

RESEARCH REPORT

Undergraduate physiotherapy students' competencies, attitudes and perceptions after integrated educational pathways in evidence-based practice: a mixed methods study

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Abstract

This mixed methods study aimed to explore perceptions/attitudes, to evaluate knowledge/skills, to investigate clinical behaviours of undergraduate physiotherapy students exposed to a composite education curriculum on evidence-based practice (EBP). Students' knowledge and skills were assessed before and after integrated learning activities, using the Adapted Fresno test, whereas their behaviour in EBP was evaluated by examining their internship documentation. Students' perceptions and attitudes were explored through four focus groups. Sixty-two students agreed to participate in the study. The within group mean differences (A-Fresno test) were 34.2 (95% CI 24.4 to 43.9) in the first year and 35.1 (95% CI 23.2 to 47.1) in the second year; no statistically significant change was observed in the third year. Seventy-six percent of the second year and 88% of the third year students reached the pass score. Internship documentation gave evidence of PICO's and database searches (95–100%), critical appraisal of internal validity (25–75%) but not of external validity (5–15%). The correct application of these items ranged from 30 to 100%. Qualitative analysis of the focus groups indicated students valued EBP, but perceived many barriers, with clinicians being both an obstacle and a model. Key elements for changing students' behaviours seem to be internship environment and possibility of continuous practice and feedback.

Keywords

Evidence-based practice, mixed methods study, undergraduate education

History

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Background

Evidence-based medicine (EBM), later incorporated into evidence-based practice (EBP), is defined as ‘‘the integration of best research evidence with clinical experience and client values’’ in order to guide clinicians to an optimal clinical decision for an individual patient (Sackett, Straus, Richardson, and Rosenberg, 2000). McKibbin (1998) states that ‘‘ultimately EBP is the formalisation of the care process that the best clinicians have practiced for generations’’. The EBP process comprises five methodological steps (Sackett, Straus, Richardson, and Rosenberg, 2000), each requiring specific knowledge and skill (Dawes et al, 2005; Iles and Davidson, 2006; Liabsuetrakul et al, 2009; Shaneyfelt et al, 2006): (1) translation of uncertainty into answerable questions; (2) search for and retrieval of the best evidence; (3) critical appraisal of evidence for validity and clinical importance; (4) application of appraised evidence to practice; and (5) evaluation of the effectiveness and efficiency in executing steps one to four. Despite this systematic process of EBP, a research-practice gap exists (Lizarondo, Grimmer-Somers, and Kumar, 2011a) owing to obstacles that prevent valid and relevant research from being translated into a change in the

behaviour of clinicians and organisations (Glasziou and Haynes, 2005; Hannes et al, 2007; Hannes, Staes, Goedhuys, and Aertgeerts, 2009; Jette et al, 2003; Solomons and Spross, 2011).

The Sicily statement on evidence-based practice (Dawes et al, 2005) proposes useful recommendations on minimum standard educational requirements for practitioners and suggests grounding the curricula on the 5-step model. Evidence-based practice education-related outcomes could be represented using the modified Kirkpatrick scale (Belfield et al, 2001; Freeth et al, 2002; Khan and Coomarasamy, 2006; Tilson et al, 2011). This scale shows different levels of outcomes: people's reactions (participation, change in attitude and self-efficacy); changes in terms of knowledge and skills; behavioural modification (individual and organisational) in clinical practice; and finally the real benefits for the people assisted. We should consider that feasible and observable outcomes for undergraduate students are, at best, limited to changes in their potential clinical behaviours and the real challenge of education might be the translation of knowledge and skills to behaviours.

Recently the Classification Rubric for EBP Assessment Tools in Education (CREATE) (Tilson et al, 2011) has tried to identify evaluation instruments at the different levels of the modified Kirkpatrick scale. Among the instruments, the Fresno test (Ramos, Schafer, and Tracz, 2003) assesses knowledge and skills for the first three steps of EBP. An adapted version of the Fresno test for health professionals (occupational therapists and

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physiotherapists) (McCluskey and Bishop, 2009) and the respective Italian version (Bozzolan et al, 2011) have been validated. A version specifically adapted to physiotherapy has recently been published (Tilson, 2010).

Khan and Coomarasamy (2006) proposed a hierarchy of effective teaching and learning to acquire competence in EBM, suggesting interactive and clinically integrated teaching and learning activities at the highest level. Other papers (Coomarasamy and Khan, 2004; McEvoy et al, 2011; McInerney and Suleman, 2010; Novak and McIntyre, 2010) have suggested that multidimensional and interactive modalities could improve attitudes, knowledge and sometimes skills, but could hardly modify clinical behaviour of professionals.

Generally, in order to achieve good outcomes (Boruff and Thomas, 2011; Schreiber and Stern, 2005) EBP training should start early, possibly at entry-level education, and should be continued at higher levels. It should also be integrated into the clinical setting and routine care (Dawes et al, 2005; Lai and Teng, 2009; West, Jaeger, and McDonald, 2011). Two reviews (Flores-Mateo and Argimon, 2007; Ilic, 2009) have suggested that improvements in knowledge and skills in EBP could be obtained in postgraduate or undergraduate health care education (medicine, nursing and allied health professions). Recently, Long et al. (2011) reported large effect sizes in changes of knowledge, attitudes, and behaviours associated with EBP courses in an entry-level physiotherapy program.

Students' perceptions and attitudes regarding EBP and EBP education have also been reported (Ilic and Forbes, 2010); in a focus group, medical students described EBM as a system with which clinicians may make medical decisions based on the best current evidence in order to help make the best patient decisions. Students also stated that "...it provides clinicians with a justification to present alternative options to patients" (Ilic and Forbes, 2010).

In any case, there is a lack of rigorous published research into health professional EBP education processes and outcomes (Long et al, 2011), especially at undergraduate levels (Thomas, Saroyan, and Dauphinee, 2010) and no educational gold standard exists. To the authors knowledge there is no known study which has incorporated evaluation of elements of the Kirkpatrick model (including changes in attitudes, knowledge, skills and behavioural modification) in any one sample of undergraduate health professional participants.

The aim of this study was to use a concurrent quantitative and qualitative approach to explore perceptions and attitudes, to evaluate knowledge and skills and to investigate the clinical behaviours of one sample of undergraduate physiotherapy students exposed to a composite integrated education curriculum on EBP.

