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***Research into Best Practices in e-
Learning for Allied Health clinical
education and training***

Grimmer-Somers, K., Milanese, S. & Chipchase, L.

2011

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Executive Summary

This project was conducted in four stages. A systematic literature review was undertaken using a realist synthesis approach (Stages 1 and 2). The findings from the review were validated by interviews with purpose-identified academics experienced in e-learning, and end-users of e-learning and distance learning (Stage 3). The interview findings were layered with those of the systematic literature review to produce Guiding Principles and Strategies for Queensland Health to underpin the development and application of effective, best-practice distance learning (Stage 4).

Guiding Principles

1. Blended learning strategies have application for distance education, as well as for traditionally-delivered education in classrooms. Blended learning combines any number of learning opportunities, including e-learning or other forms of distance education (videos and voice recordings, telephone coaching etc), traditional face-to-face teaching and tutorials, individual coaching, peer-support groups, and regular feedback.
2. Blended learning strategies should be employed where possible, for allied health undergraduate, postgraduate and continuing professional development courses, as the learning outcomes are considered better than from traditional teaching and learning strategies
3. There is no 'one size fits all' approach to optimising the learning outcomes of allied health students, no matter what the learning environment. In any one class, different students have different learning styles, and will learn at different speeds and with different educational prompts and supports. Educators should consider applying a range of different teaching and learning strategies that will address the learning needs of all students in their classes, irrespective of the learning environment.
4. For any allied health student in any class, there should be an emphasis on active learning which employs concrete as well as abstract thinking.
5. When designing and implementing distance education courses, careful consideration should be given to how students learn best when education is consumed at a distance from traditional classrooms.
 - Students studying synchronously at a distance may require different media and tutor supports to students studying asynchronously at a distance. It is important that the method of delivery of education addresses the learning needs, styles and environments of individual students, and educators should seek to understand how individual students learn, prior to them commencing distance education courses.
6. Active learning strategies should be engaged where possible for all allied health students (irrespective of the learning environment), including the use of interactive problem-solving, case demonstrations and scenarios, quizzes with immediate feedback, and problem-based learning in groups. Whilst the use of current and innovative media should be considered if e-learning is a component of blended learning, the choice of media should not be more important than the course learning objectives, and it should complement rather than dictate students' learning styles.

Strategies

1. Prior to commencing the development of e-learning training packages, it is vital to gain an adequate understanding of the nature of the content to be taught.
2. E-learning appears to have an important role in:
 - Teaching general knowledge and theoretical background information.
 - Allowing active reflection of new training material, i.e. integrating new material with old knowledge.
 - Providing updates on new advances in the discipline.
3. Areas of concern about using an e-learning medium include the educator's capacity to use it to:
 - teach interpersonal skills, and
 - teach and assess high level clinical skills, particularly where competency needs to be demonstrated
 Thus, care should be taken when using e-learning in these ways, as good learning outcomes may not result.
4. E-Learning should be supported by the use of face-to-face workshops to allow participants the opportunity to develop higher cognitive clinical reasoning skills and display interpersonal skills. This face to face experience is also important to accommodate the range of learning styles
5. The use of animations/technology etc. should be carefully selected to enhance the learning experience. Learners who are not comfortable with the use of technology will be turned off by poor animations/video.
6. Teaching material and reinforcement processes should be provided in a range of different formats that accommodate different learning styles.

1. Background

Innovations in e-learning technologies have been an important part of a revolution which is occurring in education, as they have allowed learning to be individualized (adaptive learning), and to enhance learners' interactions with others (collaborative learning) (Nelson & Steele, 2007). E-learning has transformed the role of the teacher to one of a networker and facilitator (Ruiz *et al.*, 2006). Using e-learning assists students to learn 'in place' and acquire the skills, motivation and resources to independently seek information that will assist them to solve clinical questions, and stay on top of current best evidence (Eva, 2005; Norman, 2005).

The issues of optimising adult learners' time, providing them with the most effective supports for learning and ensuring that the supports are available when they are needed, have emerged over the last decade as key drivers for effective adult education (Varpio *et al.*, 2009). Students should be supported with 'adaptive learning' expertise, which includes training by whatever medium is most appropriate, such as e-learning and face-to-face sessions. This allows students to apply adult learning principles and processes to workplace problems (Mylopoulos & Regehr, 2009).

A systematic review of the value of e-learning in the health professions reported that the main barriers to the up-take of e-learning included inadequate technology, lack of skill and learners' requirement for a component of face-to-face teaching (Childs *et al.*, 2005). Face-to-face teaching is particularly important in the health professions where skill acquisition and clinical reasoning in context underpins professional competence. Thus, 'blended learning' is viewed by many as the 'most effective approach to learning' in health professional education (Moore *et al.*, 2006). Blended learning combines e-learning technology with traditional instructor-led training, where for example, a lecture or demonstration is supplemented by online tutorials (Moore *et al.*, 2006).

This project was conceptualised to provide current best evidence regarding the effectiveness of blended learning (including e-learning), and to explore strategies to maximise learning outcomes from blended learning activities.

Project Design

The project was conducted in four stages. Stage 1 established a realist synthesis framework within which to interpret the findings of Stage 2, the systematic literature review. Stage 3 comprised interviews with purposively sampled academics with a special interest, or experience, in blended learning and/ or e-learning, and end-users of e-learning programs. Stage 4 was the establishment of Guiding Principles and Strategies to assist Queensland Health capitalize on the most effective uses of blended learning and e-learning, particularly for distance education of allied health professionals.

Project Aims

Stage 1. To establish a realist synthesis framework within which to consider the findings of the systematic literature review, with respect to allied health professionals

Stage 2. To undertake a systematic review of the literature to:

- identify the ways in which blended educational strategies are reported for clinical education and training
- synthesise the effectiveness of these strategies, using reported outcomes
- report the findings within the realist synthesis framework established in Stage 1, relevant to allied health professionals

Stage 3. To validate and enhance the findings of Stage 2 with allied health academics and end-users of blended learning strategies and /or e-learning strategies particularly related to distance education for allied health professionals

Stage 4. To develop guiding principles and underpinning strategies regarding the most effective use of blended learning strategies, for use by Queensland Health, when providing distance learning for allied health professionals



2. Methods

2.1 Stage 1: Realist synthesis framework for the literature review

A realist synthesis approach, proposed by Pawson *et al.*, (2005) for literature reviews on complex interventions, was used to frame this review. We took this approach because our preliminary reading indicated that blended learning is a complex intervention which is not readily disentangled into separate intervention arms (such as can be addressed in a standard systematic literature review). The first step in undertaking a realist synthesis approach involves the construction of a theoretical framework. The findings of the literature review are then used to populate this framework and the framework is modified or enhanced as appropriate, based on the review results.

We built our synthesis framework by considering a) the predominant theories around adult learning styles, and b) learning styles reported for allied health disciplines. We considered the literature on adult learning styles only, as these are relevant to undergraduate and postgraduate tertiary students, and continuing professional education.

2.2 Stage 2: Systematic review of the literature

A systematic, step-by-step approach was undertaken to ensure transparency, comprehensiveness and rigour in searching and data synthesis.

Two independent reviewers conducted an initial scoping search of a range of electronic databases using strategic keywords (Appendix 1). The electronic databases searched are listed in Table 1. As a result of the initial scoping search, further keywords were identified. Thus to ensure that we had captured all relevant publications, a secondary search was conducted. Independent reviewers examined all data sources to maximise the scope of the search, and to reduce errors/bias in accessing peer-reviewed evidence.

The search included all available and relevant library resources as listed in Table 1.

Table 1. Databases searched

Academic Search Premier AMED AARP Ageline CINAHL Cochrane Library Current contents connect EMBASE ERIC Health Source:consumer edition	Health Source: Nursing/Academic Edition MEDLINE PubMed PsycARTICLES Science Direct Scopus SPORTDiscus Web of knowledge Web of science
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A combination of search terms were used to identify and retrieve peer-reviewed articles from all the databases listed above for the first (Keywords 1, 2, 3 & 4) and second (Keywords 4, 5 & 6) searches. Appendix 1 provides the step by step approach which is summarized in Table 2.

