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Effectiveness of Online Cancer Education for Nurses and Allied Health Professionals; a Systematic Review Using Kirkpatrick Evaluation Framework

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Abstract

Embedding online learning within higher education can provide engaging, cost-effective, interactive and flexible education. By evaluating the impact, outcomes and pedagogical influence of online cancer and education, future curricula can be shaped and delivered by higher education providers to better meet learner, health care provider and educational commissioners' requirements for enhanced patient care and service delivery needs. Using the Kirkpatrick's four-level model of educational evaluation, a systematic review of the effectiveness of online cancer education for nurses and allied health professionals was conducted. From 101 articles, 30 papers were included in the review. Educational theory is not always employed. There is an absence of longitudinal studies to examine impact; an absence of reliability and/or validity testing of measures, limited experimental designs taking account of power and few attempts to mitigate bias. There is, however, an emerging innovative use of mobile/spaced learning techniques. Evidence for clinical and educational effectiveness is weak offering insights into experiences and participant perceptions rather than concrete quantitative data and patient-reported outcomes. More pedagogical research is merited to inform effective evaluation of online cancer education, which incorporates and demonstrates a longer-term impact.

Keywords Cancer · Education · Effectiveness · Evaluation · Online · Theory · Nurses and allied health care professionals

Introduction

Cancer is an important health care challenge leading to significant mortality and morbidity worldwide with approximately 14 million new cases and 8.2 million related deaths annually [1]. Education and training remain key factors in ensuring health professionals are prepared to meet the varied, often long-term and end-of-life care needs of people affected by cancer and their families [2].

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To ensure availability of innovative cancer education on a global scale, online learning can be considered as a platform for engaging, cost-effective, interactive and flexible education to expand continuing professional education, enhance access and support inter-professional learning [2, 3]. However, a systematic review [4] highlighted several barriers to online learning including the following: organisational and economic issues; use and accessibility of software and hardware; availability of support; pedagogical approaches; and educator skills. Recommendations emphasised the importance of well-designed, flexible programmes; global, national and local strategies to support successful e-learning; and evaluation research to identify the cost-effectiveness and cost benefits [4]. It has been recognised that evaluation must incorporate validated outcome measures, focus on student knowledge, skills, attitude and satisfaction, and determine different levels of impact for the student, educator and client outcomes [5]. For health care educators, translational research and education should focus on clinical effectiveness in terms of practise change or improving patient outcomes [6] including the need for rigorous

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evaluation of education methodologies and their influence on cancer outcomes.

In 2007, Wyatt [7] discussed the absence of evidence relating to the effectiveness of cancer programmes, suggesting there was a lack of conclusive evidence to support its impact on practise. By evaluating the impact, outcomes and pedagogical influence of online cancer education, future learning opportunities and course design can be shaped and delivered to better meet learner, educational, health care consumer and institutional needs [8].

In order to capture outcome measures, this literature review has adopted the Kirkpatrick's framework for evaluation [9]. This framework seeks to clarify evaluation and to facilitate clear and achievable goals, by breaking them down into the logical steps of, as follows: Reaction—how well did they like the programme; Learning—what principles, facts and techniques were learned; Behaviour—what changes in behaviour resulted; Results—tangible results for example reduced cost, improved quality or quantity of product. Kirkpatrick saw the levels as different but complementary.

The Kirkpatrick evaluation model provided the reviewers a framework with which to place the relevant articles within categories/levels to aid analysis and presentation of findings, with a view to identifying measurement of learning formats, outcomes and strategies that embed practise change.

This is the first review of the published literature focused on the effectiveness of online cancer education for nurses and allied health professionals. The purpose of this review was to explore the literature identifying what is known about the use of online learning and the outcome measures used to evaluate this education in order to propose recommendations.

Defining Online Education

For the purposes of this review, online education is defined as education and learning activities delivered electronically or involving the use of a computer or electronic device, either in combination with face-to-face contact or solely online format. This includes a range of media, delivered via the Web or a virtual learning environment such as the Moodle or Blackboard or hardware such as the CD/DVD format.

Method

The overall aim of the review was to critically analyse the literature relating to online cancer education for nurses and allied health professionals. The specific objectives were the following:

- To identify the nature of online education in cancer;
- To identify theory underpinning the online education in cancer;
- To identify the education and clinical outcome measures used to evaluate online cancer education;
- To determine the effectiveness of the measures used in online education in cancer.
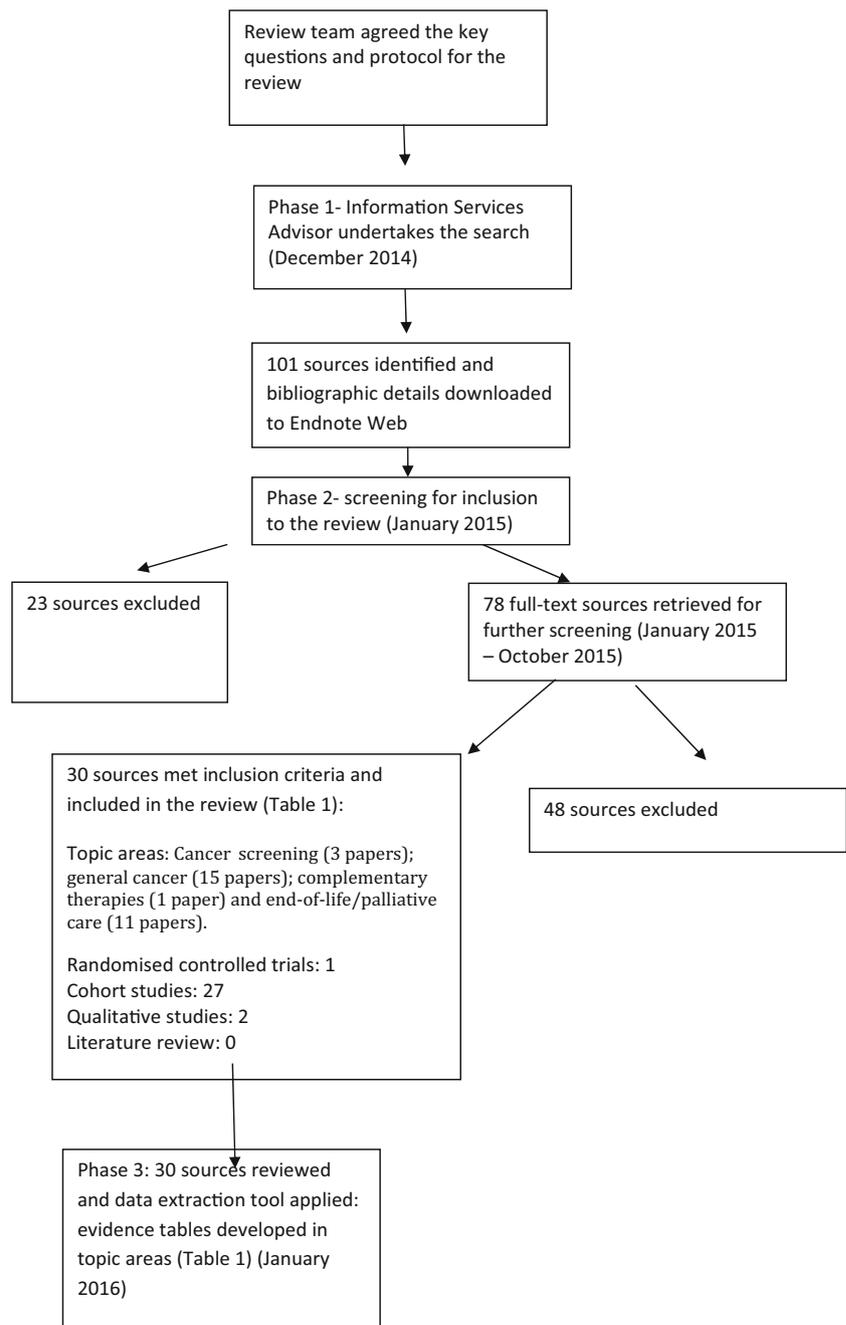
Phase 1