Methods

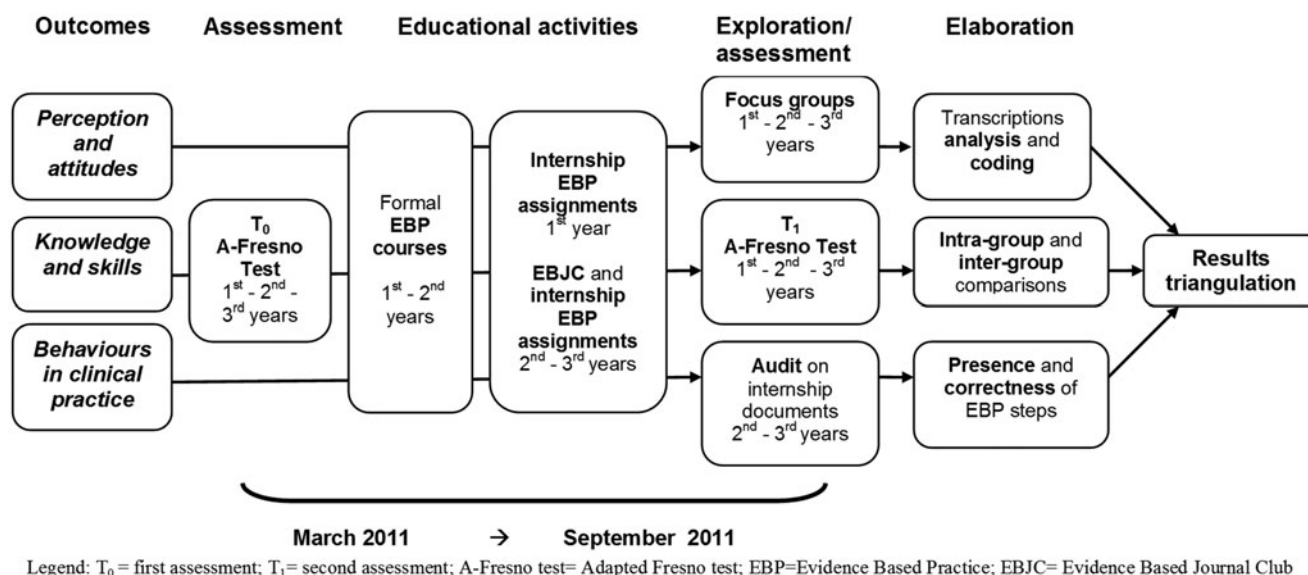
We conducted a mixed-methods research study, triangulation design, convergence model (Creswell and Plano Clark, 2007) (quantitative and qualitative), with data merging during interpretation. This mixed-methods convergence concurrent design means that the quantitative part of the study is carried out simultaneously with the qualitative approach, with the resulting data being analysed separately and integrated at the interpretation level ("Discussion" section of this study). This study design was chosen to integrate the different outcomes from two approaches, thereby combining the strengths of a quantitative and a qualitative design with a more global and valid view. The flowchart of the study design, illustrating the process of data collection and analysis, is depicted in Figure 1.

Participants

All students registered (total 73) in the physiotherapy undergraduate program at the University of Ferrara, in the academic year 2010/11, were invited to participate in the study. Students of the first, second and third year (26, 28 and 19 students respectively), who voluntarily agreed to participate, were included in the study. Participants were either students registered for the first time in their first, second or third year ("first time" students), or students who had attended the courses the year before but had not successfully completed the exams of the previous year ("repeat" students called "fuori corso" in the Italian university system). Attendance at EBP lessons was compulsory only for the "first time" students, as the "repeat" ones had already taken part in the activities the previous year.

Intervention

The educational pathway in EBP was composed of formal activities and activities during the clinical internship over the three years. Details of the curricular learning goals, educational activities and assessment methods are provided in Table 1. The



Legend: T₀ = first assessment; T₁ = second assessment; A-Fresno test = Adapted Fresno test; EBP = Evidence Based Practice; EBJC = Evidence Based Journal Club

Figure 1. Methodological flowchart of the study.

teaching strategy was interactive, using formal lessons, group working, online resources and simulations. During their curricular internships in various clinical placements (duration ranging from four to 14 weeks, inpatients with neurological disorders and outpatients with musculoskeletal disorders and the supervision of clinical educators), first year students had to compile a short EBP format (only EBP step one and two), while those of the second and third year were also required to choose a real patient case and go through all the EBP steps. Second and third year students had to fill out an ‘‘EBP format’’ and explain the integration of retrieved evidence in a specific section of the student’s ‘‘Patient file’’. The ‘‘EBP format’’ is a document where the students have to describe the results of the different steps of their EBP process applied to the chosen patient, while in the ‘‘Patient file’’, a document reporting the patient data and physiotherapy plan, the students are required to describe how findings in the literature have influenced their clinical decisions, and explain their clinical reasoning. The ‘‘EBP Format’’ and the ‘‘Patient file’’ are therefore the set of documents that provide proof of execution of the EBP process, its outcome (process and outcome correctness) and relevance to the clinical practice.

Outcomes

The outcomes related to EBP, organised according to the modified Kirkpatrick scale, assessed were: perceptions and attitude through focus groups (qualitative approach); knowledge and skills via the A-Fresno test (quantitative approach); and behaviours by auditing the internship sets of documents.

Perceptions and attitudes

We used the focus group method as it allows both the expression of the individual and group interaction and the consequent possible construction of new concepts (Carpenter and Suto, 2008). Four semi-structured focus groups were conducted; two for the third year and one for each of the first and second year students. All third year students ($n=19$) were invited to participate and organised into two focus groups. There was a quasi-random selection of 10 students for each of the first and second year focus groups.

Participation in the study was on a voluntary basis, with guarantee of anonymity during the analysis of the transcripts. Two experts in qualitative research not involved in the EBP educational pathway conducted the focus groups at the end of the academic year (after completion of formal courses and internships). The outline of the focus group was based on previous research (Ilic and Forbes, 2010; Stube and Jedlicka, 2007) and on a consensus process within the research team. Key questions explored were: the students’ experience of the educational pathway; acceptance or rejection of EBP; the consistency of EBP in theory and practice; the importance of EBP for clinical practice; the feasibility of the different steps; and the barriers and facilitators. The focus groups, lasting about two hours, were audio-recorded and transcribed verbatim.

