorten, Wallace & Crookes, 2001).

There are a number of factors that may influence the learning of EBP in undergraduate nursing education. For instance it is important to recognise that undergraduate students in different years have different needs, which may have an impact on engagement and outcomes (McBurnie, Campell & West, 2012; Thompson et al., 2013). For example, Lo (2002) found that undergraduate nursing students experienced significantly more transient stress in year 2 of their studies. It is therefore important to explore the learning experience across the whole curriculum. Furthermore, the interplay between academic and clinical teaching contexts is likely to have an impact on students' EBP learning experiences. For example, students may best understand the philosophy of EBP when involved in its practical application with actual patients (Elçin, Turan, Odabaşı and Sayek, 2014). Research also suggests that multifaceted, clinically integrated teaching and learning strategies, with assessment, are the best options for improving EBHC knowledge, skills and attitudes (Young et al., 2014; Cheng et al., 2012). However, discrepancies between the uptake and implementation of EBP in academic and clinical teaching contexts can exist (Upton,

Scurlock-Evans, Williamson, Rouse & Upton, 2015) which may impact on students' learning experiences.

Although nurses use many types of evidence in clinical decision-making including patient preferences, clinical experience and contextual knowledge, research evidence and the translation of research evidence into practice remain crucial components of EBP (Christie et al., 2012). Indeed, Christie et al. (2012) argue that developing the skills required to use research - such as assessing research authority, quality and how to apply "standardized" knowledge to patient-centred situations - is a complex process in which nurse lecturers play a key role.

This study therefore compared the impact of a spiral EBP (embedded) curriculum, with modular-based EBP teaching, on pre-registration nursing students' self-reported use of, attitudes towards, and knowledge and skills in EBP.

Methods

Design

A longitudinal panel study design was adopted: the same group of participants were invited to complete a measure of EBP frequency of use, attitudes and knowledge and skills in EBP at set intervals during their courses. Two groups of pre-registration nursing students (those studying on a modular EBP curriculum and those studying on an embedded EBP curriculum) participated in the research. Longitudinal panel studies are suited to understanding the interrelationships between experiences, behaviors and preferences, with change measured at the individual rather than the group level. This design was therefore chosen as it allowed causal inferences to be more reliably made

about how the experience of a given curriculum affected student knowledge use and attitude towards EBP

Settings

The study was feasible because two undergraduate curricula were running simultaneously within the nursing department at one university. A traditional "modular" curriculum was being replaced with an embedded-curriculum. This allowed the two curricula to be compared whilst controlling for organizational context and teaching staff characteristics, and minimising temporal differences in data collection.

Modular-curriculum characteristics. There were two pathways within this curriculum – those studying for a Bachelor level nursing degree and those studying for a Diploma of Higher Education in Nursing Studies (DipHE)[1]. Both groups learnt research methods and research utilization skills through the same research methods module (in year 2 of their studies).

Embedded-curriculum characteristics. Following changes in the standards of proficiency published by the Nursing and Midwifery Council standards in 2010, the curriculum was re-designed as a Bachelor level curriculum (no-longer offering the DipHE route to qualification). This curriculum was designed to explicitly spiral knowledge and skills in research methods and EBP throughout students' degrees. Each year knowledge and skills would be taught at an increasing complexity (vertical integration) whilst allowing for earlier knowledge to be consolidated and revised as learning of more complex topics took place (horizontal integration). All students were now taught how to assess quality of literature/evidence in year 1; what EBP is, how it

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[1] In the UK a DipHE is the academic equivalent to two years of a Bachelor level degree. The DipHE was available as a recognised stand-alone nursing qualification until 2010.

links with research methodology and process and ethics in year 2, and; all students then undertook an independent research project in their final year (which was explicitly packaged as cementing their research methods and EBP skills).

Participants

A convenience sample of fifty-six undergraduate nursing students (89.3% female and 10.7% male) were recruited between September 2011 and September 2014 from a UK university. Inclusion criteria were taking part in the three questionnaire administrations (during the second semester of each of the three years of their courses) and having no more than 10% missing data. This equated to 24% of the sampling frame, with an attrition rate of 57% over the three years of the study. Included cases were compared on key variables (i.e. age at the start of the study, field of study and gender) to cases lost through drop-out and no statistically significant differences were identified. The majority of students ($n = 40$, 71.4%) were aged between 18-29 years old and were studying on the adult nursing pathway ($n = 45$, 80.4%). The remaining students were studying mental health (n = 9, 16.1%) or child nursing (n = 2, 3.5%).