A systematic search of the literature from 2000 to 2014 was undertaken in December 2014 using the following sources: CINAHL, Medline, PsycInfo, ASSIA, Education-line, British Education Index, Australian Education Index, ERIC, Research into Higher Education Abstracts, Educational Research Abstracts, Education Research Theses, Australian Council for Education Research, NIHR Clinical Research Network Portfolio Database, Index to Theses, Web of Knowledge, Zetoc, Escalate (HEA), EvidenceNet (HEA) and Google Scholar (the full-search strategy is added as Supplementary Material). A total of 101 literature sources were identified in phase 1 (Fig. 1: Process and phases of the review).

Phase 2

Each reviewer independently assessed each literature source against the inclusion and exclusion criteria. One hundred and one papers were sourced. A preliminary number (23) of sources were excluded on the basis of the abstract, and full-text papers were retrieved for 78 papers to enable detailed screening, where 48 papers were excluded.

Inclusion Criteria

- Education for health professionals with a recordable or registered professional qualification including nurses, and the professions allied to medicine (physiotherapists, occupational therapists, clinical psychologists, dieticians, social workers and complementary therapists)
- Evaluated an educational intervention relating to cancer care, delivered in an online or electronic format. This included a fully online, blended (face-to-face and online) and a computer educational programme available on the Web or CD-ROM.

Fig. 1 Process and phases of the review

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                                    │ Review team agreed the key│
                                    │ questions and protocol for the│
                                    │ review                  │
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                                    │ Phase 1- Information Services│
                                    │ Advisor undertakes the search│
                                    │ (December 2014)         │
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                                    │ 101 sources identified and│
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                                    │ Phase 2- screening for inclusion│
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          │ 23 sources excluded  │                    │ 78 full-text sources retrieved for│
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                         │ 30 sources met inclusion criteria and│  │ 48 sources excluded  │
                         │ included in the review (Table 1):│    └──────────────────────┘
                         │                              │
                         │ Topic areas: Cancer screening (3 papers);│
                         │ general cancer (15 papers); complementary│
                         │ therapies (1 paper) and end-of-life/palliative│
                         │ care (11 papers).            │
                         │                              │
                         │ Randomised controlled trials: 1│
                         │ Cohort studies: 27           │
                         │ Qualitative studies: 2       │
                         │ Literature review: 0         │
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                         │ Phase 3: 30 sources reviewed │
                         │ and data extraction tool applied:│
                         │ evidence tables developed in │
                         │ topic areas (Table 1) (January│
                         │ 2016)                        │
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Exclusion Criteria

- Education solely aimed at medical doctors
- Non-English language sources
- Those that did not specify details of an evaluation process

Therefore, 30 papers were identified as relevant to the review and 71 papers were excluded (total 101 articles). Exclusion of papers fell into four main categories: the participants did not include nursing ($n = 18$); no evaluation or limited data ($n = 41$); no online education ($n = 6$) and no cancer courses ($n = 9$): more than one category ($n = 3$).

Phase 3

Three independent reviewers, using a developed data extraction tool, critically reviewed each data source. The extracted data were synthesised within evidence tables, grouped within levels of evaluation described by Kirkpatrick [9]. The four levels are described below:

Level 1: Assessment of learners' views
Level 2a: Change in learners' views or attitudes
Level 2b: Change in learners' knowledge or skills
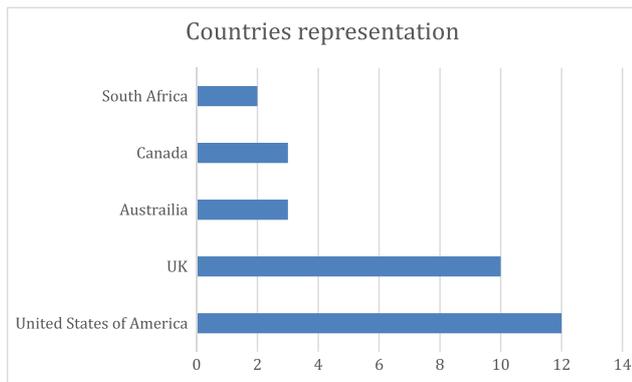Level 3: Change in learners' behaviour

Fig. 2 Country of origin. In Fig. 2 The country of origin was predominately the United States of America [10, 14, 15, 20, 21, 24, 27, 28, 30, 32, 36, 37], the United Kingdom [11, 12, 22, 23, 26, 29, 31, 33, 34, 39], with papers included from South Africa [18, 35], Australia [13, 25, 38] and Canada [16, 17, 19]

Level 4a: Change in organisational practise
Level 4b: Change in benefit to patients

Findings

The 30 Reviewed Papers

Evidence reporting included qualitative thematic methodology [10, 11] and quantitative research involving pre- and post-tests [12–22] and surveys [23–35] and clinical outcome measurements [36–39]. Only one randomised controlled trial [37] was available, so we were unable to meta-analyse the pooled data. The quality of statistical analysis was generally weak. The findings are, therefore, presented in narrative form aligned to the specific objectives of the review (Table 1, Figs. 2, 3 and 4)
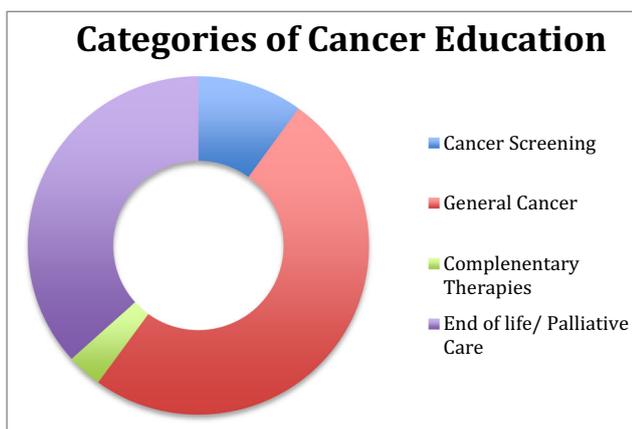
Fig. 3 Categories of online Cancer Education Topics. In Fig. 3, the foci of the online education included the following: cancer screening (n = 3) [36, 37, 39]; general cancer (n = 15) [11, 12, 14, 16–18, 22, 24, 25, 30–35]; complementary therapies [15] (n = 1); and end-of-life/palliative care (n = 11) [10, 13, 19–21, 23, 26–29, 38]

The Nature of Online Education in Cancer

Ranges of approaches to online education were apparent including unaccredited courses [11–16, 18–28, 34] and modular courses provided by Higher Education Institutions [10, 22, 24, 30, 33, 37, 39]. The formats include synchronous, asynchronous learning and a variety of interactive self-directed methods and learning objects [12, 13, 19, 28–32, 34, 38].