Knowledge and skills

The students’ knowledge and skills related to the first three steps of EBP were assessed using the Italian validated version (Bozzolan et al, 2011) of the A-Fresno test for rehabilitation professionals (McCluskey and Bishop, 2009). The Italian version of the test, composed of seven questions (and the correction grid) was integrated with a second section composed of six further questions drawn from a new version of the A-Fresno test specifically adapted for physiotherapy (Tilson, 2010). The new

six questions were independently translated into Italian and then compared by two researchers, one of whom was an expert in EBP. The resulting draft was checked for accuracy of translation by a professional translator, to obtain the final version of the second section. This section of the test was not assessed for its psychometric properties, since it had previously been decided that such an assessment would be carried out later, depending on the results obtained. Given the structure and the limits of the overall test we used, the scores resulting from the two sections were analysed and discussed separately.

The first section of seven questions (Q) explored the knowledge and skills necessary to: (Q1) define a clinical question; (Q2) describe different sources of information; (Q3) identify the best study design for a specific question; (Q4) define a literature search strategy; (Q5) identify the relevance of a study to physiotherapy; (Q6) determine the validity of a study; and (Q7) describe the statistical and clinical significance of a study. Question 1 (Q1) was related to EBP step one. Questions 2–4 (Q2–Q4) were related to EBP step two. Questions 5–7 (Q5–Q7) were related to EBP step three. The second section of the test assessed advanced knowledge and skills necessary which were necessary to: (Q8) ask patients questions; (Q9) calculate diagnostic accuracy; (Q10) determine absolute risk reduction, relative risk reduction, and number needed to treat; (Q11) judge statistical and clinical significance; (Q12) indicate the best study design for diagnosis; and (Q13) indicate the best study design for prognosis. The clinical scenarios of the questions (and the related correction grids) in order to perform the test at T_0 (time pre-educational activities) and T_1 (time post educational activities) were different, to reduce the risk of a ‘‘learning effect’’.

The tests were scored by one researcher, a physiotherapist lecturer and expert in EBP, who had demonstrated reliability in the original Italian validation study of the A-Fresno test (Bozzolan et al, 2011). The rater was blinded to the identity and year of course attendance of the students, but was aware of the administration time of the test (T_0 and T_1).

Behaviours

The EBP related behaviours were examined by auditing student compiled documents: the ‘‘EBP format’’ and ‘‘Patient file’’. An audit form was used to seek proof of behaviours related to the EBP steps one to four (Sackett, Straus, Richardson, and Rosenberg, 2000). Twenty pre-determined items were set, through a consensus process, in order to detect systematically the results of students’ behaviours in integrating EBP into the context of their clinical internship. The set of items was structured in ‘‘macro levels’’ corresponding to the EBP steps plus a further item assessing the students’ written explanation of their clinical reasoning (as defined by Higgs, Jones, Loftus, and Christensen (2008)) in translating the evidence to the patient. Two physiotherapists experienced in EBP, not involved in the physiotherapy degree program, used the audit form to verify the accomplishment of these items within the set of documents, compiled by the students, namely the ‘‘EBP Format’’ and ‘‘Patient file’’. For some items (1–8 and 10–16), the members of the research team also developed, through a consensus process, the criteria for judging the correctness of the students’ accomplishments (‘‘correctness of use’’). The set of items was accompanied by a user’s guide, in order to improve reliability. For each item, one assessor checked the presence (option ‘‘yes’’) or the absence (option ‘‘no’’) of the specific component, or declared the impossibility of deciding (option ‘‘do not know’’). If the component was present, the assessor also had to evaluate the correctness of its use. To ensure usability and face validity, four sets of documents, randomly

Table 1. EBP educational goals and activities of the formal courses and internships and the respective curricular assessment modalities.

Year	Curricular EBP educational goals, activities and assessment			Learning assessment ^a (curricular)
	Learning goals & formal educational activities	Formal learning assessment ^a (curricular exams)	Learning goals & educational activities in the clinical internship	
1st	<p>Goals (EBP steps 1 and 2)</p> <ul style="list-style-type: none"> to know literature and research taxonomy to define a PICO to search for evidence <p>Activities. Interactive course (3 credits, ~35h)</p>	<ul style="list-style-type: none"> formulation of a clinical question (PICO) starting from a scenario online database literature searches (Pubmed, PEDro) written open-ended questions (applied knowledge) 	<p>EBP skills goals:</p> <ul style="list-style-type: none"> to formulate a PICO from clinical practice to retrieve studies <p>Activities: compiling a short EBP format</p>	<ul style="list-style-type: none"> student's portfolio specific outcomes and skills descriptors (learning contract)^b
2nd	<p>Goals (EBP steps 1-5)</p> <ul style="list-style-type: none"> as 1st year, but higher level to appraise a paper critically; RCTs, SRs, diagnostic studies. to use pre-appraised resources and clinical guidelines <p>Activities. Interactive course (2.5 credits, ~30h)</p>	<ul style="list-style-type: none"> as 1st year as 1st year (+ Cochrane library) as 1st year critical appraisal of a paper (RCT, SR, diagnostic study) 	<p>EBP skills goals:</p> <ul style="list-style-type: none"> as 1st year as 1st year to critically appraise the studies retrieved to integrate evidence into the clinical decision-making process <p>Activities: EBJC, compiling an "EBP format" and a "Patient file" for each internship period</p>	<ul style="list-style-type: none"> as 1st year
3rd			<ul style="list-style-type: none"> as 2nd year, more integration of evidence in clinical reasoning required 	<ul style="list-style-type: none"> as 2nd year

EBP = evidence-based practice; h = hours; RCT = randomised controlled trial; SR = systematic review; EBJC = evidence-based journal club.

^aAssessment normally performed in the curricula to test the achievement of the learning goals.^bAssessed by clinical educator plus EBP expert.

drawn from those completed by the students, were first tested by the two assessors and the EBP expert of the study team together. Afterwards the two assessors performed an independent audit on all the remaining sets of document (30 and 38 respectively). Details of items, components and correctness criteria are reported in the “Results” section.

Data analysis and statistical methods

STATA software 11 (StataCorp LP, College Station, TX) was used for all the statistical analyses.

Perception and attitudes

The analysis and coding of the text of the transcripts was carried out independently by four researchers (two experts in qualitative research with no relationships with the participants, and two third year students) with different educational backgrounds, allowing a triangulation of researchers and theories, useful for the data completeness (Shih, 1998). The encoding process was carried out with the aid of the software Atlas.ti[®] version 5 (Scientific Software, Berlin, Germany) and revised recursively, both during the encoding by individual researchers and during the process of comparing the researchers’ encodings; an expert in EBP further validated the codes. “Super-codes”, by combining primary codes related to the same object, and “families”, by grouping codes and super-codes referable to the same general concept, were identified. A relational network was also created, graphically representing the “families”. Then, through a re-analysis of the interviews, codes of the same or different families were linked with various relationships (“is associated with”, “is because of”, “is part of”, “is”, “contradicts”, “is owned by”). The density of relationships between different codes and the number of quotations of the primary codes were also analysed. The graphic form of the network was consequently revised to identify any emerging theory.