Thirty-one students (55.4%) were studying on the spiral-curriculum (referred to as the "Embedded-curriculum group" hereafter) and twenty-five students (44.6%) were studying on the modular-curriculum (referred to as the "Modular-curriculum group" hereafter). The Modular-curriculum group consisted of fourteen (56%) students registered on the BSc Nursing degree and eleven (44%) students registered on the Diploma of Higher Education in Nursing Studies. Preliminary analyses revealed that these two subgroups of students held statistically similar EBP profiles and could, therefore, be legitimately combined to form one Modular-curriculum group.

Comparing participants on the spiral and modular curricula revealed similar demographic characteristics, although participants in the Embedded-curriculum group were slightly younger and were more likely to hold a higher education qualification prior to commencing their present course. Also, there were no students studying on the child nursing pathway in the Modular-curriculum group (see table 1).

Table 1

Demographic characteristics of participants in the modular-curriculum and embedded-curriculum groups

Demographic characteristics	Modular-curriculum group $N = 25$	Embedded-curriculum group $N = 31$
Sex		
Male	3 (12.0%)	3 (9.7%)
Female	22 (88.0%)	28 (90.3%)
Age		
18-29 years	15 (60.0%)	25 (80.6%)
30-39 years	8 (32.0%)	5 (16.1%)
40+ years	2 (8.0%)	1 (3.2%)
Pathway		
Adult	22 (88.0%)	23 (74.2%)
Mental health	3 (12.0%)	6 (19.4%)
Child	0	2 (6.5%)
Highest qualification prior to current course ($n = 55$)		
Secondary school (e.g. GCSEs/O-levels)	1 (4.2%)	0
Further education (e.g. A-levels)	16 (66.7)	17 (54.8%)

Higher Education - undergraduate (e.g. Higher National Diploma, 1st Degree)	7 (29.2%)	13 (41.9%)
Higher Education – postgraduate (e.g. Master's degree)	0	1 (3.2%)

Materials and procedure

Data were collected using the Student Evidence-Based Practice Questionnaire (S-EBPQ; Upton, Scurlock-Evans & Upton, 2016). The S-EBPQ is a 21 item measure of self-reported frequency of use of EBP (Practice subscale), attitudes toward EBP (Attitude subscale), and two scales measuring knowledge and skills in EBP, specifically in retrieving and reviewing evidence (Retrieving subscale) and applying and sharing EBP (Applying subscale). The S-EBPQ was developed with undergraduate nursing students from the EBPQ (Upton & Upton, 2006, validated with registered nurses). The measure demonstrates strong internal reliability (Cronbach's alpha for subscales ranging from .77 to .91) and has evidence of both construct and convergent validity (Upton et al., 2016).

Participants completed the S-EBPQ during lectures, in the second semester of their first, second and final years of their courses.

Analysis

A series of two-way mixed between-within Analyses of Variance (ANOVAs) were performed to explore differences between the two curriculum groups' scores (between group comparison) on each of the four S-EBPQ subscales (Practice, Attitude, Retrieving and Applying), across the three years of study (within group comparison). This method of analysis also allows for any potential interaction between curriculum-

type and year of study on S-EBPQ subscale scores to be assessed. These analyses were performed on each S-EBPQ subscale separately (i.e. one analysis for the Practice subscale, another for the Attitude subscale, and so on).

Data assumption checks identified no substantial violations. Furthermore, as there were more than 20 participants in each group, the analysis may be considered robust to violations of normality (Tabachnick & Fidell, 2014). The assumption of sphericity was violated for the analysis exploring the attitude subscale; to compensate for this, Greenhouse-Geisser test statistics were used to interpret these results.

Owing to the number of analyses performed, the Holm-Bonferroni correction (Holm, 1979) was applied to make the criteria for judging statistical significance more stringent (i.e. to reduce the risk of committing a type 1 error).

Analysis was carried out using SPSS version 21.

Ethical Considerations

The study received ethical approval from the University Human Research Ethics Committee. All participants were informed that: the study was completely voluntary; taking part in one administration of the questionnaire did not obligate them to take part in other administrations; they had the right to withdraw at any time (at which point their data would be destroyed); and their participation or non-participation in the study would have no impact on their degree and that their data would be treated confidentially.

