

Developing an evidence base for interdisciplinary learning: a systematic review

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Developing an evidence base for interdisciplinary learning: a systematic review

Aim of the study. The overall aim of the study was to explore the feasibility of introducing interdisciplinary education within undergraduate health professional programmes. This paper reports on the first stage of the study in which a systematic review was conducted to summarize the evidence for interdisciplinary education of undergraduate health professional students.

Methods. Systematic reviews integrate valid information providing a basis for rational decision making about health care which should be based on empirical and not anecdotal evidence. The accepted principles for systematic reviews were adapted in order to allow integration of the literature to produce recommendations for educational practice and guidelines for future research.

Findings. The literature on interdisciplinary education was found to be diverse, including relatively small amounts of research data and much larger amounts of evaluation literature. Methodological rating schemes were used to test for confounding influences in the research studies. The number of studies found was 141 but only 30 (21%) were included in the analysis because of lack of methodological rigour in the research and poorly developed outcome measures.

Conclusions. Student health professionals were found to benefit from interdisciplinary education with outcome effects primarily relating to changes in knowledge, skills, attitudes and beliefs. Effects upon professional practice were not discernible and educational and psychological theories were rarely used to guide the development of the educational interventions.

Keywords: systematic review, interprofessional education, evaluation, research, theory, health and social care

Introduction

Much has been written recently about how changes in patterns of health care delivery and the structure of the National Health Service (NHS) itself have impacted upon the development of the health professions (see for example, Pittiloe & Ross 1998). These changes have included calls for collaboration between professions in health and social care, an initiative that began in the 1970s with the shift in emphasis from institutional to community-based care (Warner & MacAlister-Smith 1996). The demarcations and hierarchical relations between professions familiar in hospitals were found not to be appropriate in the outside community where teamwork is required to meet the increasingly complex needs of service users. As the need for teamwork has been recognized so the pressure to change the way in which health care professionals are educated has arisen. This pressure has emanated from the belief that separate training encourages different health professional groups to hold on to their independence and autonomy, thereby detracting from effective teamwork (Pietroni 1994).

The need for change has also been accelerated under the impact of government policy since the mid-1980s, and noticeably in the 1990s, with the publication of *The New NHS* (Department of Health 1997), *Our Healthier Nation* (Department of Health 1998) and *The NHS Plan* (Department of Health 2000). These documents have detailed the move towards shifting the balance from secondary to primary care and have provided guidelines for improving the health of the nation through integrated care. Such governmental policy, with its central emphasis on the effective use of resources, has seemingly spearheaded interprofessional developments in practice (Leathard 1994). Recognition of the value of teamwork has now been formally acknowledged and extends to many health care settings, both acute and chronic. As professions come together, however, so rivalries and misconceptions about respective roles and responsibilities have become evident (Barr 1997, Atkins 1998). The need to find ways to remove these boundaries has led to 'shared learning' being advocated as the way forward (Pittiloe & Ross 1998).

Defining the concept of 'shared learning'

There is lack of clarity surrounding the use of terms associated with 'shared learning'. Interprofessional, multi-professional, shared and collaborative (amongst others) are used interchangeably, without any general agreement about their meaning (Hammick 1998). Various authors have attempted to clarify the use of a standard term but consid-

erable conceptual confusion remains. This confusion may well underlie the lack of systematic knowledge on 'shared learning', which Campbell and Johnson (1999) identify as a 'fashion that people describe rather than question'. For this review, Hammick's (1998) term of reference was used. She made a simple distinction between the terms multi- and inter- when she described multiprofessional education as 'simply learning together' and interprofessional education as 'learning together to promote collaborative practice'. As health care is delivered by a team, each member of which has a different professional training and brings different skills to bear, it was felt that the terms 'interaction' and 'collaboration' were critical to the definition of interprofessional education. However, whatever term is used, it must be remembered that interprofessional education is underpinned by different educational philosophies which comprise different concepts and different approaches (Harden 1998). These philosophies, concepts and approaches were explored during the course of this systematic review of interprofessional education.