Table 2. Key words used in searching

Keyword 1	Keyword 2	Keyword 3	Keyword 4	Keyword 5	Keyword 6
distance learning blended learning public health emergency	web-based learning e-learning e learning hybrid learning flexible learning mixed mode learning	effectiveness Success preparedness	allied health health professional	learn* educat*	combined hybrid mixed multiple

Inclusion Criteria

Quantitative and qualitative publications were considered for inclusion. The review was limited to articles published in the English language with no publication date restriction.

Data cleaning and pearling

Duplicates were removed and pearling of the reference lists of included articles was conducted to ensure all relevant literature was included in this review.

Hierarchy of evidence

The hierarchy of quantitative evidence was determined using the Australian National Health and Medical Research Council (NHMRC) Intervention Hierarchy (National Health and Medical Research Council, 2009) (see Appendix 2). We added a further level of evidence to this hierarchy for the purpose of this project (Level V, comprising expert opinion). This could include editorials, opinion pieces and non-systematic literature reviews. Where literature reviews were systematically undertaken and reported, but included other than Level II studies, we noted them as Level 1 studies, however we explained their component studies when discussing their findings. We took this approach because NHMRC offers no other way of classifying such secondary evidence. Appendix 2 provides the levels and explanations for this section of the hierarchy. The qualitative papers were categorised using Daly *et al.*, (2007) hierarchy of evidence for qualitative research. This approach uses four levels of hierarchy (Generalizable studies (level I), Conceptual studies (level II), Descriptive studies (level III) and Single case study (level IV)) (See Appendix 3).

Critical appraisal

This was undertaken where appropriate, using the CASP instrument for secondary evidence (Public Health Resource Unit, 2006) and the McMaster instrument for primary studies (Law *et al.*, 1998). The findings are reported as percentages of the total possible score, for easy interpretation.

Data Extraction

Data extraction used a purpose-built data extraction tool containing the following data:

- Country of origin
- Study Design
- Setting
- Intervention
- Environment
- Outcome Measures
- Significance
- Conclusion

Synthesis

The data extraction findings were combined into summary tables to assist in interpreting the findings. Summary tables comprised a description of interventions related to student / setting, outcome measures reported, and the number of significant (or not) outcomes related to different interventions.



2.3 Stage 3: Validation of literature review findings by interview

Ethics approval

Approval was obtained from the Human Research Ethics committee at the University of South Australia.

Purpose of Stage 3

The purpose of the interviews was specifically to seek input from experts in the field, and end-users, to validate the findings of the Stage 2 literature review, and to provide insights into the operationalization of the literature review findings relevant to Queensland Health.

Sampling frame

A list of 13 possible interviewees was generated with input from the project researchers. Names of interviewees cannot be released due to ethical considerations, however all were either prominent educators in Australia in allied health disciplines, or volunteer end-users of e-learning and distance learning programs.

A standard invitation email was sent by an independent researcher based at the International Centre for Allied Health Evidence, inviting the nominated participants to engage in an interview regarding their perspectives of the key findings of Stage 2 of this project.

Background literature

The key findings and messages from combined Stages 1 and 2 were circulated to the interviewees prior to the interview.

Draft interview questions

All interviews were conducted by Dr Steve Milanese, who used a standard set of questions which had been developed from the findings of the literature review, discussed by the researchers, and trialed for coherence prior to commencement of interviews. The interview questions (outlined in Appendix 4) were delivered over the telephone.

2.4 Stage 4: Development of guiding principles

The researchers discussed the key messages from Stage 2 and layered them with the Stage 3 findings, to propose Guiding Principles and underpinning strategies to assist Queensland Health develop and administer successful distance learning programs based on the most effective teaching and learning strategies, using blended learning and particularly incorporating e-learning.



3. Results

3.1 Stage 1 Findings: The realist synthesis framework

Adult learning styles

A 'learning style' refers to the way that an individual prefers to learn. It relates to a range of constructs, including personality variables, socio-cultural background, workplace experience and educational experience (Coffield *et al.*, 2004).

A number of models of learning styles have been reported in the literature, and we cite those that are most relevant to the literature review of blended learning strategies. We provide brief overviews of the predominant strategies in this section of the review. Along with the models of learning styles reported in the literature, there are many instruments to assess student learning attributes and preferences.

Nunan (1990) describes four types of adult learners of English as a second language:

- Type 1: 'concrete' learners (like working in groups and using pictorial aids)
- Type 2: 'analytical' learners (like working alone, finding their own mistakes)
- Type 3: 'communicative' learners (learn by watching, listening, practising)
- Type 4: 'authority-oriented' learners (prefer teacher explanations)

Kolb (1984) proposed four learning styles: Active experimentation, Abstract conceptualisation, Reflective observation and Concrete experience. These styles all involve various levels of accommodating (concrete active learning), assimilating (abstract, reflective learning), diverging (concrete, reflective learning) and converging (abstract, active learning). The Kolb learning styles were commonly reported in the allied health learning style literature (covered in the next section of this review).

Gregorc (1984) reports on four similar styles

- concrete sequential [ordered,perfection-oriented, practical and thorough]
- abstract sequential [logical,analytical, rational and evaluative]
- concrete random [intuitive,independent, impulsive and original]
- abstract random [sensitive, colourful,emotional and spontaneous].

Another popular learning style model, proposed by Dunn (2003), divides learning styles into five strands (stimuli): environmental, emotional, sociological, psychological, and physiological. According to Coffield *et al* (2004), *'the environmental strand incorporates preferences for sound, light, temperature, and furniture or seating design. The emotional strand focuses on students' levels of motivation, persistence, responsibility, and need for structure. The sociological strand addresses students' preference for learning alone, in pairs, with peers, as part of a team, with either authoritative or collegial instructors, or in varied approaches (as opposed to in patterns). The physiological strand examines perceptual strengths (visual, auditory, kinaesthetic or tactile), time-of-day energy levels, and the need for intake (food and drink) and mobility while learning. The psychological strand incorporates the information-processing elements of global versus analytic and impulsive versus reflective behaviours'* (Coffield *et al.*, 2004 pp 21).



Mumford (1987), and Honey and Mumford (2000) proposed four types of learners (activists, reflectors, theorists and pragmatists) who react positively in learning environments to different stimuli and resources (pp 75, Coffield *et al.*, 2004).

	Learning activities		
Activists react positively to	Action learning Business game simulations	Job rotation Discussion in small groups	Role play Training others Outdoor activities
Reflectors react positively to	e-learning learning reviews	Listening to lectures or presentations Observing role plays	Reading Self study/ self-directed learning
Theorists react positively to	Analytical reviewing Exercises with a right answer	Listening to lectures Self study/ self-directed learning	Solo exercises Watching 'talking head' videos
Pragmatists react positively to	Action learning Discussion about work problems in the organisation	Discussion in small groups Problem-solving workshops	Group work with tasks where learning is applied Project work

Hermann (1989) described four learning styles which can be found singly, or in combination in a class (pp 82 Coffield *et al.*, 2004) (A=the rational self, B=the safe-keeping self, C= the feeling self and D=the experimental self). He described occupations with these different learning styles. Neither allied health nor medicine was mentioned as exemplar occupations.

Profile Type	Descriptor	Occupational Group
A	Rational	Chemical engineer, actuary
B	Safe-keeping	Assembly-line processor, bank clerk
C	Feeling	Nurse, primary school teacher
D	Experimental	Artist, entrepreneur
AB	Left brained	Production engineer, bank manager
CD	Right brained	Minister of religion, psychologist
AD	Cerebral	Physicist, forestry manager
BC	Limbic	Secretary, homemaker
Multi-dominant	Balanced	Director, customer service manager

As 'learning styles' are related to the way that an individual prefers to learn, it is important that a good teacher recognises the different learning styles of students in any class, and attempts to present information in ways which will meet individual learning needs. There is evidence that learners suffer in a classroom unless everyone's learning needs are recognised and catered for (Drysdale *et al.*, 2001).

Allied Health learning styles

We undertook a focused review of library databases to identify any peer-reviewed literature that specifically related to allied health students' learning styles. We took a purposive approach to identifying literature rather than a systematic approach, as we desired a 'scan' only of the most recent, predominantly reported theories with which to build our synthesis framework.