Results

Frequency of EBP implementation (Practice subscale)

There was a statistically significant change (with a large sized effect) in frequency of EBP implementation across the three years for both groups (F(2, 108) = 11.56, $p <$ .001, η_{p}^{2} = .176), with a significant overall increase between year 1 and 3 scores (p <.001) and between year 2 and 3 (p <.001). There were no statistically significant differences overall between the modular- and embedded- curriculum groups (F(1, 54) = 1.11, p = .237, η_{p}^{2} = .026) and no statistically significant interaction effect between time and curriculum type (F(2, 108) = 3.67, p = .029[2], η_{p}^{2} = .064); indicating that the difference in the rate of change between the two groups across time was not substantial enough to be considered significant (see table 2). A profile plot of the two groups (Figure 1), demonstrates an interesting difference in the pattern of their scores, whereby the scores for the embedded- (but not the modular-) curriculum group, dip in year 2.

Table 2

Means and standard deviations for the S-EBPQ Practice subscale across time-points (N = 56).

	Modular-curriculum group M (SD)	Embedded-curriculum group M (SD)	Groups combined total M (SD)
Year 1	4.99 (0.95)	4.99 (1.04)	4.93 (1.06)
Year 2	5.49 (0.82)	4.75 (1.18)	5.03 (1.15)
Year 3	5.88 (0.61)	5.40 (1.20)	5.55 (1.03)

Note. Modular-curriculum n = 25, embedded-curriculum n = 35.

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[2] Non-significance for all ANOVA analyses was determined using the Holm-Bonferroni correction (with the maximum p-value accepted as statistically significant being *p* = .002, rather than the typical criteria of α = .05)
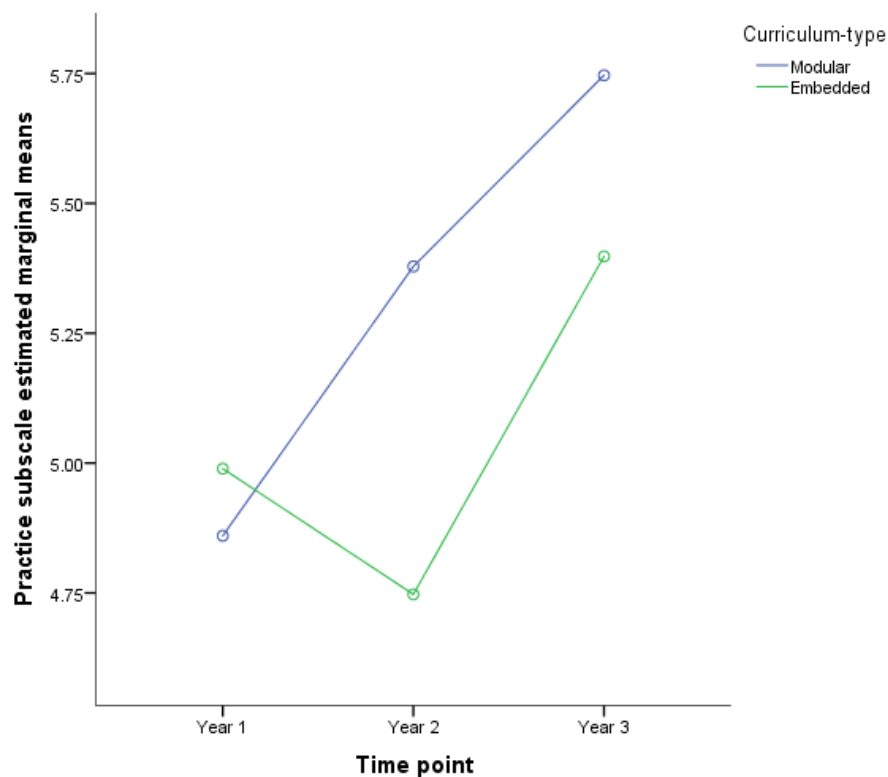
Figure 1. Profile plot of modular-curriculum and embedded-curriculum groups of pre-registration nursing undergraduates, on their self-reported frequency of use of EBP.