The emerging codes and concepts were revised throughout the process by the researchers according to the principles of “Grounded Theory” (Tarozzi, 2008), aiming to explore and understand the core individual and social processes underlying EBP and trying to identify a possible theory arising from expected and unexpected data (Watling and Lingard, 2012).

Knowledge and skills

The range and average (SD) of age were described, as well as the absolute values and percentages related to gender, non-Italian native speakers and subjects with a different university degree. A descriptive analysis of the results for the combined scores for questions 1–7 (first section), for the combined scores for questions 8–13 (second section) and for the individual scores for each the 13 questions of the A-Fresno test was performed, representing the scores (at T₀ and T₁, for the first, second and third year groups) as a mean (SD). The percentage of achievement of the pass-score (cut-off at 50% of the maximum attainable score (Tilson, 2010)), both for the single questions and the subtotal of the two sections of the test, was calculated. Fisher’s exact test was used to assess whether there was a difference between the first, second and third years, for the percentages of students who achieved the pass-score at T₁. After verifying normal distribution of data, an intra-group comparison was made using the Student *t*-test for paired data (T₀ versus T₁ for the first, second and third year), to assess the students’ improvements on the single questions and subtotals of the two sections of the test. To assess the permanence of learning, the Student *t*-test for unpaired data was also used comparing the T₁ first year’s scores versus T₀ second year’s scores and the T₁ second year’s scores

versus T₀ third year’s scores (only subtotals scores of the first and second section).

Behaviours

Absolute values and percentage of presence and correctness of use of the items contained in the audit form were calculated. Only second and third year students compiled both “EBP format” and “Patient file” and had knowledge and skills sufficient to apply EBP process to a real patient, so only their data were examined. The data of second and third year students were processed separately. After having merged the results in two classes (yes; no; and do not know), the Fisher’s exact test was used to evaluate any differences resulting from the different kind of internship (neurological and musculoskeletal area); as no difference was found, the data from different periods of internship of the students of the same year were assembled.

Results

Perceptions and attitudes

A total of 30 students (out of 36 students invited) participated in the four focus groups; 57% were female. The number of participants per focus group varied between five and nine. The analysis of the focus group transcripts led to 52 primary codes, five super-codes and five “families”. Appendix shows super-codes and code families (with the list of the codes grouped in each family), the number of citations and the density of relationships between codes. The code families that emerged are described, with examples of codes and super-codes and relative citations, followed by an introduction to the relational network.

Code Family: “Difficulties perceived by the students”

This family had the largest number of citations. Students reported many difficulties, especially related to knowledge, to linking theory and practice, and to time. Knowledge-related difficulties (which are grouped in a super-code) concerned: statistics and research methodology (“...the other (issue) for me was the knowledge of statistics...”); and the need for a continuous application of EBP knowledge to prevent its loss, especially when the students’ main aim is to pass the exam (third year student: “*I did not remember anything, that is, if you don’t do it often... you forget it.*” / third year student: “[...] *in fact, after one year I could hardly remember anything because I had studied that week just concentrating on doing the exam.*”). Students found difficulties in understanding how to link theory (of EBP) to practice (“*My difficulty is in making it simple in practice... I have not yet figured out how to do it.*”) and to find the scientific article that fits the specific case (third year student: “*...and also finding the article that is appropriate for the patient we are dealing with... is quite difficult.*”). “Time”, a code with 55 citations, represented another important difficulty. Students complained of an imbalance between the time and the effort required to complete the EBP process, and the global workload in the physiotherapy program, resulting in a feeling of fatigue and tiredness (third year student: “[...] *for us who have little time, we have millions of lectures, many exams and little time to search for articles ...*”).

All of these perceived difficulties, combined with the external “obstacles to the EBP process” (27 citations), appeared to generate a feeling of immediate uselessness of EBP (second year student: “[...] *the balance between the time spent on doing a perfect process, both searching for the article and evaluating its quality, and the real usefulness of this article... is still very much out of proportion, I mean... very unbalanced.*”).

Code Family: “Methodology of EBP process”

The students, when talking about the methodology of the EBP process, referred, in a remarkable number of citations, to the utility and importance that EBP might have for a physiotherapist (32 and 19 citations) (third year student “*It is certainly useful because after all some information can’t be found elsewhere*”, second year student: “*It (EBP) keeps you updated*”). Their perception of the usefulness and importance of EBP was strongly linked to the motivation of the individual (a super-code with 40 citations equally distributed over the three years). Motivation was the trigger of the EBP process and often referred to personal attitudes and curiosity (22 citations) (third year student: “*I think this most likely depends on the specific person*”) and more rarely arose from clinical practice problems (third year student, “[...]for example, I tried to see if the use of a splint was useful for a patient. I said: is it really effective?”).

Implementation of the EBP process requires access to the full-text of articles (15 citations) (third year student: “... (at the rehabilitation hospital), however, these searches are free of charge, but at home you have to pay a lot of money to do these searches...”), knowledge of the English language (19 citations) (second year student: “... we tend to interpret very freely, to read randomly, we can more or less do a translation”) and time for searching and reading the articles (third year student: “*If I do not find it (the article) immediately... I’ll spend an hour, an hour and a half or two looking for it... then analysing it will take at least another hour, that is, if I want to do the job well...*”).

Code Family: “Transition from theory to practice in internship”

This family describes students’ thoughts on the transition of EBP from theory to practice. Students reported that EBP does not generate visible changes either to their practice in the internship (10 citations) (second year student: “... to do it (EBP) during the internship... we know that it has no effect on the clinics, I mean... that it does not change the treatment or anything else...”), or to the practice of the clinical educator or other professionals in the clinical setting (22 citations) (second year student: “*The results that I got from the research... I took them to the clinical educator. He said: “Keep them there, they are good, we know it works, but in practice we follow our protocol, we do what we have always done”. And this is what I found.*”). This lack of effect may be due to several factors: the limited clinical skills of the students (third year student: “*If I do not have the technical skill, however, I may be wrong already there... and even if the evidence says you have to do all the positions... but I make mistakes in the technical part, I am wrong from the beginning and I’ll never get the result*”); the gap between the evidence and a very complex clinical reality (“... then the treatment that we do, is not a pill that gives such a precise result... There are a lot of variables...”); and the need for continuous practice to maintain EBP skills (16 citations) (third year student: “*If you do not do it often, you will forget it*”).