We used the words 'allied health', 'health science', and 'learning styles' and searched all major library databases (OVID, Cinahl, Pubmed, Science Direct, Ebsco Host). We found eight relevant references which reported similar findings on allied health learners. The references, study design type and key findings of these references are listed below.

Author	Hierarchy of evidence	Key findings
Brown, 2009	Correlational study	There was a difference between Australian health science students' actual and preferred learning styles, and these preferences were not good predictors of their attitudes towards e-learning.
Brown <i>et al.</i> , 2009	Comparative study	Three allied health disciplines in Australia (PT, OT, SP) preferred kinaesthetic learning (case study and practical experience). All of Kolb's learning styles were present in each discipline (Active experimentation, Abstract conceptualisation, Reflective observation and Concrete experience). A range of teaching methods is therefore required to accommodate student learning requirements
Hauer <i>et al.</i> , 2005	Comparative study	There were similar learning style preferences between nursing, OT, PA and SP students in one American university, with all four Kolb learning styles reflected in all disciplines. Nursing and SP students preferred Concrete experimentation, whereas OT students preferred Abstract conceptualisation. PT students used a convergent study and preferred Experimentation to Reflective observation.
Kapp & Ferguson 2002	Descriptive study	Mixed methods delivery of information is essential to maintain interest and active learning in Prosthetic and Orthotics students
Morton-Rias <i>et al.</i> , 2007	Correlational study	Allied health students' learning is significantly influenced by Sound, Light, Temperature, Seating Design, Intake, Time-of-day and Mobility, Auditory, Tactile, and Kinesthetic preferences. Females preferred learning by listening, whilst males preferred cooler temperatures, frequent movement, and learning in teams. There were age effects on learning styles, including Structure, Intake, Mobility, Early-Morning and Afternoon, and Auditory preferences.
Rogers <i>et al.</i> , (2010)	Survey	Clinical educators are largely untrained. Students and educators were surveyed regarding the importance of different learning styles, planning learning experiences prior to students' arrival, giving feedback, and assessing student skills based on learning goals
Sandmire & Boyce, 2004	Comparative study	Mismatched pairs of allied health students in terms of learning styles (concrete/abstract) performed significantly better than matched pairs, in a standard learning task. Clinical collaboration skills are enhanced not only by individual level of academic preparation but also by intentional pairing of concrete with abstract learners.
Zoghi <i>et al.</i> , (2010)	Survey	Allied health students at one Australian university were surveyed with Kolb's learning style inventory (dietetics and nutrition, nursing, OT, paramedics, midwifery, pharmacy, PT, radiation therapy, radiography, social work). The converger learning style was most preferred by health science students, whilst the diverger and accommodator learning styles were least preferred.

The realist synthesis framework for the Stage 1 literature review indicated that any one class of allied health students will present with a range of learning styles. Considering the most commonly-reported learning style theory in the allied health literature (Kolb), and combining this with the range of styles reported for allied health students, allied health learners generally respond to an active learning approach, incorporating both concrete and abstract components. Active learners enjoy working in a group (not generally alone). They enjoy practical exercises, group discussions, role play and learning activities in which they can problem-solve and make mistakes. Educators should apply different learning strategies that will address the learning needs of students in their class, with an emphasis on active learning.

3.2 Stage 2 Findings: Systematic Literature Review

The total numbers of publications identified (from search one and search two) are outlined in the Stage 2 consort diagram (Figure 1).

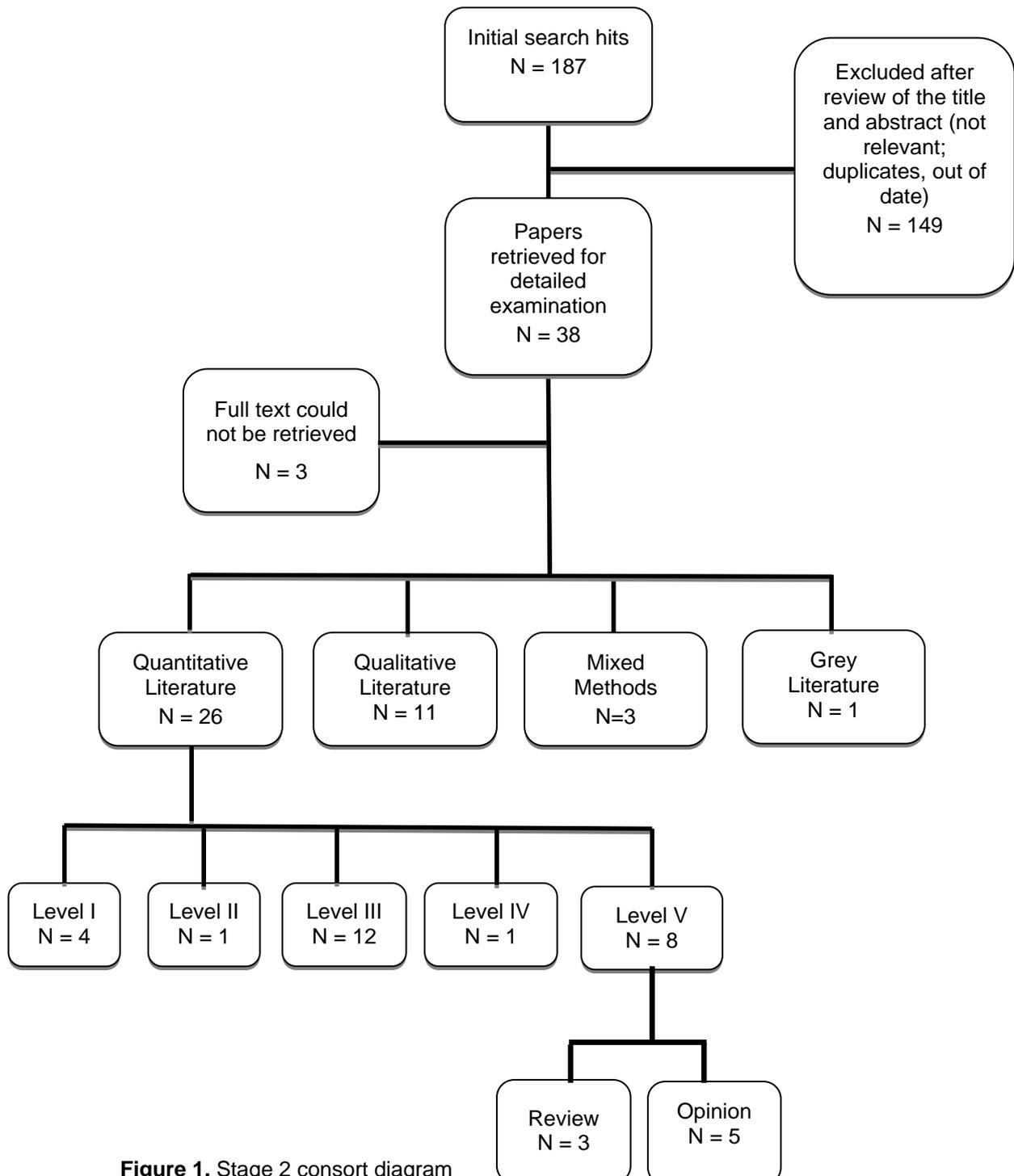


Figure 1. Stage 2 consort diagram

A total of 40 articles (26 quantitative, 11 qualitative and 3 mixed methods) were considered for this review. Of the quantitative papers, 77% were of low hierarchies (levels III-2, III-3, IV and V). This highlights the potential for methodological biases to influence the findings, and also highlights the need for better quality research. Of the qualitative literature, all studies were on the third qualitative hierarchy I (Daly *et al.*, 2007), again indicating the potential for bias in methodology and interpretation. **NB** *The reference lists of the four systematic reviews were searched, to identify any primary studies which had not been identified in the search undertaken for this review. Only one study was found and this was removed from the primary study list (this study was counted in the 149 excluded studies, as a duplicate).*

Key study descriptors

Table 3 reports on the study details, country of origin of the study, and its design (hierarchy). Relatively equal numbers of studies came from North America and UK (14 studies (35%) from North America (US / Canada), and 13 (32.5%) studies from UK). Only two studies were from Australia (5%). The remainder came from Taiwan, Denmark, Poland, Turkey, Germany, Malaysia and Sweden.