Attitude towards EBP

No statistically significant changes were detected in attitudes towards EBP across the three years of study ($F(1.71, 92.05) = 3.87$, $p = .030$, $\eta_p^2 = .067$). Furthermore, there were no statistically significant differences between the two curriculum-type groups overall ($F(1, 54) = 2.31$, $p = .135$, $\eta_p^2 = .041$) and no significant interaction between time and curriculum-type ($F(1.71, 92.05) = 0.79$, $p = .438$, $\eta_p^2 = .014$) (see table 3). A profile plot of the two groups (Figure 2), demonstrates the similarity in the pattern of scores for the two groups, whereby the scores for both curriculum groups, dip in year 2. However it is notable that this dip is greater for those on the embedded-curriculum.

Table 3

Means and standard deviations for the S-EBPQ Attitude subscale across time-points (N = 56).

	Modular-curriculum group *M* (*SD*)	Embedded-curriculum group *M* (*SD*)	Groups combined total *M* (*SD*)
Year 1	6.31 (0.51)	5.93 (0.89)	5.93 (0.89)
Year 2	6.12 (1.27)	5.34 (1.53)	5.59 (1.37)
Year 3	6.50 (0.61)	6.01 (0.92)	6.11 (0.87)

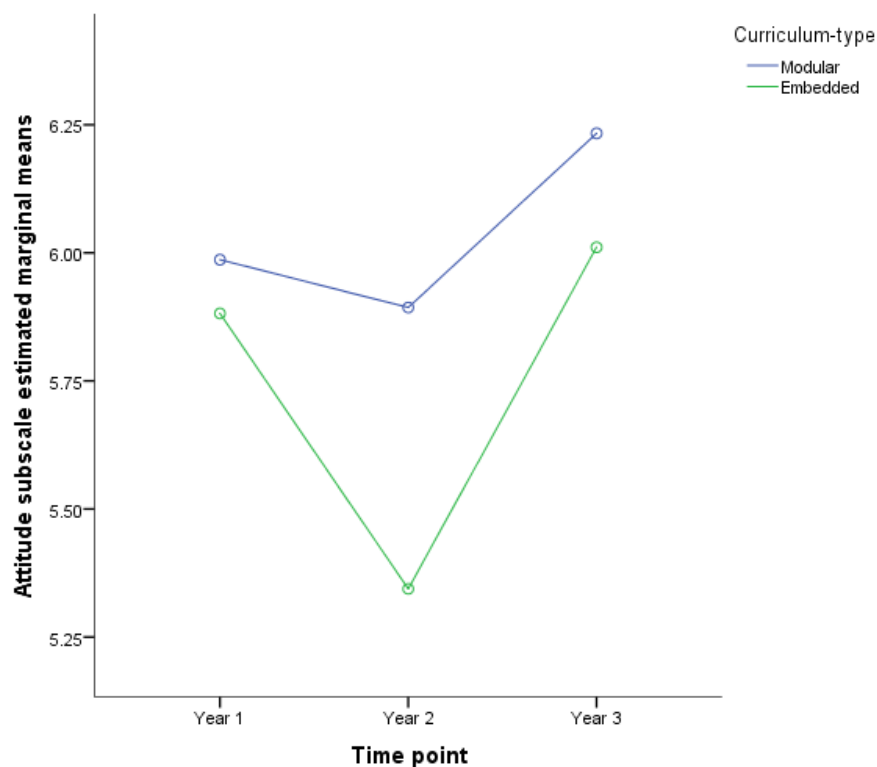*Note. Modular-curriculum n = 25, embedded-curriculum n = 35.*

Figure 2. Profile plot of modular-curriculum and embedded-curriculum groups of pre-registration nursing undergraduates, on their self-reported attitudes towards EBP.

Knowledge and skills in retrieving and reviewing evidence (Retrieving subscale)

Statistically significant changes (with a large sized effect) in retrieving evidence subscale scores were identified for the two groups overall across time (F(2, 108) = 42.97, $p < .001$, $\eta_p^2 = .443$), with a significant overall increase between year 1 and 3 scores ($p < .001$) and between year 2 and 3 ($p < .001$).

Although there was no significant difference overall between the two curriculum-type groups (F(1, 54) = 0.96, $p = .331$, $\eta_p^2 = .018$), a statistically significant interaction between time and curriculum-type was identified with a large sized effect (F(2, 108) = 6.34, $p = .002$, $\eta_p^2 = .105$ (see table 4). Examining the contrasts for this interaction effect identified statistically significant differences in the rate of change between years 1 and 3 ($p = .042$), but not between years 2 and 3 ($p = .183$). This indicates that the rate of improvement in scores for the two groups between years 1 and 3 were different (most likely owing to the much lower starting scores of the modular-curriculum group in comparison to the embedded-curriculum group). However, at year 2 these differences are reduced and the rate of improvement across the two curriculum-type groups is similar between years 2 and 3. A profile plot (Figure 3), clearly demonstrates this difference in the pattern of the scores for the two groups.