For many, the reasons for adoption were to change practise [12–14, 23, 36, 37]. The reasons could also be associated with accommodating busy professionals with limited time and finance for travel [14, 15, 24]. The online approach was justified as a national education approach or geographical initiative [13, 16, 17, 23, 24]. Many of the authors were aiming to improve flexible access [24], whilst others were being driven to change delivery to accommodate numbers [14, 25], reduce the cost of delivery or enhance the ability to track training at organisational level [10, 24, 27]. The student experience [11, 18, 23, 26] and impact upon practise were also cited as a justification for a blended approach to learning [17, 27] and inter-professional learning [16, 19, 25, 28]. In one source, a digital object was developed to represent the service-user perspective as learning and teaching strategy [29].

In regard to specific educational interventions, there were examples of case-based scenarios and multiple choice education sent by email "time spaced" at intervals [37, 38]. Student-centred learning style selection was offered by providing a choice of asynchronous web-based material [23, 32, 35]. Using synchronous approaches to real-time web-based seminars and video-conferencing were also reported [14, 16, 17, 24, 36].

Where much of the online education appeared to be developed by educators themselves, a CD-ROM for cytotoxic chemotherapy administration in the UK was developed by the expertise of a commercial company and expertise of four pharmacists [31]. A prototype online education resource developed by a US multi-media company was also described as providing health professionals with information on complementary and alternative therapies for men with prostate cancer, accessible from the Web [15].

Theory Underpinning the Online Education in Cancer

Eleven of the 30 papers described educational theory underpinning the design and/or delivery of the online learning. Several studies discussed being guided by *adult learning theory* [15, 17, 25, 26, 32]. Other theories informing the education were *interpretative pedagogy* [16]; *constructivism* [33] recognising the construction of knowledge as situated in relevant personal, social experience; *active learning* based on reflection, authentic tasks and assessments. Reflection was described as focusing on application to practise and relevant to work-based learning [23]. Only one source referred to online

learning pedagogical frameworks for example the situation learning theory and legitimate peripheral participation and community of practise [14]. Other examples were the use of a three-dimensional model of *cultural congruence* [10] and a *competency framework* used to guide the development of a course on spirituality [26]. A *trans-theoretical model* to measure changing behaviour [20] was also identified. Nineteen studies had no underpinning theoretical framework, and it was difficult to identify a clear framework for analysis, reporting of the findings and a conclusion.

Outcome Measures Used to Evaluate Online Cancer Education

Research questions were underdeveloped in most papers suggesting few were planned as a research study or with an evaluation strategy developed prior to delivery. In one study [36], participants were randomised and established a control group, whilst in three studies [17, 37, 38], primary and secondary outcomes were specified.

Kirkpatrick Level 1

Quality and Accessibility of Course and Learning Materials The quality and accessibility of learning materials were evaluated in several papers relating to format, readability, content, ease of access to materials and graphics [30–32], accessibility of activities [27] and quality of materials [33]. Student experience of access to and navigation within the VLE were evaluated alongside technical and administrative issues [26]. Evaluations were collated relating to preference of learning format and technological challenges with accessing Web-based programmes [24].

IT Use and Confidence IT use and confidence was also featured in the evaluation measured by a previously developed questionnaire [33]. This included a pre–post-test evaluation of IT use and confidence and preference for e-learning. Qualitative methodology was used to obtain the participants' perception of an online module in paediatric oncology studies [11].

General Module Evaluation Several studies drew on standard module evaluations undertaken routinely once a module was complete by using a 25-item questionnaire and open-ended questions relating to appropriateness, relevance and satisfaction with the module. Evaluations were undertaken immediately following the module completion and at 2, 6 and 12 months [32]. Others used simple evaluation tools to explore areas such as the quality of module support [33]; assessment outcomes or examination results [30]; number of hits on different areas of the module VLE [23]; and an online post-course moderator evaluation [34]. Several studies also used focus groups or individual interviews to gather qualitative evaluation data [10–12, 26, 36].

Cost-Effectiveness of Web-Based Learning Format A small number of papers considered cost-effectiveness, not in terms of detailed economic evaluations but rather an assessment of the influence of the online course on reducing demands on supervisor's time [25] or as enhancing access to education out of work hours when staff had no protected study time or limited budgets for education [24].

Kirkpatrick Levels 2a, 2b and 3

One study reported measuring attitudes specifically [19]. A number of studies evaluated changes in knowledge and confidence using pre- and post-tests completed by students which asked them to rate their achievement of learning goals on a five-point Likert scale in areas of perception of meeting learning needs, understanding, approach, pain assessment and confidence [13–15, 17, 21]. Two studies examined student
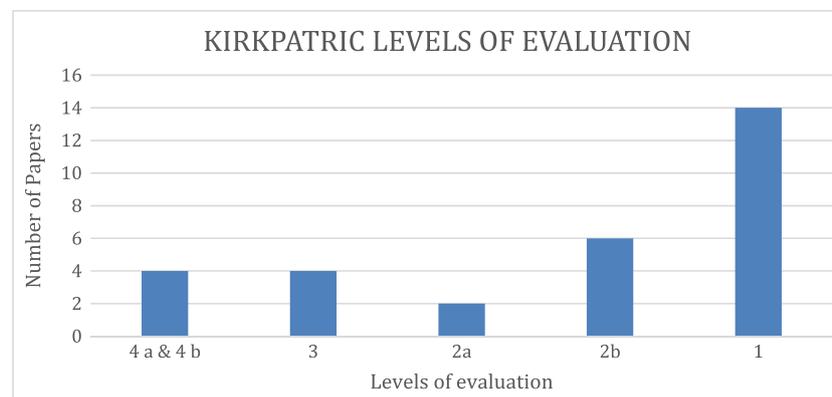
Fig. 4 Kirkpatrick level of evaluation. Figure 4 shows number of papers categorised by Kirkpatrick level 4 (a) Change in organisation and 4 (b) Change in benefit to patients [36–39], Kirkpatrick level 3 Change in learners' behaviour [18, 20, 22, 34] (*n* = 4), Kirkpatrick level 2b: Change in learners' knowledge or skills [12, 14–17, 21] (*n* = 6), Kirkpatrick level 2a: change in learners' views or attitudes [13, 19] (*n* = 2). Kirkpatrick level 1 assessment of learners' views [10, 11, 23–33, 35] (*n* = 14)