Critical appraisal

Only the quantitative studies at hierarchy Levels 1, II and III-1 were critically appraised. Table 3 reports the critical appraisal scores for the higher hierarchy literature in the right hand column. The systematic reviews were of consistently high quality, and the intervention studies were of moderate quality.

Table 3. Study details

Reference	Country	Study design	Hierarchy	Critical appraisal score (%)
<i>Systematic Reviews (NHMRC hierarchy)</i>				
Bernard <i>et al.</i> , 2004	US	MA ¹ of 232 studies	L 1	92%
Booth <i>et al.</i> , 2009 ²	UK	SR ¹ of 29 studies	L 1	85%
Carroll <i>et al.</i> , 2009	UK	SR of 19 studies	L 1	85%
Cook <i>et al.</i> , 2010	US/ Canada	SR of 51 studies	L 1	92%
<i>Quantitative (NHMRC hierarchy)</i>				
Atack & Rankin 2002	Canada	Descriptive study	L III-3	
Chandler <i>et al.</i> , 2008	US	Cohort	L III-3	
Chen <i>et al.</i> , 2008	Taiwan	Questionnaire	L III-3	
Chen <i>et al.</i> , 2009	Taiwan	Survey	L III-3	
Cucciare <i>et al.</i> , 2008	US	Literature review	L V	
Hadley <i>et al.</i> , 2007	UK	Questionnaire survey	L III-3	
Jensen <i>et al.</i> , 2009	Denmark	Single blinded RCT + telephone interview	L II	82%

¹ MA: Meta-analysis, SR: Systematic Review

² NB SRs by Booth *et al* (2009) and Carroll *et al* (2009) are based on similar datasets (Carroll reporting on a subset of Booth) and used the same qualitative approach for analysis

Reference	Country	Study design	Hierarchy	Critical appraisal score (%)
Association for Dental Education in Europe, 2007	Poland	Conference proceedings	L V	
Johnson <i>et al.</i> , 2010	UK	Expert opinion	L V	
Jones <i>et al.</i> , 2010	UK	Expert opinion	L V	
McMillan, 2011	US	Curriculum report	L V	
Moore <i>et al.</i> , 2006	US	Literature review and personal opinion	L V	
Oztekin <i>et al.</i> , 2010	Turkey	Literature review + assessment tool development + case study	L IV	
Pinto <i>et al.</i> , 2008	Italy	Literature review	L V	
Ransdell & Gaillard-Kenney, 2009	US	Cross-sectional cohort	L III-2	
Reasons 2005	US	Cross-sectional cohort	L III-2	
So, 2009	US	Case study	L V	
Sullivan <i>et al.</i> , 2005	US	Experimental study	L III-1	82%
Taradi <i>et al.</i> , 2005	US	Prospective observational	L III-2	
Warren <i>et al.</i> , 2008	UK	Prospective observational	L III-2	
Woltering <i>et al.</i> , 2009	Germany	Online intervention	L III-2	
Yu <i>et al.</i> , 2007	Taiwan	Feasibility study	L III-3	
<i>Qualitative (Daly et al., 2007 hierarchy)</i>				
Bekkers <i>et al.</i> , 2010	UK	Qualitative: Semi-structured, digitally recorded, and transcribed telephone interviews	L III	
Carbonaro <i>et al.</i> , 2008	Canada	Qualitative: questionnaires & focus groups	L III	
Cooner, 2010	UK	Qualitative : questionnaire & focus groups	L III	
Davies <i>et al.</i> , 2005	UK	Qualitative: questionnaires & focus groups	L III	
McGovern & Barnes, 2009	UK	Qualitative: online survey, questionnaires	L III	
Mohamad <i>et al.</i> , 2006	Malaysia	Experiences (interview)	L III	

Reference	Country	Study design	Hierarchy	Critical appraisal score (%)
Roll-Pettersson & Ala'i-Rosales, 2009	Sweden	Qualitative: questionnaires	L III	
Sullivan <i>et al.</i> , 2005	US	Longitudinal survey	L III	
Wakefield <i>et al.</i> , 2008	UK	Staff perspectives	L III	
Wilkinson <i>et al.</i> , 2004	UK	Student perspectives	L III	
Yu <i>et al.</i> , 2006	Taiwan	Questionnaire	L III	
<i>Mixed Methods</i>				
King, 2002	UK	Literature review and Case study (qualitative)		
Koch <i>et al.</i> , 2010	Australia	qualitative + quantitative		
Maley <i>et al.</i> , 2008	Australia	questionnaires (students) & interviews (staff)		

Interventions

Key Findings

Definitions

Blended learning is any combination of traditional and e-learning approaches

Traditional learning occurs face-to-face and can include didactic classroom-based teaching, tutorials, coaching

Distance learning occurs when students are located remotely from lecturers/ tutors

Distance learning can occur synchronously (same time, group, place) and asynchronously (different time, place, individual)

Distance learning can comprise any or combinations of the following media

- satellite/TV/radio broadcast
- telephone
- e-mail
- web-based +/- audio and video
- web-based text-based communication (such as discussion boards)
- any other form of two-way telecommunication

Web-based education is usually delivered as modules of learning which include text, drawings/ photographs, interactive animations, formative self-tests and quizzes

The interventions described in the included systematic reviews and relevant intervention studies are listed in Table 4. Blended education was described using different nomenclatures, as were its component elements and how the educational strategies were delivered. Thus before any findings of this review can be adopted by Queensland Health, there needs to be clarity on what Queensland Health means by e-learning, blended learning and relevant learning environments.

Table 4. Interventions and comparators reported in the included intervention literature (where available)

Reference	Intervention description	Comparator
Bernard <i>et al.</i> , 2004	Distance education (DE) (satellite/TV/radio broadcast + telephone/e-mail, e-mail-based correspondence, text-based correspondence + telephone, web/audio/video-based two-way telecommunication). Two styles of distance education are reported: synchronous DE (group-based and time and place-dependent), and asynchronous DE (“individually-based”) where students in remote locations work independently or in asynchronous groups	Classroom instruction (including lectures, seminars, tutorials and laboratory sessions).
Booth <i>et al.</i> , 2009	E learning as relevant to health libraries, defined as ‘Learning facilitated and supported through the use of information and communications technology [which] can cover a spectrum of activities from the use of technology to support learning as part of a “blended” approach (a combination of traditional and e-learning approaches), to learning that is delivered entirely online’.	Any other form of instruction compared within e-learning
Carroll <i>et al.</i> , 2009	UK health professionals’ experiences of on-line learning delivered in higher education and other relevant institutions (qualitative data).	NA
Cook <i>et al.</i> , 2010	Internet-based learning for practicing and student physicians, nurses, pharmacists, dentists, and other health professionals.	Other internet-based or computer-assisted instructional intervention
Chandler <i>et al.</i> , 2008	Online and face-to-face (including coaching by a supervisor)	Pre-post
Hadley <i>et al.</i> , 2007	One day face-to-face workshop + 60 hour online web-based module	One day face-to-face workshop only
Jensen <i>et al.</i> , 2009	Advanced Life Support: e-learning group: monthly self-directed use of computer program presenting individual patient cases with debriefing on steps of treatment	Baseline ALS competence after graduating from Med School, not given e-learning program
Johnson <i>et al.</i> , 2010	Blended learning module incorporating both face-to-face instruction (large and small groups) and online modules. Included a computer-assisted assessment instead of a written essay, online discussions/quizzes	NA
McMillan, 2011	Face-to-face and web	NA
Moore <i>et al.</i> , 2006	Cyclic program (Initial face-to-face meeting, online course under direction (email, threaded discussion with postings and responses, frequent feedback and assessment made during course), final face-to-face class	NA
Ransdell & Gaillard-Kenney, 2009	Blended learning: online and face-to-face course	Pre-post