Table 4

Means and standard deviations for the S-EBPQ Retrieving subscale across time-points (N = 56).

	Modular-curriculum group M (SD)	Embedded-curriculum group M (SD)	Groups combined total M (SD)
Year 1	3.88 (1.12)	4.56 (0.94)	4.28 (1.08)

| | Year 2 | 4.88 (0.82) | 4.70 (0.71) | 4.76 (0.84) |
| | Year 3 | 5.05 (0.70) | 5.31 (0.88) | 5.25 (0.80) |

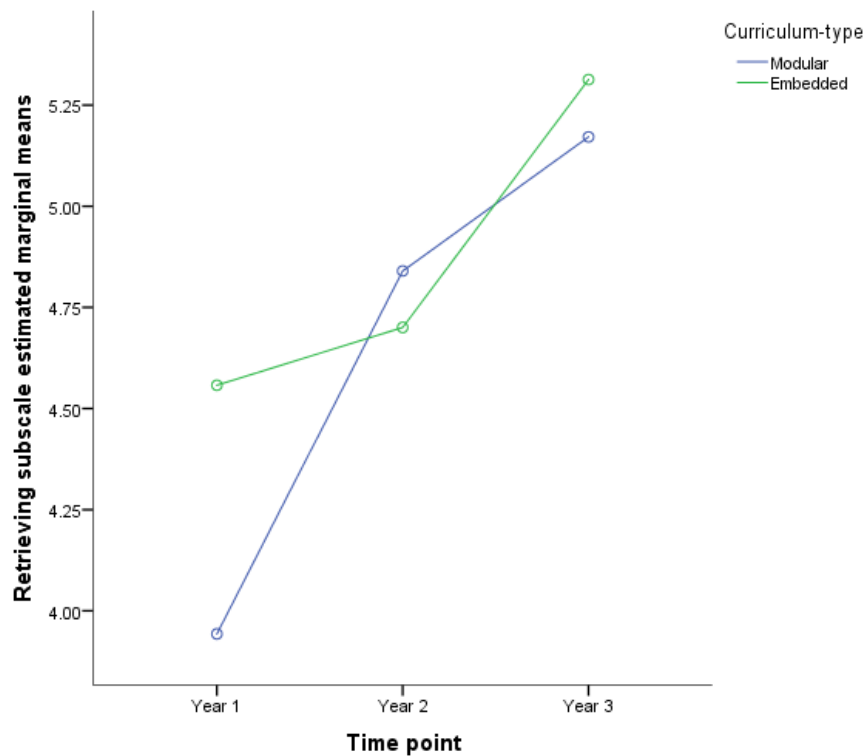*Note. Modular-curriculum n = 25, embedded-curriculum n = 35.*

Figure 3. Profile plot of modular-curriculum and embedded-curriculum groups of pre-registration nursing undergraduates, on their self-reported knowledge and skills in retrieving and reviewing evidence.

Knowledge and skills in applying and sharing EBP (Applying subscale)

Statistically significant changes (with a large sized effect) in applying evidence subscale scores were identified for the two groups overall across time ($F(2, 108) = 12.33$, $p < .001$, $\eta_p^2 = .186$), with a significant overall increase between year 1 and 3 scores ($p < .001$) and between year 2 and 3 ($p = .002$).

Although there was no significant difference overall between the two curriculum-type groups (F(1, 54) = 0.02, p = .888, η_p^2 < .001), a statistically significant interaction between time and curriculum-type was identified with a large sized effect (F(2, 108) = 7.14, p = .001, η_p^2 = .117) (see table 5). Examining the contrasts for this interaction effect identified statistically significant differences in the rate of change between years 2 and 3 (p =.007), but not between years 1 and 3 (p = .248). This indicates that the rate of improvement in scores for the two groups between years 2 and 3 were different (most likely owing to the notable decrease in scores for the embedded-curriculum group at year 2 in comparison to the modular-curriculum group). However, the rate of improvement across the two curriculum-type groups overall (between years 1 and 3) is similar. A profile plot of the two groups (Figure 4), demonstrates this difference in the pattern of their scores.