Code Family: “Methodology of education in EBP”

This family describes how students perceived the methodology of education in EBP and its implementation. In this family the super-codes “Lessons” (20 citations) and “Journal Club” (23 citations) stood out. Students described the practical aspects and methods by which the lectures were given (“[...] more participation was required on our part, because we had to exercise on the computer ourselves and not only listen to a professor and do nothing else,... so these classes were probably even more interesting than other classes because we actually had to do something... it was nice to be there searching on the computer”). In the opinion of some,

these types of lectures were more productive with class groups of limited sizes. Others stated that the activity was proposed too early in the degree program (first year).

Regarding the Journal Club, the strengths (16 citations) were mainly emphasised (third year students “*You are satisfied because when you finish you have some secure results, you have understood how to do it and you have learned something...*”), in particular, the possibility of dialogue and collaboration with others was considered positive (third year student: “*It is perhaps useful to interact with someone who knows how to highlight the main aspects*”). Students highlighted that only a small number of Journal Clubs were carried out (7 citations) (3 year: “*You leave feeling almost satisfied because you were able to find something but it happens once, twice a year depending on your internship*”) and, as a critical issue, the fact that the expert in EBP was not only their EBP teacher but also the degree course coordinator and the person who assessed them at the exam.

Concerning the teaching during internship, the students emphasised the role of the clinical educator; she/he was more often seen as a “barrier” (36 citations) to EBP and to the education of the students in this field (third year student: “*In my experience we did not have the support of the clinical educators, but it is not their fault because, not knowing (EBP), they cannot be of help or support us*”) rather than as a “resource” (16 citations) (second year student: “*My clinical educator was very young... she had attended our faculty and the course of evidence-based practice, so she was qualified... and in the end, at least, we did it together (the search)...*”). There were also some critical aspects about the EBP education assignments during the internship at times perceived as a duty or obligation, time-consuming and frustrating (third year student “...as a first approach it was mainly an obligation, in the sense that we had to follow the EBP process because we were given it as an assignment” / “It is almost frustrating to do a literature search and then to know I’ll probably do it wrong ...”).

Generally speaking, the students made suggestions for future students and as to how the educational pathway might be improved (28 citations), especially concerning the scheduling of the EBP activities (“*We will tell them (the other students) what we have achieved after one year and that we have not yet understood it all... and as time goes on everything will come together, so keep calm and don’t get impatient or lose hope...*” / “*To do something every two months, a Journal Club or something else, to refresh our knowledge a little*”).

Code Family: “Impact of EBP on professional practice”

This is the family with the smallest number of citations. Students found it difficult for a professional, even in the presence of valid evidence, to change his/her clinical practice (5 citations) (“...when, in my opinion, you have a certain number of years of experience, it is difficult to completely change the way you operate...”), and they attributed this difficulty to the limited facilities available and to the organisations in which professionals work (10 citations) (“[...] (at the rehabilitation hospital) you have many patients at the same time, and therefore it is virtually impossible to work with all patients and also do the search”). Consequently, EBP was seen more as a personal upgrade/culture without immediate practical consequences. Nonetheless, from the analysis of the super-code “Future” and of some examples of successful experience (third year student: “*I had two clinical educators who have taken the results I found into account. I told one of them that I had found these (articles), she said that she might change the way she worked...*”), the students predicted their (probable) use of EBP after the end of their degree program (29 citations), particularly in the perspective of being autonomous