Reference	Intervention description	Comparator
Reasons, 2005	Blended: combination of face-to-face and internet (comparators)	<p>1. Face-to-face: lectures, discussions, and hands-on individual and group assignments, Multiple choice tests, course materials distributed in class and published on web.</p> <p>2: internet-based: video-streamed lectures and lecture notes, online discussion boards and support testing. Coursework completed via discussion forum reviews of material, distributed group assignments, and individual projects (disseminated via email). No face-to-face meetings. Used "Blackboard" system.</p>
Sullivan <i>et al.</i> , 2005	Blended: two, one-week, full time, on site sessions, separated by six months that include interim distance-learning component.	Pre-post
Taradi <i>et al.</i> , 2005	Blended web-based learning PBL course (involving drawings and photographs, interactive animations, formative self-tests and quizzes (with immediate feedback), and specialized calculators.) in 90min synchronous sessions. Asynchronous communication was possible.	Traditional face-to-face PBL: two formal meeting per week, each 3 hours long for 5 weeks (one meeting included a site visit). Tutor available during this time. Written teaching materials provided and tradition classroom PBL environment without using computer technologies.
Warren <i>et al.</i> , 2008	Online modules on various topics, scenario based with text and photographs	Pre-post



Outcome measures

Key Findings

Outcome Measures

Outcomes of blended learning include measures of

- Student achievement (grades, skill and knowledge acquisition, achievement of core competencies, summative grades)
- Student attitudes (satisfaction, confidence, enjoyment)
- Amount and quality of interaction with peers
- Use and application of e-media (competency, speed, accuracy, efficiency of acquiring information)

The outcome measures described in the systematic reviews and relevant intervention studies are listed in Table 5. The outcome measures generally reflected measures of student achievement (skill and knowledge acquisition), user skills regarding quality of the uptake of new technology and interface engagement, and user participation and/ or satisfaction. Measures of opportunity cost savings (time, travel, cost of accessing) were less frequently reported.

Table 5. Primary study outcome measures

Reference	Outcomes
Bernard <i>et al.</i> , 2004	Student achievement, student attitudes and retention
Booth <i>et al.</i> , 2009	Qualitative themes generated from the collated literature
Carroll <i>et al.</i> , 2009	Qualitative themes generated from the collated literature
Chandler <i>et al.</i> , 2008	Perceived (opinion) and documented learning (Core competency)
Chen <i>et al.</i> , 2008	Perceived usefulness, Perceived ease of use, Attitude, Behavioural Intention
Cook <i>et al.</i> , 2010	Satisfaction, knowledge, skills, and behaviours/patient effects in health professions learners, associated with elements of learning
Hadley <i>et al.</i> , 2007	Knowledge, confidence, skills in clinical practice
Jensen <i>et al.</i> , 2009	Locus of control, motivation, computer competence, program specific evaluation, perceived learning outcome
Johnson <i>et al.</i> , 2010	Theoretical knowledge and application
Jones <i>et al.</i> , 2010	Clinical training, learning, level of content presented as e-learning, presentation, navigation
Moore <i>et al.</i> , 2006	Student opinion
Oztekin <i>et al.</i> , 2010	Efficiency, effectiveness and satisfaction of the learning process <i>NB not the impact on outcomes of learning</i>
Ransdell & Gaillard-Kenney, 2009	Student performance (grades) and internet user measures (hits, read, follow up, homepage views, organizer, assignment, mail, total visits)
Reasons, 2005	Course participation and final course grade
Sullivan <i>et al.</i> , 2005	Learning, and the program's clinical content and teaching methods
Taradi <i>et al.</i> , 2005	Student performance, Access information on the net, student satisfaction
Warren <i>et al.</i> , 2008	Pre and Post intervention skills test
Yu <i>et al.</i> , 2006	Nursing care knowledge, travel time, cost, freedom of choice for learning, course diversity, abundance, and individuality

The outcomes from the Level 1 studies were more closely examined with respect to statistical analysis and synthesis. These findings are reported in Table 6. The systematic reviews concurred that overall, there is weak evidence regarding improved outcomes from blended learning interventions, compared with other educational models (e.g. individual educational interventions such as e-learning alone or traditional models of face-to-face teaching). More importantly, the reviews indicate that there are elements of presentation that are critical to the success of any form of education (however it is presented), these elements being engagement and communication with peers, flexibility of how learning occurs (to suit the learning styles and environment of the student), the provision of adequate support from tutors, mechanisms by which to validate knowledge, repetition and practice exercises, and design and presentation of courses.

Table 6. Level 1 study findings

Reference	Outcomes
Bernard <i>et al.</i> , 2004	<p>The methodology of education delivery, pedagogy and media accounted for 65.8% of variability in synchronous distance education attitude outcomes, and 53.1% of variability in asynchronous distance education outcomes.</p> <p>Key lessons were:</p> <ul style="list-style-type: none"> • Student achievement: grades, skill and knowledge acquisition, achievement of core competencies • Attention to quality course design (systematic instructional design) should take precedence over the characteristics of media, particularly in asynchronous distance education. • Active learning that includes (or induces) collaboration among students fosters better achievement and attitude outcomes in asynchronous distance education. • Opportunities for communication (face-to-face and mediated) benefit students in synchronous and asynchronous distance education. • “Supplementary one-way video materials” and “use of computer-based instruction” promote better achievement and attitude outcomes in synchronous and asynchronous distance education. • In asynchronous distance education, media that support interactivity (eg telephone) facilitate better attitudes • Providing advance course information benefits achievement
Booth <i>et al.</i> , 2009	Important elements of e-learning environments are peer communication, flexibility, support, knowledge validation and course presentation and design.
Carroll <i>et al.</i> , 2009	Important elements of e-learning environments are peer communication, flexibility, support, knowledge validation and course presentation and design.
Cook <i>et al.</i> , 2010	<p>Only two studies (observational) compared Internet-only versus blended Internet/ face-to-face courses³. Duffy <i>et al</i> found that the combination of Internet-mediated and face-to-face discussion was associated with lower learning outcomes than an Internet-only approach, however the study was potentially confounded by cultural differences and language barriers. In Campbell⁴ <i>et al</i>, students in an Internet-based course could self-select Internet-based only or additional face-to-face discussion groups. Those choosing Internet had higher course grades than those selecting face-to-face.</p> <p>Considering the entire review, learning opportunities that included interactivity, practice exercises, repetition and feedback were associated with improved learning outcomes.</p>

Considering the primary articles whose interventions were listed in Table 4, there were 11 which offered the opportunity to extract data on blended learning interventions, compared with other forms of learning. There were significant findings from seven of these primary studies (six for intervention arms of blended learning, and one for an intervention arm of internet only), the findings from which have been combined and

³ Duffy, T, Gilbert, I, Kennedy, D & Wa, KP 2002, ‘Comparing distance education and conventional education: Observations from a comparative study of post-registration nurses’, *Association for Learning Technology Journal*, vol. 10, pp. 70–82.

⁴ Campbell, M, Gibson, W, Hall, A, Richards, D & Callery, P 2008, ‘Online vs. face-to-face discussion in a Web-based research methods course for postgraduate nursing students: A quasi-experimental study’, *International Journal of Nursing Studies*, vol. 45, pp. 750–759.

represented diagrammatically (See Figure 2). The non-significant findings from the remaining 4 studies are not reported in this figure. The upward arrow indicates significant improvements in listed measures of outcome. The most commonly reported outcome measures as seen from this Figure were clinical practice skills and student satisfaction. One study (Reasons 2005) reported improved interaction with media for students who used internet-based learning only, compared with blended learning.

Outcomes	Blended						Internet only
	Chandler 2008	Hadley 2007	Jensen 2009	Sullivan 2005	Taradi 2005	Warren 2008	Reasons 2005
core competency	↑						
satisfaction	↑				↑	↑	
clinical practice skill		↑		↑		↑	
confidence		↑					
social interaction			↑				
summative grade					↑		
teaching skill acquisition				↑			
interaction with website							↑

Figure 2. Summary of significant outcomes from comparative studies



Key Messages from Stage 2 – Systematic Literature review

Blended education is more effective than e-learning or traditional learning on its own, in improving student knowledge acquisition, and satisfaction. The difference in effect is however, neither strong nor convincing.

Education in any form (e-learning, blended learning, traditional education delivery) should:

- focus on student achievement (grades, skill and knowledge acquisition, achievement of core competencies, summative be well structured with clear aims and learning objectives)
- be flexible in construction and delivery so as to address individual learning styles and learning requirements
- be structured in readily-consumed and completed learning sessions
- be entertaining and informative
- engage participants individually and in peer-groups
- provide feedback
- assess learning summatively
- be consistently revised and improved using a Plan Do Study Act (PDSA) cycle

Distance education can be delivered synchronously or asynchronously and students consuming education in these environments will have different learning needs and environments.