Systematic review of interprofessional education

The need for health care practice to be evidence-based is currently being emphasized (Sackett *et al.* 1996, Muir Gray 1997). Systematic reviews integrate valid information providing a basis for rational decision making about health care which should be based on empirical and not anecdotal evidence. This underlies the current focus on clinical governance. With this emphasis, systematic reviews of randomized controlled trials (RCT) are recommended for reviews that pertain to answer scientific questions. For reviews of educational practice, however, other types of evidence need to be considered, including both quantitative and qualitative evaluations of interventions.

The Cochrane collaboration utilizes a recognized format for systematic reviews and has a subgroup, the Cochrane Effective Practice and Organization of Care Group¹ (EPOC), which deals with topics that are outside the strict biomedical remit. Their focus is on systematic reviews of interventions designed to improve professional practice and includes education. EPOC's focus is on high quality research, primarily randomized controlled trials, but also includes controlled before and after and interrupted time-series studies (Mulrow & Oxman 1997). EPOC's approach is therefore located firmly within the paradigm of clinical research in medicine. From EPOC's register a group of researchers was

¹ URL for the EPOC website is: <http://www.abdn.ac.uk/publichealth/hlsru/epoc>.

found currently working on a systematic review of interprofessional learning. To date they have been unsuccessful, finding no studies that merited inclusion because they all failed to meet the criteria for study design laid down by the Collaboration (Barr 1998). They are now systematically reviewing the wider literature on interprofessional education for health and social care (Barr *et al.* 1999). Their work includes all forms of interprofessional education aimed at both trainee and trained health professionals. Our review had the narrower focus of interprofessional education aimed purely at undergraduate students in the health professions.

The literature on interprofessional education was found to be diverse including relatively small amounts of research data and much larger amounts of evaluation literature. The accepted principles for systematic reviews therefore had to be adapted for this review. No hierarchy of methodologies was used and both qualitative and quantitative studies were included. In recognition of this, the review was referred to as a 'generalized synthesis of the evidence'. It combined studies with disparate designs, what Sutton *et al.* (1999) call a cross-design synthesis and the methodology developed for the review utilized an approach based on the epistemological assumptions associated with qualitative data analysis. A purposefully designed data extraction sheet was used to enable the reviewers to appraise the quality of all types of material, including research and evaluation literature. For more detailed information on the methodology used the reader is directed to an earlier publication (Cooper *et al.* 2000).

Results

Description of the studies reviewed

Using the following inclusion criteria, the literature search produced 141 articles. Of these, however, only 30 articles (21%) met all the inclusion criteria:

- Articles published in an English language journal between 1994 to early 1999.
- Initiatives aimed at undergraduate health professionals.
- Educational initiatives which included one or more of the following aims:
 - To increase interdisciplinary understanding and co-operation.
 - To promote competent team work.
 - To make effective/efficient use of resources.
 - To promote high quality, comprehensive patient care.

Reasons for exclusion of studies related primarily to the nature of the sample population which included trained health professionals rather than those at undergraduate level, the nature of the information provided (surveys/reports/

commentaries/letters were not included), and to lack of presented data. Of the 30 papers, six represented data on interventions and outcomes that had been described in more than one article. The 30 interventions were therefore represented by a total of 47 papers. Methodological rating schemes were used to test for confounding influences in the research studies (Cooper *et al.* 2000). The evaluation studies had to provide sufficient detailed information to allow for the data sheets to be completed.

The majority (47%) of the studies were published in the United Kingdom, with the largest proportion of the papers (27%) being published in 1998. There were 16 evaluation studies and 14 research studies. Of the 14 research studies, 11 used quantitative designs (single group pre/post test design and single post group designs), two used qualitative designs and one used a combination of both. A methodological rating scheme found lack of rigour in the research studies with an average score of five (maximum 14, range 4–8) for the quantitative designs, and 17 (maximum 25, range 14–21) for the qualitative designs. Lack of rigour related to:

- Selection bias: lack of control for confounding variables (no matched controls in any of the studies reviewed).
- Attrition bias: lack of information on attrition rates to interventions.
- Detection bias: differences in methods used to assess the outcomes of interprofessional education and in the selective reporting of results.
- Use of nonvalidated instruments to measure outcomes.
- Inadequate description of statistical analysis.