Table 5

Means and standard deviations for the S-EBPQ Applying subscale across time-points (N = 56).

	Modular-curriculum group *M* (*SD*)	Embedded-curriculum group *M* (*SD*)	Groups combined total *M* (*SD*)
Year 1	4.97 (1.07)	5.21 (0.82)	5.06 (0.91)
Year 2	5.43 (0.62)	5.01 (0.88)	5.24 (0.84)
Year 3	5.49 (0.65)	5.65 (0.97)	5.61 (0.89)

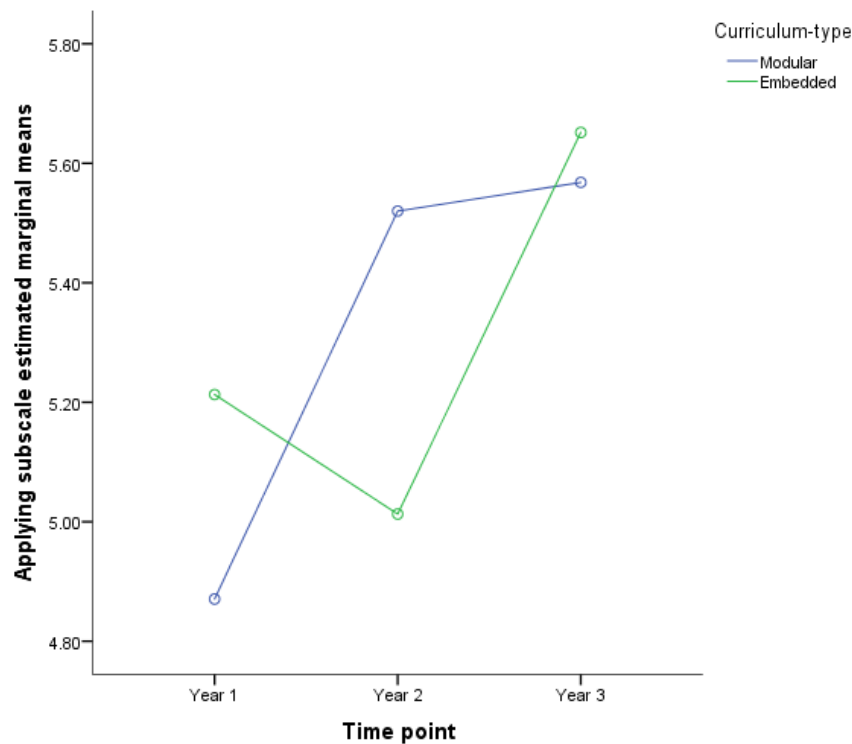*Note. Modular-curriculum n = 25, embedded-curriculum n = 35.*

Figure 4. Profile plot of modular-curriculum and embedded-curriculum groups of pre-registration nursing undergraduates, on their self-reported knowledge and skills in applying and sharing EBP.

Discussion

Significant improvements were found across all domains for both curriculum groups, except on the Attitude subscale. This limited change in attitude may be explained by the fact that students reported holding positive attitudes towards EBP to start with – which supports the findings of previous research on this topic (Leach et al., 2015).

Although no statistically significant differences were identified between the two curricula overall (and both ultimately demonstrated improvements in EBP use, knowledge and skills), the results indicated that the direction and rate of change of scores on the Retrieving and Applying subscales differed across the three years for

the two groups. Examining the profile plots for these subscales revealed a complex pattern, with a slower rate of improvement evident for the embedded-curriculum group on the Retrieving subscale and a notable drop in scores on the Applying subscale in the second year of study, compared with modular-curriculum group scores. Furthermore, this pattern of lower scores for the embedded-curriculum group in year 2 was echoed (although not statistically significantly) on both the Practice and Attitude subscales.

In order to better understand the different patterns of change evident for the two groups, two of the authors (L-SE & JR) compared the curricula on other aspects not directly related to the EBP teaching characteristics. A difference in the pattern of placement start-dates on the two curricula in year 2 was noted: students on the embedded-curriculum returned to the classroom at the start of Semester 2 for only a short period of time (three weeks) for theory teaching and skills practice before starting placement. In contrast those on the modular-curriculum spent more than twice as long in the classroom during the same period (seven weeks) for theory and skills practice training at the start of Semester 2, before starting placement.