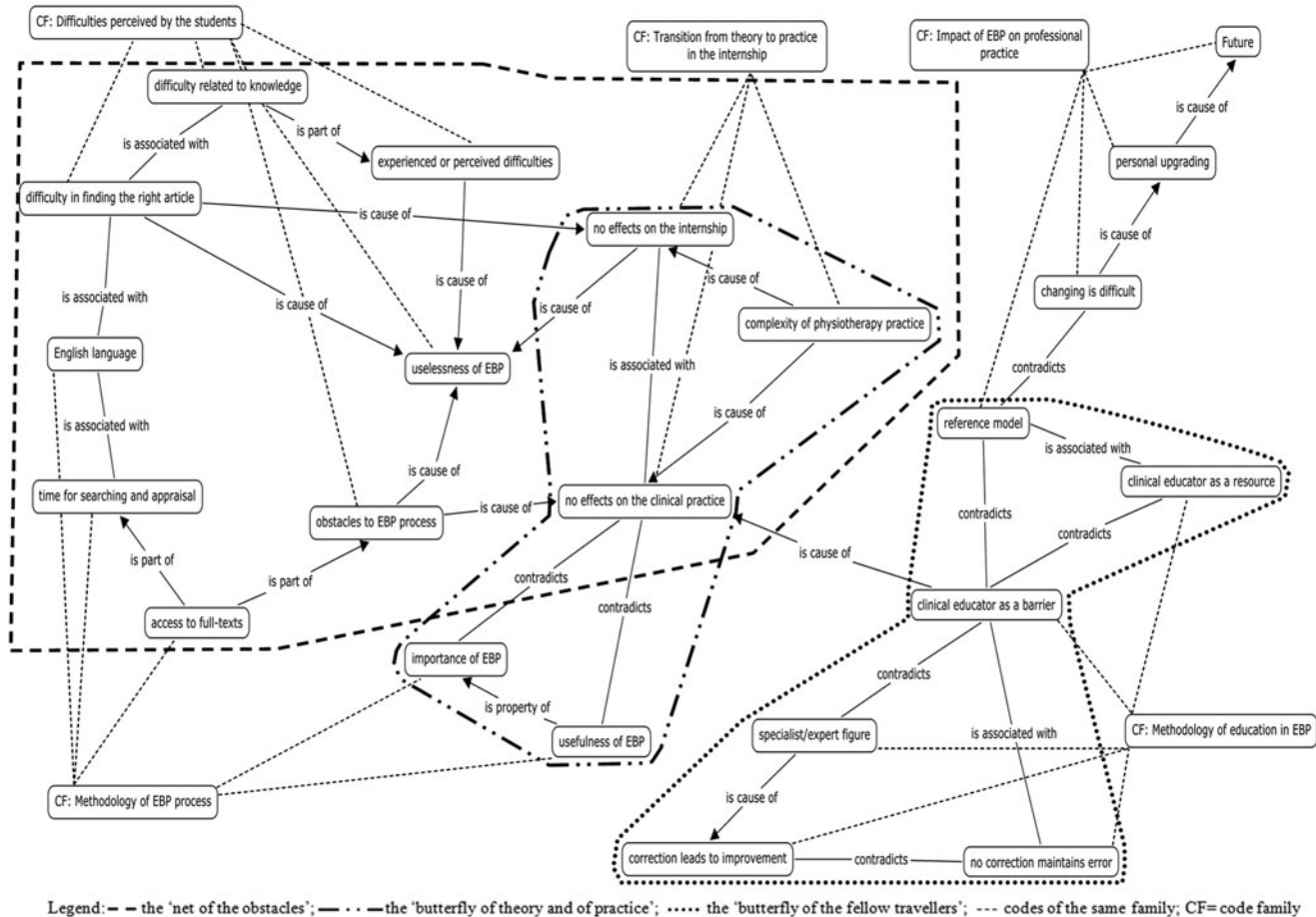


Figure 2. Relational network.

professionals ("It (EBP) will not be so useful in our current practice. Sometimes it may seem boring, but when we are autonomous professionals..."). The students concluded that what they learned from EBP education pathways will be helpful for their future (7 citations) ("[...] even if it is now only an exercise... it is something that will be applicable in the future ..." / "I have put it (EBP) aside, but it is also true that if you do not learn it (EBP) you will not be able to use it when graduated...").

Relational network

The overall graphical representation allowed us to identify two main groups of codes with common relationships: (1) the three families of "methodology of EBP process", "difficulties perceived by students" and "transition from theory to internship practice", and (2) the families of "impact of EBP on professional practice" and "methodology of education in EBP". The only connection between the two groups of families was the code "clinical educator as a barrier" as a cause of "no effects on the clinical practice". Within the relational network (Figure 2) some geometrical shapes were also noted, thanks to their relationship circuits: one polygon ("the net of the obstacles") and two shapes resembling a butterfly ("the butterfly of theory and practice" and "the butterfly of fellow travellers").

Knowledge and skills

Participants

Of the 62 students who completed at least one A-Fresno test, 32 (51.6%) were male and 30 (48.4%) female; they had a mean age of 23 (SD 3) and 87% were included in the range between 19–24 years. Only one student (1.6%) was not a native Italian speaker.

Seven students (11.3%) had already graduated from a previous bachelor degree. The number of participants who took part in the different administrations of the test, divided by year and in relation to all the potential eligible students, is shown in Figure 3.

The time-lapse between T_0 and T_1 was 205, 196 and 170 days respectively for the first, second and third years. The results of the A-Fresno test are depicted in Table 2.

T_0 – T_1 scores comparisons

The evaluation of EBP knowledge and skills through the A-Fresno test was proposed to all students, but only "first time" students (83% of the first year, 65% of the second year, and 79% of the third year of this type of students) actually completed both the T_0 and T_1 . The results of the t test for paired data therefore reflected the performance of these "first time" students. For the first year there was a significant average improvement of 34.2 points (95% CI 24.4 to 43.9) in the first section of the A-Fresno test, but only one student achieved the pass score. The improvement in the second section of the test was minimal. For the second year, the significant average improvement was 35.1 points (95% CI 23.2 to 47.1) in the first section of the test, and 76% of the students achieving the pass score. Despite the significant improvement in the second section of the test, only 24% of the students achieved the pass score. The significance of the improvement in the third year was borderline for the first section of the test, with 88% of the students achieving the pass score. No improvement was seen in the second section of the test and only 19% of the third year students achieved the pass score. The increase in the pass-percentage (first section of the test) was significant ($p < 0.0001$) between the first and second year, but not between the second and third year.