The strength of the quantitative studies lay in the detail provided about the educational interventions being tested, whilst qualitative studies provided more detail on their research methodology but not on the educational intervention being researched. These limitations meant that it was not possible to estimate effect size numerically, thus qualitative outcomes were described using thematic analysis.

Subjects

As planned, all the participants were undergraduates. The number of participants varied widely from nine to over 5000 students, depending upon whether single or multiple interventions had been evaluated/measured. The majority included 10–50 students, with several including more than 200 students. For three studies the number of participants was unclear.

The number of professional groups taking part in each intervention ranged from 2–13, with a variety of health professionals being involved in the interventions at both student and faculty level. Commonly, the majority used two different professional student groups, generally student

Table 1 Quality scoring system for interprofessional educational interventions

Principle	Score	Description
Consonance	1	Intervention directed toward affecting intended outcome(s)
Individualization	1	Intervention based on individuals' cognitive levels of knowledge, attitudes and beliefs
Relevance	1	Intervention geared to student groups' learning needs in relation to individual professional role development
Feedback	1	Intervention designed to show students the extent they are progressing through the course
Reinforcement	1	Intervention assessed to provide students with 'reward' for their work
Facilitation	1	Intervention designed to affect student professional practice by providing them with means to take action and/or reduce barriers to their action

nurses and medical students. Others included students of: social work, pharmacy, dentistry, laboratory science, speech therapy, dietetics, audiology, occupational therapy, physiotherapy, health administration, chiropody and psychology. In one study the number of professional groups taking part could not be identified.

Setting

The majority of the interventions took place in nonclinical environments using academic classrooms for teaching. Where clinical locations had been used they tended to be based in the community rather than in hospital settings. Two interventions had taken place in clinical skills laboratories.

Educational interventions

Quality

Not surprisingly, given the different student groups and the broad search strategy, there was great variation in both the quality and the type of educational interventions. Interventions were graded to provide an overview of their quality using the six principles described by Mullen *et al.* (1985) in their review of educational interventions for patients (see

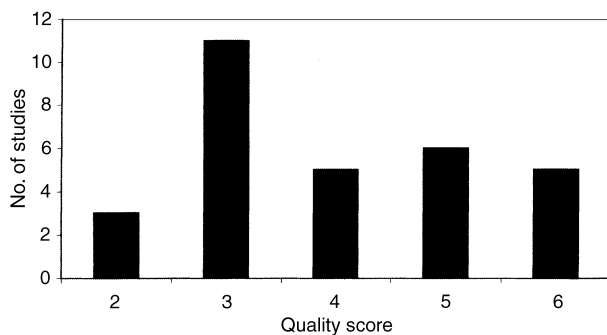
Table 1; median score 3, interquartile range 2–6 and a mode of 3). The majority of the interventions had included the principles of consonance, relevance, individualization and feedback. The remaining two principles, reinforcement and facilitation, were found in only four studies with just one study demonstrating both of these latter principles (Figure 1).

Teaching methods and topics

Educational interventions addressed various topics with teamwork and primary health care predominating (Table 2). A wide range of teaching techniques were employed, with only one intervention utilizing a variety of methods. Small group teaching, case studies (real or simulated), and experiential learning prevailed but traditional didactic methods were also used in over a third of the interventions (Table 3).

Theory

There is clearly a relationship between the methods used in an intervention and the underlying theory as the former represents an operationalized version of the latter (Griffin *et al.* 1998). In the majority of the interventions (73%) there was no evidence of links to underlying theory, neither in the description of the method nor in the choice of

**Figure 1** Educational intervention scores.**Table 2** Topics

Topics	Frequency
Team work	10
Primary health care	8
Problem solving	4
Chronic illness	4
Clinical skills	3
Communication skills	3
Health behaviour	3
Continuous improvement	1
Therapeutics	1
Labour and delivery	1

Table 3 Teaching methods

Method	Frequency
Small group teaching	23
Case studies – real/simulated	17
Experiential learning	14
Didactic teaching	12
Problem based learning	9
Self-directed (e.g. project work, computerized learning programmes)	8
Role play	6
Teaching sessions with professional staff from clinical environments	3
Course guide/reader	2
Link tutor	3
Videos	2
Community profiling	1

process or outcome measures. Only four interventions made reference to an educational model and four to a behavioural model. In the case of the latter, two psychological theories were used: the ‘contact hypothesis’ (Amir 1969) which looks at outcomes when two opposing groups are brought together (‘intergroup’ behaviour); and a tool devised by Seymour (1983) which looks at students’ reasoning processes. In both these cases the underlying theory had been used to guide the choice of outcome measures.