Examination of Nursing Program evaluation and feedback data indicated that the pattern of teaching and placements on the embedded-curriculum caused substantial anxiety for students with respect to meeting learning outcomes and completing assessments (i.e. performance anxiety).

As the second year data were collected during this period in the classroom, the drop in scores for the embedded-curriculum group may reflect this anxiety. Anxiety related to academic performance has been demonstrated to be inversely associated with beliefs about competence (Putwain & Symes, 2012), thus the high levels of anxiety

felt by students studying the embedded-curriculum may have resulted in a drop in students self-ratings of competency, particularly in relation to the skills necessary for applying EBP.

Alternatively, the constructivist approach to EBP teaching that underpinned the embedded-curriculum may have had a direct influence on student perceptions of EBP competence. According to Taylor and Hamdy (2013) adult learners construct clinical knowledge and skills by moving through five phases: dissonance, refinement, organisation, feedback and consolidation. As a part of this process, the constructivist curricula aims to foster greater self-reflection (Taylor & Hamdy, 2013), however the impact of this on self-awareness and self-reported beliefs of competency is unclear. The patterns of scores on the subscales of the S-EBPQ may simply reflect a deeper sense of cognitive dissonance (discomfort experienced when there is a discrepancy with what you already know/believe and new information you are presented with) experienced by the students on the embedded-curriculum. Furthermore, experiential learning is a key strategy in constructivist approaches; thus whilst professional behaviours such as EBP are usually initially taught in the classroom, understanding of them must be demonstrated and consolidated within the clinical environment. Therefore, although the nature of an embedded-curriculum may be particularly suited to fostering these five phases of learning (Coelho & Moles, 2015) the timing of clinical practice in relation to academic teaching must also be considered.

Despite this caveat, improvements for the embedded-curriculum group were most notable for skills related to retrieving and reviewing evidence, and applying and sharing EBP. As previous research suggests that these are particular barriers to EBP use for many nurses (Rolloff, 2010) this is a welcome finding.

Limitations

Self-report measures may be subject to socially desirable responding (van de Mortel, 2008) which may in part explain the potential ceiling effects identified on some of the variables. However, the anonymous nature of the survey helped ameliorate this. To help explore this issue future research should incorporate a measure of socially desirable responding and an actuarial measure of EBP knowledge/skills. Ultimately it is anticipated that social desirability effects would be present at the same rate for each group.

Finally, owing to the nature of the research (using opportunistic sampling) it was not possible to calculate response rates. However, it is possible that only those students with more positive attitudes towards research self-selected themselves to take part in the study. The impact of this on participants' responses cannot be assessed.

Future research

Further research exploring how nursing undergraduates' learning is affected by practice climate in both academic and practice-based settings is required to fully understand the effectiveness of curriculum design, and how curriculum changes may affect the development of EBP habits, attitudes, knowledge and skills. For example, the EBP profiles of academic and clinic based teaching staff may differ (Upton et al., 2015). Furthermore, climate in practice will impact on nursing students' learning of EBP, which may in turn affect the effectiveness of curriculum design for students' learning (Cooper, Courtney-Pratt & Fitzgerald, 2015). Research exploring the impact of clinical placement on students' EBP learning experiences is therefore required. Ultimately, if learning in academic and clinical contexts is not well aligned, learning opportunities may be missed (Kinchin, Cabot, Kobus & Woolford (2011). Finally,

research exploring the long-term impact of spiral education on EBP in nursing practice once qualified would help shed light on the long-term influence of curriculum design for EBP orientation; it may be that whilst the learning process triggered by a spiral curriculum is slower, the practice of revisiting and reflecting on knowledge and skills gained, provide a deeper understanding, which in turn leads to greater mastery of skills, which are then more deeply embedded in practice.

Conclusions

The findings of the present study suggest that curriculum-design did not statistically significantly impact on students' EBP profiles during their courses. However, there are a number of aspects of curriculum-design, separate from the approach to embedding the teaching of EBP, which may impact on its effectiveness on fostering students' use of, attitudes towards and knowledge and skills in EBP. For example alignment between learning experiences on placement and in the classroom are likely to be particularly important, along with the timing of placement experiences, and assessment patterns. Further research is required to explore how curriculum-design can build on students' positive attitudes towards EBP and its use in their future practice.

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