The choice of media by which learning occurs is secondary to the design of the learning material itself.

Students should be able to access whatever teaching media is used, without constraints on time, cost, efficiency of access, and effectiveness of learning.

Effective e-learning strategies should

- focus on student achievement: grades, skill and knowledge acquisition, achievement of core competencies, summative employ a range of media in each learning module (visuals, auditory stimulation, reading/ writing components and movement)
- be readily navigated
- be enjoyable
- engage the participant even when use of computers & web is not an individuals' preferred learning media
- provide opportunities for interaction with peers (discussion boards, virtual meetings etc)
- provide opportunity for regular feedback and coaching
- provide as many active learning opportunities as possible e.g. problem-based learning, case presentations and synchronous discussions, interactive quizzes with immediate feedback
- not be driven by the latest advances in media, rather by what media best supports the learner to learn

Contextualising the findings of Stage 2 within the Stage 1 realist synthesis framework

The realist synthesis framework that was established in Stage 1 of this project highlighted that allied health students in any undergraduate or graduate class will have different learning styles. Allied health learners generally respond to active learning environments which incorporate both concrete and abstract components. Active learners enjoy working in groups and generally do not enjoy working alone. They enjoy practical exercises, group discussions, role play and learning activities in which they can problem-solve and make mistakes. Consequently there is no 'one size fits all' educational approach which will work equally well with every student in any setting, to optimise learning outcomes and student satisfaction with the learning experience. Thus, to optimise learning outcomes and satisfaction with the learning process for allied health students who are being educated at a distance, opportunities should be overtly sought to provide active learning strategies within a distance education framework.

Considering the findings of the Stage 2 literature review in the realist synthesis framework, there is weak evidence that blended learning is more effective than e-learning on its own, or traditional learning environments (such as face-to-face teaching). The most common measures of outcome which benefitted from blended learning were acquisition of knowledge / skills/ competencies, and student satisfaction. We believe that the most reasonable explanation for weak effects of blended learning is potential confounding of the study findings by heterogeneous learning styles and expectations of education, which would have been found within the groups of learners who were engaged in the research. Measuring and assessing for subgroups of learning styles and expectations would have assisted researchers in identifying groups of

students who learnt better using different educational approaches. Consequently, considering the general active learning requirements of allied health students, we propose that one explanation for the better effects of blended learning may be that the variety of ways in which students were educated in 'blended learning' may have been more acceptable to the predominantly active allied health learners in any one class, than one educational approach alone (e.g. e-learning, traditional methods).

Blended learning itself is not a 'one size fits all' model of education. It is variously described in the literature as combinations of different e-learning media, e-learning combined with traditional teaching such as face-to-face lectures or tutorials (such as short courses or podcasts), or e-learning with/without traditional education, combined with individual coaching (for instance via telephone or other electronic means). It is clear from the literature that the use of media should enhance the learning objectives of any education (particularly distance education), and should not 'drive' the learning environment.

Engaging students in active learning is potentially easier in synchronous learning environments, when groups of students can actively engage in learning activities with peers using 'virtual' real-time environments such as discussion groups and chat rooms. It would be more difficult to engage students who are learning asynchronously (on their own and accessing the educational material at different times). Thus it seems that distance education course designers whose students are learning asynchronously need to be mindful of not only different student learning styles, but also the application of a range of educational strategies. They should understand how their students learn best prior to course commencement, and provide them with learning opportunities appropriate for their needs. Thus effective distance education using blended learning should integrate well-designed courses with clear learning objectives and outcomes, with the best mix of educational interventions. These should be selected from traditional face-to-face learning environments and opportunities, coupled with virtual or face-to-face tutorials and individual coaching by lecturers/ tutors. E-learning should be underpinned by the best available media which is unobtrusive, easily accessed by students, and is time and resource efficient. E-learning should incorporate as much interactivity and problem-based learning as required to deliver the learning objectives and outcomes. Peer-learners should be engaged where possible in real time, using chat rooms and discussion boards.



Key Messages combining Stages 1 and 2

Regarding the most effective delivery of distance education

- Student achievement (grades, skill and knowledge acquisition, achievement of core competencies): Blended learning strategies should be employed where possible, for allied health undergraduate, postgraduate and continuing professional development courses. Blended learning strategies have application for distance education as well as traditionally-delivered education in classrooms
- Blended learning can consist of combinations of any number of learning opportunities, including e-learning or other forms of distance education (videos and voice recordings, telephone coaching etc), traditional face-to-face teaching and tutorials, individual coaching, peer-support groups, and regular feedback
- Allied health educators should appreciate that there is no 'one size fits all' approach to optimising the learning outcomes of their students, no matter what the learning environment
- In any one class, different students have different learning styles, and will learn at different speeds and with different educational prompts and supports, no matter what the learning environment. Educators should consider applying a range of different teaching and learning strategies that will address the learning needs of all students in their classes, irrespective of the learning environment
- For allied health students, there should be an emphasis on active learning which employs concrete as well as abstract thinking
- How students learn best when education is consumed at a distance from traditional classrooms, should be carefully considered before distance education courses are designed and implemented. Students studying synchronously at a distance may require different media and tutor supports to students studying asynchronously at a distance. It is important that the method of delivery of education addresses the learning needs, styles and environments of individual students, and educators should seek to understand how individual students learn prior to them commencing distance education courses
- Active learning strategies should be engaged where possible for all allied health students (irrespective of the learning environment), using strategies such as interactive problem-solving, case demonstrations and scenarios, quizzes with immediate feedback, problem-based learning in groups. Whilst the use of current and innovative media should be considered if e-learning is a component of blended learning, the choice of media should not be more important than the course learning objectives, and it should complement rather than dictate students' learning styles



3.3 Stage 3: Interview findings

Interviews were held with 12 purposively sampled academics in the area of distance learning and e-learning and end-users of distance learning. Academics represented a number of disciplines in the area of allied health, including physiotherapy, occupational therapy and speech pathology. End-users were represented by both urban and rural and regional practitioners.

The findings from the interviews were consistently supportive of the literature review findings in general terms. The interviews identified a number of practical strategies, which, from interviewees' personal experience, were successful (or unsuccessful as the case may be) in terms of teaching and learning outcomes for distance learning and /or e-learning.

When rating the value of different e-learning formats for the presentation of new materials on a scale of 1 to 10, the interviewees reported that, on average the highest values were for video (8.7), linking the material directly to other sources (8.2), linking the new material with reinforcement (8.2) and printable summaries (7.7). The lowest value was scored for the use of still pictures (6.6) and animations (4.2).

When rating the value of different e-learning formats for the reinforcement of new material taught, on a scale of 1 to 10, the interviewees reported that, on average the highest values were for the use of scenarios and case presentations (8), and on-line quizzes (6.8). The lowest scores were recorded for threaded discussions (5.4) and one to one discussions (5.6).

Interviewees on average, rated the value of e-learning for the presentation of new material as 7.8, the reinforcement of taught material as 6.3, and assessment as 4.8, on a scale of 1 to 10.

Mean scores (SD) are reported in Figure 3 for key findings from the three quantitatively answered questions.

On the negative side, interviewees highlighted concerns with the use of e-learning to teach interpersonal skills, as well as to teach and assess high level clinical skills, particularly where competency needs to be demonstrated. This point in particular raised different opinions, with a number of interviewees suggesting that this would be feasible, however would depend on access to the technology that was currently available (but expensive).