Table 1 Articles reviewed and associated Kirkpatrick's evaluation levels

Author	Aims/research question/s	Theoretical framework	Intervention	Research methodology	Findings	Kirkpatrick level
10: Doorenbos et al. (2010) USA	Description of the theoretical foundation, development and content of a Web-based educational intervention to improve cross-cultural communication about end of life concerns for social workers.	1) Based on 3-dimensional model of cultural congruence 2) LEARN model.	Created web-based training called "Culture and End-of-Life" composed of 6 interactive case studies enriched with photos and audio recordings, with focus on problem solving, interactive exercises and instruction. Content delivered in small increments with text boxes for reflection and comparison to best-practise examples.	Sample size 21 Preliminary evaluation using a qualitative design with non-structured questions with convenience sample of 12 hospice providers. Focus group one (n = 6) and two (n = 7) focused on case studies whilst focus group 3 (n = 8) reviewed all case studies and usability of the training. Analysis and coding explained	Themes: Content—generally helpful More emphasis required on communicating core hospice information; coping with communications; using interpreters; expanding the content for decision making. Identifies key factors that influence applicability and use: functionality; presentation; navigation.	1
11: McInally et al. (2012) UK	Perception and impact of a blended online module in paediatric oncology.	None	Participation in a blended online paediatric oncology module.	Phenomenology Sample size 7 Purposive samples were interviewed. Semi-structured interviews lasted an hour, and the participants used a reflective diary.	Participants perceived that modules had positively influenced their practise; quality of care given to patients and family; own personal development. Participants felt they gained more from the face-to-face education. Using the technology; insufficient time to complete, lack of confidence in the technology, felt isolated and disconnected.	1
12: McGuigan et al. (2008) UK	Evaluation of an e-learning programme specific to the care of patients with oesophageal cancer.	None	CancerNursing.org package delivered in the surgical setting caring for Oesophageal cancer.	Nurses in 2 general surgical wards. Phase 1—survey of sample group (n = 22 with 20 women and 2 men with <6 months to >20 years' experience in area) Phase 2—delivery of web-based programme with pre- and post-testing of knowledge and skills using MCQ and vignettes (simulations) (n = 9) Phase 3—focus group and individual interviews (n = 8 included 6 who completed the programme and 2 who did not)	E-learning can impact on practise through knowledge gain and application. Barriers to engagement include IT skills, access issues, organisational barriers, lack of protected study time. There were statistically significant increases in post-programme scores in MCQ (p < 0.01) and vignette (p < 0.01)	2 b
13: Koczwara et al. (2010) Australia (NSW)	Development of a 7.5-h online educational programme on palliative oncology with a focus on rural providers; process evaluation.	None	Project developed in five phases including: needs assessment (38 took part in focus groups); content development; production of material and recruitment of facilitator; programme launch; programme evaluation. Programme content included: introductory unit; case studies; didactic presentations; resource toolkit; interactive learning; facilitator kit.	Sample size 90 Participants were requested to rate achievement of learning goals on a five-point Likert scale in terms of perception of meeting learning needs—understanding, approach, pain assessment, confidence. 90 respondents—82 (91%) indicated they partially or entirely met all learning goals. 97% indicated the programme confirmed their practise or starting	2a

Table 1 (continued)

Author	Aims/research question/s	Theoretical framework	Intervention	Research methodology	Findings	Kirkpatrick level
					point for review of practise; 75% were planning to review or change their practise as a result. 98% found it easy to navigate; 96% found lectures easy to access; 99% found cases very useful; 83% found the facilitator enhanced the experience	
14: Blazer et al. (2012) USA	Comparison study of learning effectiveness of web based case conferencing to face to face training	1) *Situation learning theory:* 2) *Legitimate peripheral participation, community of practice.*	Intervention group (n = 52) engaged in web-based case conferencing during distance learning; the comparison group (n = 44) participated in the course as originally designed. Cohort 2: intervention was the 5 web-based case conferences live or recorded and a reflective learning worksheet.	Quasi-experimental design compared pre to post knowledge, skills, and professional self-efficacy. Comparison group ran in 2009 Intervention group ran in 2010. 96 participants. Comparison group (n = 44) Intervention group (n = 52). Of the 52 participant in the intervention arm only 7 attended live webinars and 12 in the recorded webinars. 33 participated in a combination of live and recorded.	Both groups increased knowledge ($p < 0.015$) but were higher in the intervention group; skills ($p < 0.33$) and self-efficacy ($p < 0.30$) were comparable between the intervention and normal group.	2 b
15: Brink et al. (2004) USA	Pilot test project: Can "Cancer CAM" increase knowledge, perceived communication support and communication self-efficacy among nurses and health educators?	Adult learning theory	Online prototype module called Cancer CAM relating to prostate cancer patient; text-based instruction, web-links, printable handouts; summary sections with key points, tips and resources	42 Registered nurses and health educators completed 1) pre- and post-test; 2 tailed paired t test applied. Included: 2) demographic data 3) 10 knowledge questions 4) self-efficacy questions 5) 4 CAM communication support questions 6) usability 7) qualitative analysis of free-text comments	Knowledge: improved ($p = 0.000$) Self-efficacy: improved ($p = 0.000$) Communication support: improved ($p = 0.000$) Flexible access valued by professionals; some technical difficulties. Key improvement in confidence in communicating about CAM to physicians	2b
16: McLeod et al. (2011) Canadian	Comparison of knowledge and attitudes as a result of a Web-based course on psychosocial oncology	Social construction of knowledge	A course entitled "Interprofessional Psychosocial Oncology: Introduction to Theory and Practice" approved by 11 Canadian universities and cancer agencies in 8 provinces. Focus on and inter-professional collaboration. Funded by Health Canada. Graduate and continuing education version. Participants join a national cohort of learners forming small inter-professional learning	293 health professionals and students took part between 2008 and 2010 with 158 (54%) nurses. 53 completed pre-post surveys (49%) Pre- (T1) and post-course surveys (T2) were administered and a non-parametric Wilcoxon signed-rank test was used to compare changes in pre- and post-course knowledge and attitudes. Post-course survey included narrative questions about learning, planned changes in practise and	Authors report that the course significantly improved knowledge of other professional roles, confidence and satisfaction with interprofessional collaboration and psychosocial oncology practise.	2 b

Table 1 (continued)