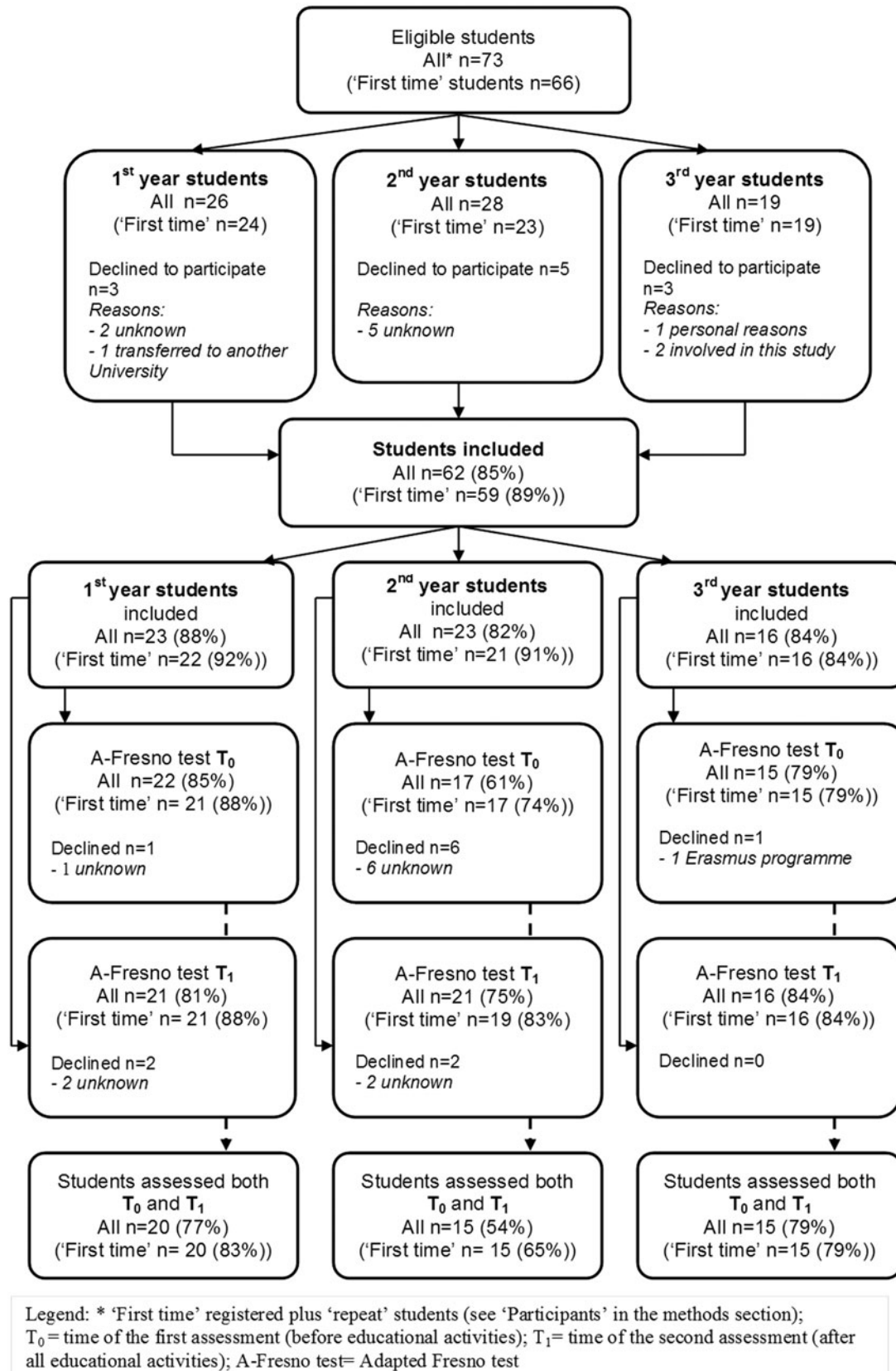


Figure 3. Adapted Fresno test administrations flowchart. It should be noted that only ‘first time’ students were expected to attend EBP educational activities in that period.

At an individual question level, first year students reported good scores in the questions related to EBP steps one and two: 100% (Q1); 57% (Q2 and Q3); and 86% (Q4) of them achieved the pass score. Second year students had significant improvements in questions related to internal and external validity of studies: large

in Q6 (determining the validity of a study) with 67% of them passing the cut-off score; and significant but small in Q5 (relevance of a study) and Q7 (statistical and clinical significance) with only 29% of students achieving the pass score. One hundred percent of the third year students achieved the pass score in Q3

Table 2. A-Fresno test scores at T₀ and T₁, p values resulting from T test for paired data, absolute and percentage values of the students who achieved the pass score.

Questions	Score comparisons T ₀ -T ₁ on the Adapted Fresno Test																										
	1st year T ₀ (n=20)		1st year T ₁ (n=20)		Mean difference 1st year T ₀ -T ₁		Pass score at T ₁ ^b n (%)		2nd year T ₀ (n=15)		2nd year T ₁ (n=15)		Mean difference 2nd year T ₀ -T ₁		Pass score at T ₁ ^b n (%)		3rd year T ₀ (n=15)		3rd year T ₁ (n=15)		Mean difference 3rd year T ₀ -T ₁		Pass score at T ₁ ^b n (%)				
Description	Mean (SD)	SD	Mean (SD)	SD	Delta (95% CI)	p-value (T-test) ^a	Mean (SD)	SD	Mean (SD)	SD	Delta (95% CI)	p Value (T-test) ^a	Mean (SD)	SD	Mean (SD)	SD	Delta (95% CI)	p Value (T-test) ^a	Mean (SD)	SD	Mean (SD)	SD	Delta (95% CI)	p Value (T-test) ^a	Mean (SD)	SD	
Q1 (MS = 12)	4.2 (2.5)	10.8 (1.4)	12 (7.2)	10.9 (7.3-14.6)	6.6 (5.3-8.0)	0.0000	9.1 (2.9)	11.3 (0.9)	2.2 (0.6-3.8)	0.0094	21 (100%)	8.5 (2.4)	10.2 (1.7)	1.7 (0.1-3.4)	0.0399	16 (100%)											
Q2 (MS = 24)	12.5 (5.1)	14.9 (6.3)	2.4 (-1.7-6.5)	0.24	2.4 (-1.7-6.5)	0.24	17.1 (5.4)	14.3 (5.5)	-2.8 (-6.2-0.6)	0.10	11 (52%)	14.9 (6.2)	14.5 (5.9)	-0.4 (-4.1-3.3)	0.82	11 (69%)											
Q3 (MS = 24)	1.1 (3.5)	12 (7.2)	10.9 (7.3-14.6)	0.0000	10.9 (7.3-14.6)	0.0000	11.4 (8.0)	16.4 (4.1)	5 (-0.2-10.2)	0.06	16 (76%)	12.6 (5.6)	17.8 (2.4)	5.2 (1.8-8.6)	0.0056	16 (100%)											
Q4 (MS = 24)	2.9 (3.3)	17 (3.7)	14.1 (12.2-16)	0.0000	14.1 (12.2-16)	0.0000	14.2 (4.6)	19.5 (4.1)	5.3 (3.1-7.5)	0.0001	19 (90%)	18.4 (4.2)	19.5 (1.8)	1.1 (-1.1-3.4)	0.31	16 (100%)											
Q5 (MS = 24)	2.5 (3.0)	10.1 (4.7)	-2.25 (-3.85-0.64)	0.0086	-2.25 (-3.85-0.64)	0.0086	3.1 (4.9)	7.3 (6.0)	4.2 (0.2-8.2)	0.0428	6 (29%)	9.2 (5.8)	8.7 (7.3)	-0.5 (-5.5-4.6)	0.85	6 (38%)											
Q6 (MS = 24)	1 (2.61)	3.6 (6.84)	2.6 (-0.9-6.1)	0.14	2.6 (-0.9-6.1)	0.14	5.1 (8.1)	16.7 (9.7)	11.6 (5.3-17.9)	0.0014	14 (67%)	15.3 (9.2)	16.7 (9.5)	1.3 (-5.1-7.8)	0.67	12 (75%)											
Q7 (MS = 24)	0.5 (1.5)	0.3 (1.1)	-0.2 (-1.2-0.7)	0.58	-0.2 (-1.2-0.7)	0.58	0.3 (1.3)	9.9 (6.5)	9.6 (6.1-13.1)	0.0000	6 (29%)	7.6 (6.4)	11.3 (7.2)	3.7 (-1.2-8.5)	0.13	5 (31%)											
First section subtotal score^c (MS = 156)	24.6 (9.3)	58.8 (16.9)	34.2 (24.4-43.9)	0.0000	34.2 (24.4-43.9)	0.0000	60.4 (20.8)	95.5 (18.4)	35.1 (23.2-47.1)	0.0000	16 (76%)	86.5 (8.6)	86.5 (8.6)	12.2 (-2.1-26.5)	0.09	14 (88%)											
Q8 (MS = 16)	8.2 (4.1)	10.1 (4.7)	1.9 (-0.5-4.3)	0.11	1.9 (-0.5-4.3)	0.11	9.6 (5.0)	8.7 (3.9)	-1.3 (-4.2-1.5)	0.33	7 (33%)	12.1 (4.7)	7.6 (4.4)	-4.5 (-8.3--0.7)	0.0228	7 (44%)											
Q9 (MS = 12)	0.2 (0.9)	0 (0)	-0.2 (-0.6-0.2)	0.33	-0.2 (-0.6-0.2)	0.33	0 (0)	2.6 (3.8)	2.6 (0.5-4.7)	0.0194	5 (24%)	0.9 (2.2)	2.7 (3.3)	1.8 (-0.1-3.7)	0.06	3 (19%)											
Q10 (MS = 16)	0.2 (0.9)	0 (0)	-0.2 (-0.6-0.2)	0.33	-0.2 (-0.6-0.2)	0.33	0 (0)	5.5 (4.7)	5.5 (2.8-8.1)	0.0005	3 (14%)	6.6 (6.2)	3.7 (4.7)	-2.9 (-7.4-1.6)	0.19	1 (6%)											
Q11 (MS = 4)	0 (0)	0 (0)	0 (0)	0	0 (0)	0	0 (0)	0.3 (1.0)	0.3 (-0.3-0.8)	0.33	2 (10%)	0.8 (1.7)	0 (0)	-0.8 (-1.7-0.1)	0.08	0 (0%)											
Q12 (MS = 4)	0 (0)	0.8 (1.6)	0.8 (0.1-1.6)	0.0421	0.8 (0.1-1.6)	0.0421	0.8 (1.65)	2.9 (1.8)	2.1 (0.5-3.8)	0.0148	14 (67%)	0.3 (1.0)	1.6 (2.0)	1.3 (0.3-2.4)	0.0192	6 (38%)											
Q13 (MS = 4)	0 (0)	1.8 (2.0)	1.8 (0.8-2.8)	0.0009	1.8 (0.8-2.8)	0.0009	1.6 (2.0)	4 (0)	2.4 (1.3-3.5)	0.0004	18 (86%)	2.4 (2.0)	2.7 (1.9)	0.3 (-1.0-1.6)	0.67	11 (69%)											
Second section subtotal score (MS = 56)	8.6 (4.1)	12.7 (5.5)	4.1 (1.5-6.7)	0.0034	4.1 (1.5-6.7)	0.0034	12 (6)	23.5 (8.4)	11.5 (6.4-16.7)	0.0003	5 (24%)	23.1 (9.3)	18.3 (10.1)	-4.9 (-11.1-1.4)	0.12	3 (19%)											