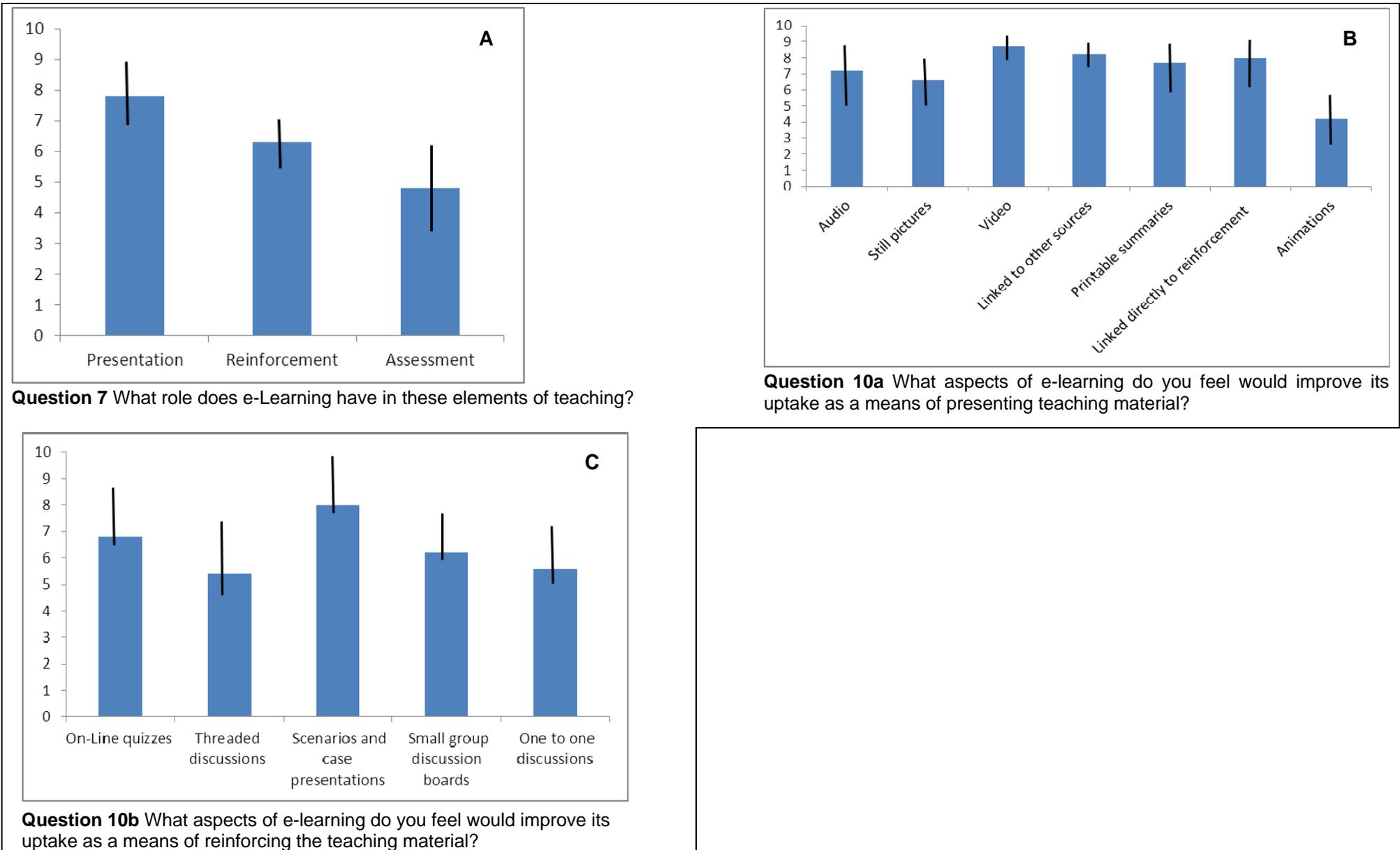


Figure 3. Summarised quantitative responses from Questions 7 (Figure 3A) and 10 (Figures 3B, 3C)



Strategies

A number of strategies were identified in the interviews, in order to get the best out of e-learning, and blended learning opportunities. The strategies comprised:

- a) Ensure that the platform and technology upon which the training package is based is compatible with those of the participants. Participants should not be required to go out and purchase new equipment/technology, but should be able to use the technology they already have and are familiar with.
- b) Ensure that the e-learning training package is easy to navigate. The process of working through the training package should be intuitive, following normal convention.
- c) Ensure that the program has been tested and re-tested to ensure that any technological hitches have been dealt with prior to use by students. This includes the issues associated with broadband speed in rural and regional centres.
- d) Training packages should require between 1 to 2 hours of activity per module (a mix of reading, writing, thinking activities) that can be completed at a pace self directed by the individual participant.
- e) Reinforcement procedures such as discussion boards etc. require adequate levels of moderation, both in terms of resources (time) but also using staff with appropriate levels of experience and expertise.
- f) E-learning training packages should involve a range of different teaching material formats to suit different learning styles, including video, workbooks, on-line and DVD.
- g) Assessment feedback should be provided quickly to reinforce the learning of material.



3.4. Stage 4: Guiding Principles

This project provided the researchers with rare, rich information from which to build Guiding Principles and strategies for use by Queensland Health, when developing and delivering training via effective distance learning for allied health professionals. We propose the following Guiding Principles.

- Blended learning strategies have application for distance education as well as traditionally-delivered education in classrooms.
- Blended learning strategies should be employed where possible, for allied health undergraduate, postgraduate and continuing professional development courses, as the learning outcomes are considered better than from traditional teaching and learning strategies
- There is no 'one size fits all' approach to optimising the learning outcomes of allied health students, no matter what the learning environment. In any one class, different students have different learning styles, and will learn at different speeds and with different educational prompts and supports, no matter what the learning environment. Educators should consider applying a range of different teaching and learning strategies that will address the learning needs of all students in their classes, irrespective of the learning environment.
- For any allied health student in any class, there should be an emphasis on active learning which employs concrete as well as abstract thinking
- How students learn best when education is consumed at a distance from traditional classrooms, should be carefully considered before distance education courses are designed and implemented
 - Students studying synchronously at a distance may require different media and tutor supports to students studying asynchronously at a distance. It is important that the method of delivery of education addresses the learning needs, styles and environments of individual students, and educators should seek to understand how individual students learn prior to them commencing distance education courses.
- Active learning strategies should be engaged where possible for all allied health students (irrespective of the learning environment), using strategies such as interactive problem-solving, case demonstrations and scenarios, quizzes with immediate feedback, problem-based learning in groups. Whilst the use of current and innovative media should be considered if e-learning is a component of blended learning, the choice of media should not be more important than the course learning objectives, and it should complement rather than dictate students' learning styles.

Strategies to underpin the Guiding Principles

The literature review identified one opinion piece (Jones *et al.*, 2010 (L V)) which reported a set of Practice Points to underpin successful learning. In summary, these comprised:

- An e-learning experience will be most successful if it is easily accessible, intuitive, memorable, enjoyable, affordable
- A standardised learning design with clear learning objectives and 'bite-sized' learning sessions will be effective for learners.
- Based on VARK's model, learning can be visual (V) (graphics, animations, charts), aural/ auditory (A), read/write (R) (reading and reflective writing), kinesthetic (K), (video clips, simulation, case studies)
- A robust quality assurance structure must be in place to ensure that editorial, production and technical standards are adhered to so that the overall e-learning session is of a high standard and continually reviewed and updated.

Strategies identified from the interviews in this project were layered on those of Jones *et al.*, (2010). These strategies should assist Queensland Health in operationalizing our proposed Guiding Principles.



- Prior to commencing the development of e-learning training packages an adequate understanding of the nature of the content to be taught is vital.
- E-learning appears to have an important role in:
 - Teaching general knowledge, and theoretical background information.
 - Allowing active reflection on new training material, i.e. integrating new material with old knowledge.
 - Providing updates on new advances in the discipline.
- Areas where there are concerns about the ability of e-learning include limitations in using it to:
 - teach interpersonal skills
 - teach and assess high level clinical skills, particularly where competency needs to be demonstrated

Thus care should be taken when using e-learning in these ways, as good learning outcomes may not result.

- E-Learning should be supported by the use of face-to-face workshops to allow participants the opportunity to develop higher cognitive clinical reasoning skills and display interpersonal skills. This face to face experience is also important to accommodate the range of learning styles.
- The use of animations/technology etc. should be carefully selected to enhance the learning experience. Learners who are not comfortable with the use of technology will be turned off by poor animations/video.
- Teaching material and reinforcement processes should be provided in a range of different formats that accommodate different learning styles.



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Appendix 1

Search strategy for the literature review on ways in which blended educational strategies are reported for clinical education and training, their outcomes, and effectiveness.