Author	Aims/research question/s	Theoretical framework	Intervention	Research methodology	Findings	Kirkpatrick level
			groups, meeting in weekly, real time, and web-based seminars.	suggestions to improve the course. Narrative data were thematically analysed.		
17: Rashleigh et al. (2011) Canada	A study group led by educator's embraced telemedicine and web-based technology to enable flexibility, different locations, varied learning styles, self-direction to reach nurses across the province. Various small groups linked with a larger group.	1) Adult learning theory 2) Generational learning 3) Co-operative learning underpinned the design.	Participants connected weekly for 16 weeks by videoconference to the Ontario Telemedicine Network. Weekly sessions included assigned pre-readings, 45 min guest expert live conference lectures (also recorded), case studies and question and answer sessions. Also one day symposium.	107 participants—65% indicated to intend to undertake the oncology certification exam. Participants from 17 health care centres and 12 provincial regions. 1) Pre-evaluation 2) Leaner demographics 3) Knowledge and confidence prior to the study group using a short MCQ and based on specialist oncology competencies. 4) Post-study test suggested an increase in knowledge.	1) Final evaluation—only 31% response. 2) Exam success rate was 94% (n = 72) 3) Increased understanding of disease processes and cancer treatments 3) Increased confidence in their work.	2 b
18: Joubert et al. (2002b) South Africa	Evaluate the effect of a computer-based teaching programme on the knowledge, problem-solving skills and learning approach of student nurses in an oncological practise area.	Concept learning approach	Evaluation of online programme	Quasi-experimental design with convenience sample of student nurses in first and second year, including a 2-month placement in oncology: 80 nursing students accessed programme in multi-media centre, and 40 during clinical placement. Pre- and post-test recorded using 5 instruments: - Computer-based data collection programme - Lancaster learning appraisal and course evaluation - MCQ pre- and post-test - Problem-solving case study pre- and post-test - Guiding and coding form	Responses ranged from 82.5 to 100% with different outcome measures. The computer-based programme made no difference to problem-solving skills; there was no statistically significant change in learning approach; lecturer input was required with problem-solving and care planning skills.	3
19: Hall P et al. (2011) Canada	Development of a total pain module	Theory: 1) Inter-professional education 2) Engestrom activity theory 3) Knotworking'; Illerisi's tension triangle; Petrie's idea dominance; and narrative-based learning.	4 pilot groups (n = 6, 3, 5) 89% women 11% men Total Pain Module, 12 h of learning over 2 weeks. Based on a fictional patient. 49 monologues across the domains of physical psychological, social and spiritual. Monologues were supplemented with videos, audiotapes and photographs. Additional tools: referencing material, electronic medical record—inter-professional progress reports, discussion forum and private note pad. Learners assigned to	Nursing n = 5, Medical n = 7 Spiritual care n = 4, Physiotherapy n = 2 Other n = 2 1) Pre- and post-module questionnaires on Attitudes Toward Health Care Teams Scale 2) Satisfaction —Likert scale Knowledge (designed for the study) 3) Survey—follow-up 3 months after (devised by the team)	Different professionals took different routes through the module. Spiritual care focused on spiritual and social aspects; medical on the physical domain; nursing each domain equally but not in-depth. Scores doubled for identification of spiritual domain and physical domain. Explicit identification for inter-professional collaboration. 3-month follow-up survey identified benefits to team work, reported sustainable value of the module with application in practise.	2 a

Table 1 (continued)

Author	Aims/research question/s	Theoretical framework	Intervention	Research methodology	Findings	Kirkpatrick level
20: Letizia M and Jones T (2012) USA	Develop and deliver 3 modules	Transtheoretical Model (TTM) changing behaviour.	groups—assignment is as inter-professional care plan. Community of practise based on 3 modules. Divided into three sections over 3 months and 3 modules/month.	99 participants 1) Pre-test and post-test of 50 questions. 2) Self-rating scores on confidence and application to change in practise. 3) Rated: achievement of each objective for each module, guest lecturers' teaching effectiveness/expertise, and current confidence in managing pain and dyspnea in patients receiving palliative care. 4) Additional items included the participant's rating of (1) effectiveness of technology in delivering information, (2) ease of accessing materials in the modules, (3) relevance of the content to NP practise, (4) benefit of participation on the discussion board to NP practise, and (5) change in NP practise resulting from learning/understanding the content.	Characteristics of the participants Internal consistency of a 50-item post-test Cronbach's coefficient (0.81), Kuder Richardson 20 (0.79). Item difficulty scores Low 0.657 to high 0.9990. Pre- and post-test comparison t test analysis indicates significant learning gains among participants. Programme evaluation extraordinary positive. Confidence levels were reported as increased by 83.6 and 92.7% participants indicated that they had changed their practise.	3
21: Wittenberg-Lyles et al. (2014) USA	Utility of a palliative care communication curriculum offered through online platform Examined HCP clinical communication experiences related to palliative care topics.	None	4 of 7 modules of the COMFORT communication curriculum were made available online, and participant assessments and knowledge skills were measured. Module lasted for average of 96 min. On average, 1.6 modules were taken out of the 4 offered. Attrition rate low. Four modules were as follows: Communication module Orientation/opportunity module Family communication Team communication	177 Participants had to have finished an "end-of-life" module in the past. 1) Pre-module survey—close-ended items: cultural differences and literacy in communication pre-survey 2) Immediate post-module evaluation and knowledge quizzes were used to assess program effectiveness. Outcomes measured: experience, knowledge, most useful communication skill. 3) Self-reported confidence in communication 4) Communication with family members survey 5) Kruskal-Wallis p values applied to 5-question evaluation item about the course structure design and knowledge pre- and post-module.	On-going study in progress 177 participants completed 292 modules. This is a snapshot with no longer-term impact data available. No enhancement to communication skills No detailed information other than the HCP status.	2B

Table 1 (continued)

Author	Aims/research question/s	Theoretical framework	Intervention	Research methodology	Findings	Kirkpatrick level
22: Moore et al. (2012) UK	Evaluate an academic module on the management of mesothelioma for health care professionals; skills knowledge and confidence indirectly/directly enhancing quality of services and improve patient care.	None	Module development and delivery.	First level analysis—module evaluation Second level of analysis—impact measured after a year from the course completion. 26 students.	First level analysis—Students reported increase in knowledge, understanding and confidence. Stating that they favoured the content, networking and learning methods. Response rate was 88%/67% Second-level analysis—47% response rate. With 87.5% stating that they had increased confidence; 75% positive impact on practise and 37.5% developed a wider network of support with 25% stating that it had helped them develop initiatives in their clinical area.	3
23: Kinghorn (2005) UK	Descriptive evaluation of an online delivery of "The management of cancer: psychological perspectives".	None	Module on an MSc in Clinical Oncology/Palliative Care, run over 16 weeks validated through the University of Newcastle. The group was invited to identify ground rules for the discussions, had access to course materials on Blackboard 6, including 21 full-text articles and 15 web links; learning activities were based on work-based learning approach including reflection, application of psychosocial frameworks, consideration of best practise, discussion boards, email and assignment submitted to the module leader.	Sample size 23 Evaluation completed by 23 of the 29 staff who undertook the module included: number of hits to each part of the VLE; and 25% completed the module evaluation.	318 contributions to discussion; discussion board as most popular with 73.5% of hits attributed to this. Authors concluded that staff need support with e-learning; vigilance of moderator important so unburdening comments are picked up; work-based activities were useful	1
24: Faiman (2011) USA	To educate oncology nurses about the latest treatments and strategies for optimal side-effect management for patients with multiple myeloma (MM).	None	Multiple Myeloma Mentorship Program, linked nurses and educators with a MM expert mentor to design a curriculum to address unmet educational needs. Modules in various formats including Web-based with live webcasts to review progress and answer questions.	Sample size 75 Mentees ranged from novices to experienced educators: 25 expert nurses from 23 cancer centres partnered with 50 nurses and nurse educators from 49 institutions. Mentors compiled anonymised feedback from the webcasts at midyear and end of programme.	Emergent themes identified: preference of learning format; technological challenges with accessing Web-based programmes; time challenges to complete Web-based or live programmes; implementation of practises; content; communication between mentors and mentees; cost-effectiveness of Web-based learning format.	1
25: Chapman and Oultram (2008) Australian	To investigate the effectiveness of e-learning compared with the traditional face-to-face methods of education for an in-service educational project for radiation therapists.	1) Adult learning principles and 2) Learner-centred approach	Previously didactic, reading and interactive orientation and planning modules transformed into an e-learning format using Knowledge Presenter authoring	2 cohorts of radiation therapists during intern year after graduation. Evaluation part of a year assessment of interns; assessment completed every 6 weeks.	Median hours of face-to-face: E-learning group: 4.5 (range 3.00–6.50) Face to face group: 28.13 (range 9.70–42.00) Median number of phone calls:	1