Whilst many of the papers referred to the principles of adult education, they made no reference to specific educational models used in designing their interventions. The four interventions that did, made reference to either Kolb’s experiential learning cycle (Kolb 1984) or the problem solving approaches advocated by Szasz (1969) and Knowles (1973).

Time scale

Time scale for courses varied from single sessions, lasting less than a day, to curriculum strands running through whole courses. The majority, however, lasted up to 4 weeks. Three papers failed to provide sufficiently clear information on the time scale of their courses.

Assessment of student performance

Assessment procedures were used in only 12 (39%) of the interventions. These were judged to provide feedback to students in the intervention scoring system. The methods used for graded assessment included one or more of the following:

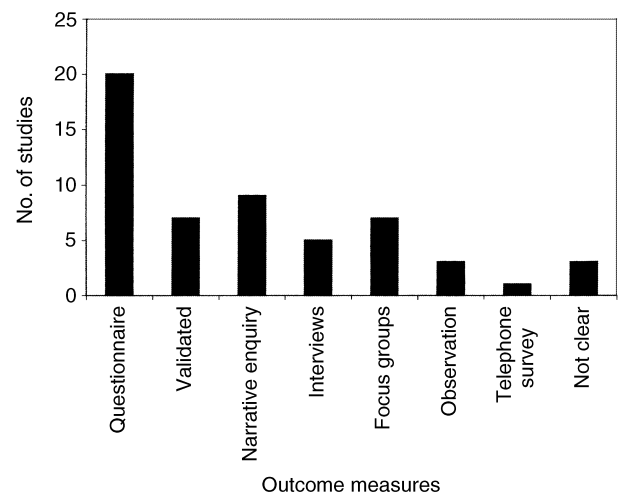
- Attendance at sessions
- Essays

- Poster presentations
- Reflective diaries
- Community profiles
- Case presentations
- Reports
- Projects
- Objective structured clinical examination (OSCE)
- Written examinations
- Self-assessment exercises

The fact that so few interventions summatively assessed their students, detracted from the significance of interprofessional education. For the studies that did, interprofessional education did not affect exam pass rates.

Assessment of the educational intervention

A variety of tools were used to provide feedback on the courses reflecting the multidimensional aspect of interdisciplinary interventions (see Figure 2). Attention was paid primarily to the measurement of process variables that informed whether the intervention was successfully applied and if it was operating in the expected manner. Questionnaire type tools were the most common method used (67%), with narrative enquiry in 30%. Many of the questionnaires included open as well as closed questions giving them a qualitative theme. Some of the questionnaires examined knowledge outcomes only, whilst others measured variables such as attitudes, beliefs, and/or levels of satisfaction. Of the 20 studies/evaluations that used questionnaires, only seven (35%) used validated instruments. Authors often developed new instruments of their own to evaluate interventions without considering issues of reliability and validity.

**Figure 2** Tools used in the evaluation of interventions.

Duration of follow-up

Outcomes tended to be measured immediately after the educational intervention. In 87% of the studies/evaluations, for which information on duration of follow-up was provided, interventions were assessed immediately post-course. In only three studies/evaluations (10%) were outcomes assessed at a later time point. Seven (23%) of the studies/evaluations failed to provide clear information on the length of time of follow-up. Information on losses to follow-up was provided in only four papers.

Outcomes

Outcome results were categorized according to Kirkpatrick's (1967) classification system which uses four stages of educational evaluation (Figure 3). Each stage reflects a hierarchy of levels of evaluation with the complexity of behavioural change increasing as the evaluation of the intervention ascends the hierarchy. The data were analysed to produce themes and subthemes aligned to each of these four categories so that both the educational process and its effects were evaluated. The themes did not always sit in 'splendid isolation', however, and judgements were made jointly by the research team about which category each conformed to. A single paper could reference more than one theme in each category but it could reference each theme only once.