Databases

- OVID
 - Medline
 - Ageline
 - AMED
 - EMBASE
- EBSCO host
 - Academic Search Premier
 - CINAHL
 - ERIC
 - Health Source Nursing/Academic Edition
 - SPORTDiscus
 - PsycARTICLES
 - PsychINFO
- Science Direct
- Web of Knowledge
- Google Scholar

Search Terms

No.	Keywords
1	combined or hybrid or mixed or multiple
2	health or allied or nurse
3	learn* or educat*
4	1 and 2 and 3
	"hybrid learn*" and health
	"blended learning" and health
	"blended learning" + health or nurse or allied
	"hybrid learning" + health professional
	mixed mode learning + health
	hybrid education to health students
1	Effectiveness OR success OR distance learning OR blended learning OR public health OR emergency OR preparedness
2	Web-based learning OR e-learning OR e learning OR hybrid learning OR flexible learning OR mixed mode learning
3	Effectiveness OR success OR preparedness
4	Allied Health OR health professional
5	1 and 2 and 3 and 4

No.	Keywords
6	1 and 2 and 3
7	1 and 2
1	Effectiveness OR success OR distance learning OR blended learning OR public health OR emergency OR preparedness
2	Web-based learning OR e-learning OR e learning OR hybrid learning OR flexible learning OR mixed mode learning
3	Effectiveness OR success OR preparedness
4	Allied Health OR health professional
5	1 and 2 and 3 and 4
6	1 and 2 and 3
7	6 and health (ti,ab,kw)
1	Effectiveness OR success OR distance learning OR blended learning OR public health OR emergency OR preparedness
2	Web-based learning OR e-learning OR e learning OR hybrid learning OR flexible learning OR mixed mode learning
3	Effectiveness OR success OR preparedness
4	Allied Health OR health professional
5	1 and 2 and 3 and 4
1	Effectiveness OR success OR distance learning OR blended learning OR public health OR emergency OR preparedness
2	Web-based learning OR e-learning OR e learning OR hybrid learning OR flexible learning OR mixed mode learning
3	Effectiveness OR success OR preparedness
4	Allied Health OR health professional
5	1 and 2 and 3 and 4
6	5 and learning (limited to TI)



Appendix 2

NHMRC Hierarchy of Intervention Evidence

http://www.nhmrc.gov.au/files_nhmrc/file/guidelines/Stage%20%20Consultation%20Levels%20and%20Grades.pdf

Level 1	Systematic review of Level II studies
Level II	A randomised controlled trial
Level II-1	A pseudo-randomised controlled trial (i.e. alternate allocation or some other method)
Level III-2	A comparative study with concurrent controls: <ul style="list-style-type: none"> • Non-randomised, experimental trial⁹ • Cohort study • Case-control study • Interrupted time series with a control group
Level III-3	A comparative study without concurrent controls: <ul style="list-style-type: none"> • Historical control study • Two or more single arm study¹⁰ • Interrupted time series without a parallel control group
Level IV	Case series with either post-test or pre-test/post-test outcomes
Level V	Expert opinion



Appendix 3

A hierarchy of evidence-for-practice in qualitative research—summary features (reproduced from Daly *et al.*, 2007)

Study type	Features	Limitations	Evidence for practice
Generalizable studies (level I)	Sampling focused by theory and the literature, extended as a result of analysis to capture diversity of experience. Analytic procedures comprehensive and clear. Located in the literature to assess relevance to other settings.	Main limitations are in reporting when the word length of articles does not allow a comprehensive account of complex procedures.	Clear indications for practice or policy may offer support for current practice, or critique with indicated directions for change.
Conceptual studies (level II)	Theoretical concepts guide sample selection, based on analysis of literature. May be limited to one group about which little is known or a number of important subgroups. Conceptual analysis recognizes diversity in participants' views.	Theoretical concepts and minority or divergent views that emerge during analysis do not lead to further sampling. Categories for analysis may not be saturated.	Weaker designs identify the need for further research on other groups, or urge caution in practice. Well-developed studies can provide good evidence if residual uncertainties are clearly identified.
Descriptive studies (level III)	Sample selected to illustrate practical rather than theoretical issues. Record a range of illustrative quotes including themes from the accounts of "many," "most," or "some" study participants.	Do not report full range of responses. Sample not diversified to analyze how or why differences occur.	Demonstrate that a phenomenon exists in a defined group. Identify practice issues for further consideration.
Single case study (level IV)	Provides rich data on the views or experiences of one person. Can provide insights in unexplored contexts.	Does not analyze applicability to other contexts.	Alerts practitioners to the existence of an unusual phenomenon.



Appendix 4

Telephone script for interviews

Dear

Thank you for agreeing to participate in this interview. My name is Steve Milanese and I am ringing you on behalf of a research team, based at the University of South Australia. Is now a good time to conduct the interview?

As outlined in the email invitation, you will not be identified by name or location in the final report, and we will not be reporting on the details of specific individual interviews. We will be drawing on the themes raised during the interviews. Are you comfortable to proceed with the interview? *[If not, the call will be terminated. If Yes, the interviewer will proceed to ask the questions below]*

Interview questions

Blended learning is any combination of learning approaches, such as traditional teaching (that is face-to-face teaching including classroom-based teaching, tutorials, coaching etc) and e-learning approaches. E-Learning refers to on-line learning and can be broadly defined into three categories

- a) Presentation of material: Online modules,
- b) Reinforcement or support of material: on-line threaded discussions with postings and responses, scenarios and case presentations, small group discussion boards, one to one discussions
- c) Assessment of teaching material: on-line quizzes

The aim of this project is to identify the best way to incorporate e-learning into training packages for Queensland Health.

1. Have you had time to read the summary findings of the literature review? *[These were enclosed in the response email after the participant indicated that he/she would like to participate in the research] **NB for HRECThe literature review is currently underway and we do not have the findings as yet to provide as an appendix to this application.***
2. Do you have any questions about the literature review, or the way the findings were reported?
3. Do the findings of the literature review regarding the effectiveness of blended media for teaching surprise you? If so, in what way?
4. From your perspective, were there gaps in the finding of the literature review or would you have expected other information to have been found in the review? If so, what, and could you expand on this??
5. Do you know of any training program that uses a blended learning approach in any allied health (or health sciences) training courses? Can you provide us with details? Who could we talk to to find out more about this?
6. From your experience do you feel E-Learning has a role in training packages? Yes/No
7. As described E-Learning can be broadly defined into three categories i.e. presentation, reinforcement, assessment. On a scale of 1 – 10 (where 0 is no role and 10 is the only role) what role do you see E-Learning has in each of these categories
 - a) Presentation 1-----10
 - b) Reinforcement 1-----10
 - c) Assessment 1-----10
8. Are there some allied health learning opportunities in which e-learning works better than others? (Please explain)
9. Are there some allied health learning opportunities in which e-learning does not work well? (Please explain)
10. Looking the practicalities of e-learning



a) Presentation

What aspects of e-learning do you feel would improve its uptake as a means of presenting teaching material?

- | | |
|---|----------|
| a) Audio | 1-----10 |
| b) Still pictures | 1-----10 |
| c) Video | 1-----10 |
| d) As a resource linking to other sources of information
(for more indepth presentation of material) | 1-----10 |
| e) Printable summaries | 1-----10 |
| f) Linking presentation to reinforcement processes directly | 1-----10 |
| g) Animations | 1-----10 |

Are there any other aspects of e-learning you feel would improve its uptake as a means of presenting teaching material?

b) Reinforcement

What aspects of e-learning do you feel would improve its uptake as a means of reinforcing the teaching material?

- | | |
|---|----------|
| a) On-Line quizzes | 1-----10 |
| b) Threaded discussions with postings and responses | 1-----10 |
| c) Scenarios and case presentations, | 1-----10 |
| d) Small group discussion boards | 1-----10 |
| e) One to one discussions | 1-----10 |

Are there any other aspects of e-learning you feel would improve its uptake as a means of reinforcing teaching material?

c) Assessment

What aspects of e-learning do you feel would improve its uptake as a means of assessing teaching material?

- | | |
|--------------------|----------|
| a) On-Line quizzes | 1-----10 |
| b) | |

11. What do you think makes a good allied health student learning environment? (Please explain)

12. Are there any other things you would like to say about e-learning or blended learning?