Table 1 (continued)

Author	Aims/research question/s	Theoretical framework	Intervention	Research methodology	Findings	Kirkpatrick level
			software; delivering the same content and activities.	Resource utilisation was measured using: - Face-to-face hours spent by the supervisors with interns - Phone calls by interns to seek assistance Data retrieved from a quality assurance system recording daily statistics for clinical educators. Descriptive statistics: median and range reported; and non-parametric analysis (Mann–Whitney U test) to compare face-to-face with e-learning.	E-learning group: 0 (range 0–6) Conventional group: 8 (range 2–18) Significant different in face-to-face contact between intern and supervisor ($Z = -2.46$, $P = 0.14$) but not in number of phone calls ($Z = -1.50$, $P = 0.13$). Authors suggested that e-learning programmes may free up education time.	
26: Smith and Gordon (2009) UK (Scotland)	A pilot process evaluation—how can competencies and a competency model help educates and guide practitioners?	Course based on a 4-level competency framework for spirituality and adult learning theory delivered on Moodle.	Three focus groups held to determine level and content: 4 themes—self-awareness, communication skills, theoretical knowledge, and professional role. Blended face-to-face (one day) and online activities over 5 weeks; including discussion boards, video clip, self-assessment of competency, case study and reflection.	12 participants; 4 withdrew early and another 4 did not complete. Evaluation included: technical and administrative issues; content and timing of learning activities on face to face day; Moodle activities; access to VLE; navigation of course site and course layout Final reflections at 7 weeks.	Fairly brief descriptive findings. A few had initial technical difficulties; and 2 had anxieties about lack of technical skills. Paper reports narrative data on participants comments collated from end of day discussion which appeared generally positive.	1
27: Arenella et al. (2010) USA	Evaluation to assess the effectiveness of a pilot partnership with Medscape to disseminate a portion of an Education in Palliative and End-of-Life Care for Oncology curriculum.	None	Activity consisted of 10 Web pages including text, graphics, streaming video clips related to preparing for end of life. Printer-friendly downloads. Activity on Medscape Palliative Care Resource Centre.	Sample size 869 Descriptive evaluation using 1) Post-activity evaluation surveys posted routinely by Medscape, on user feedback between August 2006 and March 2007.	109,283 unique users and 20,061 earned continuing education credit for completion. Third were doctors and two thirds were nurses from different specialities. 869 responses from participants Table of results suggests they were scored from 1 to 5 (strongly disagree to strongly agree) with 5 questions: Activity supported learning (mean score 4.62) Organised material (mean score 4.60) Impact on practise (mean score 4.41) Objective material free from bias (mean score 4.59) Recommend to others (mean score 4.60)	2 a
28: Ellman M S et al. (2012) USA	Does Inter-professional education work in an online format: How do students from different professions interact with the educational content?	None	Online module format with content on spiritual/cultural care. Length approximately 30–45 min long.	50 post-graduate nurses The methodology was free-text analysis and a questionnaire	The findings suggest that there were differences in reflection on and within the different professions in the online environment. Nursing students found it significantly	1

Table 1 (continued)

Author	Aims/research question/s	Theoretical framework	Intervention	Research methodology	Findings	Kirkpatrick level
					helpful yet medical students found it least helpful.	
29:Fenton G (2014) UK	Does the digital learning object of a service user increase awareness, knowledge and satisfaction?	None	Digital learning object	Sample size 40 Review instrument: Acceptability Content quality Motivation Design interaction Reusability learning and reflection	Findings presented in a table format with either agree/neither/disagree statements for 8 questions. With free-text comments for each question. Written comments were grouped into three themes "Valuing the patients' perspective", "the nurses' skill" and the "learning object". Nursing students reported that this was a useful addition to their learning and could be accessed through out the module. Giving an insight into the patient journey.	1
30: Trocky et al. (2011) USA (Baltimore)	Article describes the development and implementation of the Web-based modules, review outcomes and discuss potential implications.	None	Breast cancer experts and external consultants developed 7 Web-based educational modules to supplement a full curriculum of a baccalaureate degree programme: epidemiology, risk, screening, staging and grading, treatment, survivorship, disparities. Each module has pre-test MCQ and links to other modules and contains some information on the nursing role	Sample size 32 An entry-level curriculum committee evaluated the modules which were integrated into an undergraduate course on women's health, hosted on Blackboard. They were a course requirement and students received a certificate as evidence of completion.	32 students successfully completed the modules during 2007. Formative feedback using a standard course evaluation questionnaire: "high degree of acceptance of the modules" No issues with accessing materials p values reported relating to difficulties with the examination questions (vague) In 2008, around 1600 people accessed the modules and some schools have no integrated them into the school curricula	1
31: Cushen et al. (2002) UK	Evaluation (pilot) of a CD-ROM used with all staff involved in cytotoxic chemotherapy administration.	None	CD-ROM Package: "Safety in the clinical use of cytotoxics" commissioned by North Thames	Sample size 15 Formative and summative knowledge assessed using MCQs. Doctors, nurses and pharmacists undertook the training: 10 (70%) completed the evaluation questionnaire, which focused on access, quality of graphics, content, re-accessibility. Outcomes: results of knowledge questions and free-text comments.	Content: all found it good or very good in all sections; Comments: repetition/duplication in teaching package; some gaps or information not explicit. Concluded that the package complemented local education and training programmes; use for staff induction along with clinical experience.	1
32: Meade et al. (2006) USA (Florida)	Evaluation of the development and application of web-based modules relevant to communicating cancer and literacy for cancer control researchers	Adult learning theory	Web-based modules on Blackboard including topics such as applied anthropology, literacy, and importance of cultural beliefs in cancer control, cancer genetics. Based on adult learning theory and aimed to create a community of	Module evaluation instrument with 25 MCQs and open-ended questions to identify if objectives were met, the appropriateness and relevance of content, satisfaction with the module. Point 1—immediately	Response rate was 89%. Objectives met at Pt 1, 2 and 3—90.5%, 98% and 97.6% Level of content at Pt 1, 2 and 3–83%, 76.5%, 86.6%	1

Table 1 (continued)