Within the four categories, a total of 12 themes were identified (see Tables 4–7). Interprofessional educational interventions seemed to be most effective in relation to two areas: 'reaction' and 'learning'. Much less apparent were

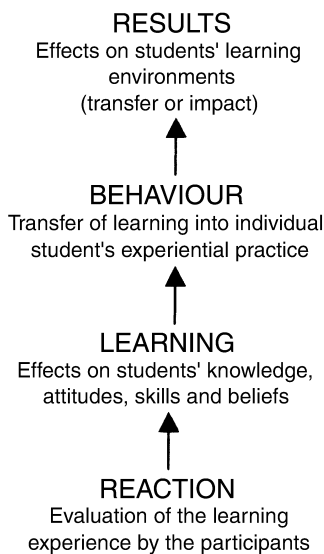


Figure 3 Hierarchical levels of evaluation of interprofessional educational interventions developed from Kirkpatrick (1967).

Table 4 Reaction

Category	Themes
Reaction	Evaluation of interprofessional learning experiences Timing of courses Teaching methods Perceptions held by different student groups

Table 5 Learning

Category	Themes
Learning	Understanding of professional roles and professional socialization Differential outcomes for student groups Alteration of stereotypical images Team working

Table 6 Behaviour

Category	Themes
Behaviour	Experiential learning Employment outcomes

Table 7 Results

Category	Themes
Results	Co-operation Patient outcomes

effects upon 'behaviour' and 'results', but this reflected the fact that the majority of the interventions had not focused upon measuring these outcomes.

Category 1: reaction

This category produced three shared themes for the research studies and the evaluation literature, and a fourth theme that was found in the research studies only. The three shared themes included that of 'evaluation of interprofessional learning experiences' which showed that students found such learning experiences highly relevant and wanted more learning of this type in the future. A second shared theme related to 'timing of courses'. This showed that early learning experiences were favoured because it was found that it benefited later participation in interdisciplinary activities. Barrington *et al.* (1998) noted that by the final year, attitudes towards other health professionals were entrenched and these acted as barriers to successful teamwork. Disconfirming evidence was, however, located in two of the evaluation papers. Both these studies had introduced interprofessional education at the foundation level. Arkesog (1994) noted

students' criticized an early introduction of interprofessional education because of unclear goals and a frustrating delay to their professional training. Davidson and Lucas (1995) noted that students often saw interprofessional education as being irrelevant and onerous in the face of an already overloaded curriculum. Both authors commented on the need to distinguish between core studies and those that are enriched by sharing. In contrast to these findings, Harris *et al.* (1998) found that students failed to understand the benefits of interprofessional education initially but with experience spoke enthusiastically of learning with other health professional students.

A third shared theme, 'teaching methods' showed that interprofessional education required strong administrative support and a consistent team of experienced faculty members to plan and facilitate the courses. Obstacles to success included:

- lack of time;
- scarce financial resources;
- assignments specific to each professional group;
- varying educational schedules;
- discipline-specific requirements for registration.

This theme also found that problem-based learning was an effective means of presenting interdisciplinary material, but it was felt that more time was required to develop group processes. One author (Hughes & Lucas 1997) found 6–8 weeks to be the most effective time for developing groups. Another author (Brickell *et al.* 1997) found that groups needed to be kept small enough (no more than eight) for interaction and diverse enough (no fewer than four) for members to learn from one another.

The fourth theme, from the research papers only, related to 'perceptions held by different student groups'. It revealed differences between nursing and medical students, with the nurses finding the learning experience more useful. This outcome related to differences in students' perceptions about the usefulness of the course, which in turn was reflected in their perceptions of faculty (and professional) support for the initiatives.

Category 2: learning

This category produced four shared themes in the research studies and the evaluation literature. For the theme of 'understanding of professional roles and professional socialization' the interventions produced positive outcomes for enabling students (and facilitators) to understand others' professional roles, their skills and responsibilities and for helping to clarify their own roles and responsibilities. Aligned to this, the interventions helped to raise awareness of cross-over and overlap in knowledge and skills and a realization of

professional limitations. They also served to demonstrate different discipline styles of education which acted as a learning experience for the facilitators.