Author	Aims/research question/s	Theoretical framework	Intervention	Research methodology	Findings	Kirkpatrick level
			professionals via distance learning in self-paced, motivational and inexpensive format. Included discussion boards, steps to ensure accessibility, web links, crosstalk 30-min discussions with guest scholar, quiz, student tracking.	after the module; Points 2 and 3 at 6 and 12 months. 64 interdisciplinary group of doctoral prepared cancer control researchers including 83% women and 61% racial/ethnic minorities.	Appropriateness of materials—90% found then appropriate or very appropriate. Organisation of materials at Pt 1, 2 and 3 identified as excellent or very good (91%, 75.4% and 94.8%) Flow of content as excellent/very good at pt. 1, 2 and 3—88.4%, 84.3% and 95.3% Format satisfaction extremely high to high ranged from 91.4 to 94.1% Discussion board found fairly useful (53%) or not useful (51.2%) in another cohort	
33: Probst et al. (2009) UK (Sheffield)	Case study to review experience of moving to an online learning approach for a MSc in Radiotherapy and Oncology	Based on constructivism—that knowledge is situated through social experiences and 5-stage Salmon model (active learning based on reflection, construction of knowledge, authentic tasks, assessment for learning)	MSc in Radiotherapy and Oncology for radiation therapists and others. Inter-professional research methods module and cancer-specific CPD and two new Advanced Practise modules. Use Blackboard with national and international students.	Sample size 75 Students enrolled on traditional and online modules over 2 semesters and 50 completed the pre-course questionnaire and 25 the post-course questionnaire. Evaluation tool developed from Wilkinson with 8 scales: IT use and confidence; preference for e-learning, orientation to the module, research skills, support through the module, quality of materials, intrinsic motivation, evaluation of the module.	Preference toward e-learning correlated with IT confidence e-Learning students had higher scores for intrinsic motivation At completion, there was no identified difference in mean assignment scores between the 2 delivery modes and no difference in completion rates. Younger students more likely to complete; module evaluations showed similarity in experience.	1
34: Smith et al. (2010) UK	Descriptive evaluation of an online module relating to end of life needs.	None	A 6-week online programme developed by Marie Curie Cancer Care called Communication Skills for Effective Patient and Carer Assessment. 90 min per week working on the learning materials with key areas in: getting to know each other; access to useful literature; review and online discussion of case studies (audio and visual); and evaluation Online self-assessment of confidence before and after course using modified Wilkinson questionnaire Online post-course candidate evaluation Online post-course moderator evaluation.	30 Practitioners participated in the pilot including RNs and HCA with 12–15 in each group. Required: 6 months experience in the area, access to a pc and able to contribute 2 h per week. 3 withdrew 1) Increased confidence in explaining the assessment process to patients, summarising the assessment interview and discussing an action plan with patients and carers.	57% evaluated the course as excellent and 43% as good. Online discussion—60% strongly agreed and 40% agreed this helped develop new insights Moderators found co-facilitation positive but demanding; need to make expectations clear; online presence of tutor as important	3

Table 1 (continued)

Author	Aims/research question/s	Theoretical framework	Intervention	Research methodology	Findings	Kirkpatrick level
35: Joubert et al. (2002a) South Africa	To evaluate a computer-based teaching programme developed for student nurses in oncological clinical practise, comparing groups accessing the e learning in two different settings.	Concept learning approach	Moderators underwent online training over 8 weeks. Interactive online education programme: undertaken over 2 months; or over 6 h in a multi-media centre. Previous pilot with 3 experts in oncology nursing, 3 experts in computer-based learning and 4 student nurses.	Sample size 60 Comparative, descriptive design with convenience sample of student nurses in first and second year, including 2-month placements in oncology. One group accessed the programme in practise ($n = 40$) and one in a multimedia centre ($n = 20$). Used 67-item questionnaire with Likert-scale rating effectiveness in: Teaching, cosmetic, programme and curriculum.	60 students completed the questionnaire. There were no statistically significant differences between the two groups in all criteria in non-parametric Mann-Whitney test and 95% non-parametric confidence intervals.	1
36: Jerome-D'Emilia et al. (2010) USA	Feasibility study to educationally prepare nurse to work with vulnerable rural breast screening mammography population To determine whether patient outcomes change as a result of the education, and if these outcomes can be evaluated at a distance.	None	Four Blackboard web-based sessions: Videoconferencing, Distance learning, Slide presentations, Interaction with experts through online discussions.	8 community health clinics in areas of >25% African American population: 4 clinics randomly assigned to the education intervention; 4 to the control group. 13 in the intervention group and 4 in the control. Nurses' breast cancer knowledge tested before and after the programme; technology evaluation survey after each educational intervention; and review of 50/266 anonymous charts of women eligible for mammogram to determine rates of referral and uptake of screening mammograms.	t tests indicated an increased knowledge about breast cancer in the intervention group. 22 nurses logged onto Blackboard but only 1 took part in the discussion. Indication that the intervention resulted in a small increase in likelihood of African American women receiving referral or going for mammogram.	4
37: Kerfoot et al. (2010) USA	Hypothesised that an email-based intervention termed "spaced education" could reduce clinicians' inappropriate screening for prostate cancer.	None Learning outcomes based on national standards.	Series of four isomorphic cycles of nine e-mails over 36 weeks (0–2 per week). Each presented a clinical scenario and asked whether appropriate to obtain a PSA test.	95 primary care professionals Randomised into two cohorts: intervention group who received emails; and control group received no emails. Primary outcome was number and percentage of inappropriate PSA screening tests ordered- defined as use of PSA in patients aged >76 or <40 years.	In weeks 1–36 professionals receiving the e-mails ordered significantly fewer inappropriate PSA screening tests than control clinicians ($p = 0.041$). In 72-week period following intervention, the intervention group continued to order fewer inappropriate tests than control group ($p = 0.011$).	4
38: Philips et al. (2014) Australia	To test the impact of an online pain assessment module on specialist palliative care nurses.	"Spaced education"	Using Q stream mobile application— Intervention was 11 case based pain assessment learning scenarios which were "pushed" to the	103 nurses were invited to participate in two hospital sites. $N = 74$ participated.	The survey—60% ($n = 45$) participated in the baseline survey and the intervention of those who completed the intervention 75%	4

Table 1 (continued)

Author	Aims/research question/s	Theoretical framework	Intervention	Research methodology	Findings	Kirkpatrick level
			participant's email over a 28-day period. "Spaced" and "repeated" over time. Multiple choice and short answers. The correct answer was provided as soon as answered. Participants were allocated 20 min per week to undertake the content and exercise. They also provided designated computer to complete the session.	They used a survey devised to have 17 questions reflecting essential elements of comprehensive pain assessment. Also collected audit data on 60 patients admitted with pain charts. The audit data was collected 1 month before the intervention and then again 6 weeks after the intervention finished.	($n = 34$) proceeded to complete the second survey. A significant difference was found associated between the mean competency scores across all three domains when comparing the T1 and T2 surveys. Pain assessment knowledge, pain assessment tool awareness, and pain assessment confidence. Audit data—reported a significant reduction in reported pain ratings; however, this is only reported in the paper as a mean pain score so hard to determine by patient type or relevance to reason for admission.	
39: Lewis (2008) UK	An audit to compare face-to-face with online delivery as identified in the number of inadequate smears, and pick up of transformation zone cells from the cervix.	None	e-Learning programme to deliver theory prior to attendance at a one-day theory/clinical delivery and practical skills training in a clinical setting.	Group 1: 135 participants undertook 3-day theory course face to face in 2003. Group 2: 153 undertook an e-learning programme during 2004–5. Cervical Screening Wales audited individual smear-taker activity using their unique codes to identify numbers of inadequate smears in <50-year old women. Level of study accessed and completion rates also recorded.	Inadequate smears: Group 1—0–9.5% Group 2—0–7.7% Transformation zone sample: Group 1—33–94.4 Group 2—5–93.9% The academic achievements of both groups were similar. Author suggests that a move to e-learning did not alter the characteristics of sampled material or disadvantage patients.	4

confidence in communicating before and after the course [15, 34], and one study undertook pre- and post-testing of knowledge and skills using multiple choice questions and vignettes [12]. Three studies built in a follow up of the knowledge and skills in estimating the impact and potential behavioural change of the student over differing lengths of time; after 3 months [19], after a year [22]; and after a period not reported after the course [16, 18, 20].

Kirkpatrick Level 4

In a small number of papers, there was evidence of attempts to evaluate clinical impact. For example, the uptake of mammogram was measured in women aged 50–65 in one study where an online education programme for nurses had been instigated [36]. Similarly, the number of prostate screening tests ordered by practitioners receiving educational emails was recorded [37], whilst face-to-face teaching was compared with online delivery of cervical smear education by recording the rates and quality of smears in the two groups [39]. Finally, evaluation of using a mobile application of "spaced education" as an intervention for pain assessment learning included audit data which suggested a significant reduction in pain ratings [38].

In summary, the literature reviewed indicated different levels of evaluation with limited evidence of validated tools in use. Some evaluation methods were not clearly stated or at a very early stage, and tools were not always included in the papers. Many papers incorporated different methods of evaluation, although none considered the synthesis of evaluation data. Mostly, data were qualitative in nature or developed as descriptive statistics, which were not always robust or clearly presented.

Discussion

The overall aim of this systematic review was to critically analyse the literature relating to the effectiveness of online cancer education for nurses and allied health professionals. To achieve this, the Kirkpatrick's model of evaluation [9] was utilised as a framework for analysis, reporting of findings and structuring of the discussion. Thirty papers were examined giving rich information on the education that is internationally relevant.

In this section, we will discuss the studies in general and then group by the Kirkpatrick's level of evaluation, concluding by comparing the levels in terms of key indicators for a rigorous evaluation in online cancer education.

From this review, it is apparent that there is no singular reason to develop and deliver an online or blended education intervention. The reasons ranged from the geographical to the numbers of students attending the course. In arguing for the impact of the education intervention in terms of increasing

knowledge and skills, including confidence or actual clinical outcomes, there is no evidence to suggest that online delivery of the education is better or worse in education terms than face-to-face delivery. The advantage of online delivery is the potential to engage more health care professionals in education. This is reported in the four education Kirkpatrick level 4 interventions delivered [36–39] that all used clinical patient referral rates, with change of practise in screening as their outcome measure. These studies identify that the online delivery does not hinder the achievement of clinical outcomes. Furthermore, these studies also indicate that the education intervention can be delivered using different, innovative formats to achieve a similar aim, focused on improving knowledge about cancer screening [36, 37, 39] and symptom assessment [38].

Using the Kirkpatrick's model of evaluation to structure the analysis of the evidence, we have afforded the review team a lens to identify that the majority of papers (n = 15) are evaluating at level 1 of the Kirkpatrick's model; assessing the views of the quality and accessibility of the content and the IT infrastructure [13, 23–25, 29]. Here, the predominant approach to measurement of views is the survey's inclusion of open-ended questions [28, 32, 33, 35], evaluation questionnaires [27, 30, 31] or a qualitative research approach utilising focus groups and individual interviews [10, 11, 26].

From the 12 papers at levels 2a, b and 3 of the Kirkpatrick model of evaluation, we can see the introduction of pre- and post-questionnaires, developed specifically to study changes in knowledge, confidence attitudes and self-efficacy [19]. There is a trend of larger numbers of students being involved in these studies [14–18, 20, 21] than those representing level 1 evaluation. The rigour was enhanced due to cohort comparisons of student populations [14, 18]. However, a number of studies had low participant numbers [12, 13, 19, 22] with high attrition and low response rates limiting their findings [12, 22].

The trend of higher numbers of participants can also be seen in the evidence relating to Kirkpatrick's level 4 grouping with one exception [36]. The relationship between the education and clinical impact is measured in referral rates to services; audit of appropriate smear [39]; pain medication received [38]; and reported patient pain scales. It is acknowledged that trying to find a causal link between the education and the clinical outcome data is challenging because there is a sense that, in these studies, the research is trying to move this educational evidence base forward.

Education and theoretical models were seen at all the levels of the Kirkpatrick's evaluation model. At levels 4a and b, a new theoretical model evaluation was represented by the "spaced education" [37, 38]; and two studies used specific online education theoretical models; one study representing levels 2a, b and 3 evaluations identified *situational learning theory* and *legitimate peripheral participation of community*

of practice [14]. The other study represented level 1 evaluation which used the *5 stages Salmon Model* [33]. Each of these theoretical models, and others, is important to embrace, to underpin the design and participation and to enhance the online learning experience.

Given the limited outcome measures above, the scope for assessing effectiveness of online education from the literature identified in this review is challenging. Additionally, the research methodologies used within studies indicate a need for caution in accepting claims. For example, that online education influenced the uptake of mammograms in a rural area [36] or reduced the number of prostate screening test ordered by clinician receiving emails incorporating clinical scenarios [37]. Adapting a face-to-face course for online delivery did not appear to influence the quality of smear-taking [39], although there are many other variables that might influence the outcomes in such as study.

There are several examples in the literature of the use of pre and post-test tools, which suggest some evidence of effect; however, poor responses to post-tests in some studies indicate a further need for caution in interpreting results. A study of an online cancer education format for 107 nurses in 12 regions of Canada reported outcomes such as increased knowledge and confidence but only had a 31% response rate in the final evaluation whilst also recording an exam success rate of 94% [17].

Limitations of This Review

There are several limitations within this review. Firstly, the review team had a focus on the nursing and allied health care professionals. Consideration of other professionals was given, in fact the theoretical framework "spaced education" has been translated from the medical education field into these education initiatives for the nursing and allied health care professionals. However, the team felt that a focus specifically upon nursing and allied health care professionalswould give a robust and focused view to enable the development of education for current educational practise. Secondly, the review only incorporated English reported studies, which could exclude a number of online cancer educational evaluations. Thirdly, studies were included from the year 2000 onwards as there is an indication that this evaluation and research was in its infancy before this date. Fourthly, it could be argued that by using the Kirkpatrick's evaluation model [9], the review team limited the lens on the articles; however, the use of Kirkpatrick model is not viewed as a hierarchical level of success rather an attempt to analyse the studies and categorise them according to the reported level of evaluation: views, knowledge, attitudes, organisational change and clinical outputs. Therefore, this review provides an overview of methods used to evaluate on-line learning at different Kirkpatrick levels.

Conclusion

To determine the effectiveness of the methods of evaluation used in the online education in cancer care, this review concludes that understanding participants views/experiences and identifying changes in participants' values and attitudes, knowledge and skills are being reported for groups educated over a wide geographical and/or rural areas. Evidence for clinical and educational effectiveness is weak, offering insights into experiences/satisfaction and participant perceptions rather than concrete quantitative/impact data and patient-reported outcomes.

Therefore, key indicators/recommendations are for more clinical educational research, which incorporates and demonstrates the longer term effectiveness and impact of online cancer education on patient-reported outcomes, underpinned by theoretical frameworks and using more rigorous methods i.e. standardised evaluation tools or randomised control trials to build upon and enhance the quality of evidence.

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