A second theme, 'differential outcomes for the student groups', found no differences in distribution of grades between student groups and no changes in registration pass rates. It was found, however, that students needed to be at a similar stage in their intellectual development for courses to work effectively.

A third theme, 'alteration of stereotypical images', was found to be mediated through changing attitudes regarding professional autonomy and competence. These outcomes were also shown to be applicable to course facilitators.

The fourth theme, 'team working', found that interprofessional education enhanced team-working skills. These skills included problem solving abilities and resolution of team conflicts. The natural group dynamics created by the interdisciplinary formats was used by facilitators as a resource to teach these skills.

Category 3: behaviour

This category produced one shared theme, 'experiential learning' in both the research studies and the evaluation literature, although the latter produced more references to this theme than the former. Sub-themes related to practical experiences which were valued by students and were found to enhance interdisciplinary learning. Experiential learning was judged to set knowledge in context and students gained from working together on such 'hands-on' experiences.

A second theme, 'employment outcomes' was explored in two of the evaluation papers only (Harris *et al.* 1998, Oneha *et al.* 1998). In these it was found that graduates from interdisciplinary courses were positively influenced to consider community health care as an employment option. This outcome, however, probably reflected the community orientation of the courses rather than the interdisciplinary format.

Category 4: results

This category produced very few references, reflecting the limited number of papers that had measured these outcomes. A theme of 'co-operation' was shared by both the research studies and the evaluation literature, whilst a theme of 'patient outcomes' was found in the evaluation literature only. The theme of 'co-operation' found that students' perceptions of actual co-operation and resource sharing within and across professions had significantly improved after interdisciplinary learning. Disconfirming evidence was noted, however. Erkel *et al.* (1995) found that students' perceptions of barriers to health care increased postcourse.

Such contrasting outcomes in such a small subgroup question the legitimacy of the findings so that its conclusions are not transferable. This also applies to the theme of 'patient outcomes'. In two evaluation papers only it was found that patients and providers benefited from having (student) individualized attention and interprofessional case-conferences.

Discussion

This review aimed to provide a platform for evidence-based interprofessional training programmes for undergraduate health professionals. The main findings, summarized below, suggest that such educational provision has beneficial outcomes across a range of measures. Whilst interpretation of the evidence was difficult and the method used for conducting the review had to be adapted, the outcome effects described were generally found to be analogous for both the research studies and the evaluation literature. This endorses the strength of the findings.

The qualitative studies were found to produce better scores for their methodology but few studies were found that used this research method. This is a surprising finding given that qualitative data can provide a rich source of information on process variables and can help researchers to generate (or revise) conceptual frameworks, particularly for relatively untested areas of study such as interprofessional education. The predominance of quantitatively orientated research is well established in the clinical world. It is not, however, necessarily applicable to the world of health care professional education which needs to be alert to other research philosophies that embrace qualitative approaches (Buckley 1998).

The large number of evaluation studies found for this review reflects the tendency for educational research to concentrate on short-term evaluations. These provide anecdotal evidence rather than the recognized and accepted outcomes provided by rigorous research studies (Hargreaves 1996). This is appropriate in the discipline of education where descriptions of project experiences are valuable and contribute to a better overall understanding of project development, implementation and management, or can indicate common problems and how to avoid them (Atkins & Walsh 1997). Such a distinction lends itself to the argument about the differences between educational research and medical research and whether such a comparison serves any useful purpose. In this review an attempt has been made to integrate the two methodological areas. The validity of the findings therefore rest on the methodology developed for the review. Whilst evidence-based medicine differentiates itself from such integrative approaches there is obviously a need to define appropriate situations when other forms of knowledge

and reasoning take precedence, as has been carried out here. The outcomes can then be used to set standards for future practice, in particular future research practice.

One of the fundamental principles for studying educational processes and their outcomes is the need to choose methods on theoretical grounds. This can add to the comprehensibility and validity of the study. This review has demonstrated that few studies had incorporated relevant theory. This was a disturbing finding that added to the lack of methodological rigour demonstrated in the published literature on interdisciplinary education. This same finding applied to the application of educational theory. The need to relate data collected from interprofessional interventions to relevant theory adds weight to the general criticisms directed at all forms of educational research (Hargreaves 1996). Without such theory it is difficult to understand the means by which outcomes have transpired. The outcomes of this review have therefore endorsed the need to develop guidelines for future educational research so that the weaknesses identified will not arise again. It is beyond the scope of this paper to examine research methods in detail but guidelines specific to this review are provided below. These may provide a pathway to improving the quality of data collected so that confidence in the validity of findings on interprofessional education can be maximized.

Summary of main findings

- The largest effects were on students' knowledge, attitudes, skills and beliefs, in particular on understanding of professional roles and team working.
- The smallest effects were for transfer of learning into student's experiential practice, and on effects on students' learning environments. These discrepancies reflect the choice and length of follow-up of outcome measures rather than differential effects *per se*.
- Educational and psychological theories were rarely used to guide the development of interventions and outcomes measured.
- Early learning experiences were most beneficial to develop healthy attitudes toward interprofessional working.
- Interventions require detailed and committed team planning and increased resources.
- The educational approaches generally centred around the principles of adult education using problem based learning, small group teaching, case studies and experiential work.
- Interventions were of a fairly high quality but few had included the principles of reinforcement and facilitation.
- The majority of interventions took place in academic environments and/or in community settings using the subject areas of teamwork and primary health care. Interprofessional education was seen as the vehicle through which the topic

was taught. In this way topic and process were dealt with using a combined approach.

- Few interventions summatively assessed their students, which detracted from the significance of interprofessional education. For the studies that did, interprofessional education did not affect exam pass rates.
- Outcomes primarily represented short-term effects only. Few studies provided evidence of longer-term outcomes, in particular effects upon professional practice.

Guidelines for interprofessional educational research

- Use clear aims and objectives to guide the research question to include: rationale, context and description of the intervention.
- Use the research question to guide selection of the research methodology.
- Recruitment procedures from target population to include theoretical base for sampling procedures.
- Educational intervention, chosen with reference to an educational model, to include clear description of context, content, frequency and duration of the intervention being tested.
- Use validated outcome measures chosen with reference to theoretical model(s).
- Provide data on participation rates, with reasons for nonparticipation and attrition rates, with reasons for withdrawal.
- Include a clear description of methods used to analyse data to lend validity to the findings.
- Longer term follow-up of outcomes to include assessing effects upon professional practice.

Conclusions

The aim of this review was to explore the evidence on interprofessional education for undergraduate health professionals. The evidence available has been explored using an innovative method developed specifically for this review. It has produced outcomes based on textual analysis which have provided guidelines for future interventions and recommendations for research.

In trying to answer the research questions it has been shown that there are no clear-cut answers in terms of the effects upon professional practice. This finding reinforces those of previous reviews (albeit unsystematic reviews) of interprofessional education (see for example, Barr & Waterton 1996). However, this review has also found that there has been a lack of educational or psychological theory guiding the development of interprofessional educational interventions. Approaches based on such theories were

found to be associated with rigorous outcomes and these warrant further development.

The outcomes of the review indicate that a fundamental approach to interprofessional education is required, one that integrates the best external evidence with educational expertise and students' choices. This highlights the need for greater discussion between educators, practitioners and students from an early stage to determine basic requirements. These findings are not unique to interprofessional education and have been found in systematic reviews of patient education (see for example, Griffin *et al.* 1998).

As the need for interdisciplinary teamwork evolves with the increasingly complex needs of service users and changes in the boundaries of professional practice, so the need for formal preparation for this way of working becomes more important. Professional education, as it currently stands, does not appear to equip practitioners with these skills. However, if teaching on an interdisciplinary basis is seen as an educational approach rather than a subject in itself, then it can only provide additional benefits. These benefits have been shown to relate to changes in knowledge, attitudes, skills and beliefs. The question that remains to be answered is how it affects professional practice. As yet there are no answers to this crucial question and so perhaps the most useful outcome from this review is the guidelines it has provided for future research studies into interdisciplinary education.

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