Q = question; SD = standard deviation; CI = confidence interval; MS = maximum achievable score; n = number of students.

^aCalculated on the students who took part in both T₀ and T₁.^bAchievement of the pass score, calculated on all the students who took part in T₁.^cItalian validated section.

(identifying the best study design for a specific question), while other changes were minimal even when significant. Question 5 (relevance of a study) and Q7 (statistical and clinical significance) were the only questions in the first section of the test in which the pass score was never reached by at least 50% of the students.

The scores reported in the questions of the second section of the test were variable but basically low, with the exception of Q12 (best study design for diagnosis) (67% of the second year students achieving the pass score) and Q13 (best study design for prognosis) (86% of second year and 69% of third year achieving the pass score).

T₁–T₀ scores comparisons

Concerning the carry-over of learning, no statistically significant changes were observed between the subtotal mean scores (first and second section of the A-Fresno test) of the first year T₁ and the second year T₀, and the second year T₁ and the third year T₀.

Behaviours

Thirty eight students (21 for the second and 17 for the third year) were considered for the outcome ‘‘behaviours related to EBP’’ because only for those students were the internships scheduled. They compiled a total of 72 sets of documents, 40 sets for the second year and 32 sets for the third year. Two additional sets of documents were not available for reasons unknown, and two further sets of documents were not required due to the specific kind of internship. The results of the audit on behaviours of the second and third year students during the internship are shown in Table 3. The data were extracted from the sets of documents ‘‘Patient file’’ and the related ‘‘EBP format’’, which together were considered units of evaluation.

The most remarkable results, grouped by each EBP step, were:

EBP step one (question formulation)

Satisfactory results were reported in items 1-3-4-5 regarding the presence of components (between 87 and 100%), while around 50% of the students answered item 2 (‘‘motivation of the choice of a specific case for the EBP search’’). Correctness of use was satisfactory in items 2-3-4 for the second year students (between 70 and 85%) and even better for the third year students (between 72 and 94%).

EBP step two (literature search)

Values of 63% for second year and 70% for third year were reported in item 7 (‘‘the reason for choosing the specific kind of sources’’), while the other items (6-8-9-10) reported percentages between 81 to 100%. Correctness of use reported high percentage results (more than 90%) for item 11 where the students had to make a complete report on the quoted references. Other positive results (81%) were reported for third year item 6 (‘‘sources of information of good quality and containing the literature relevant to the specific question’’) and item 10 (‘‘motivation for the selected article’’). The other results relating to correctness of use were between 30% and 68%.

EBP step three (critical appraisal of internal validity)

Only item 12 (judgment on internal validity) in the second year reported values of more than 50%, items 13–14 ranged between 43% and 23% while items 15–16 ranged between 13% and 8%. The correctness of use of item 12 (‘‘validated critical appraisal instruments or pre-appraised literature’’) reported excellent results (more than 90%); item 13 (clinical and statistical

significance) achieved 11% in the second year and 25% in the third. No set of documents from the second year reported a comparison between real practice and the study examined concerning the physiotherapist’s expertise and clinical settings (item 15–16) while the third year put the same items at 50%.

EBP step four (application of evidence to practice)

Item 17 ranged between 8% and 22%. Only 6% of the sets of documents from the third year reported a modification in clinical organisation (item 18). No set of documents reported modification in clinical practice of the educators (item 19).

Clinical reasoning

Item 20 reported the presence of clinical reasoning in 28–32% of the sets of documents.

Discussion

In this part, as already mentioned in the ‘‘Methods’’ section, the data merging during interpretation was carried out. The results of the qualitative part (regarding students’ perceptions and attitudes), are discussed and then integrated with the quantitative part (relating students’ knowledge, skills and behaviours).

Perceptions and attitudes

Five code families and a relational network emerged from the focus groups. There is a correlation between the main difficulties (time and knowledge-related problems) described in the focus group and those reported in the literature (Iles and Davidson, 2006; Jette et al, 2003; McInerney and Suleman, 2010). Lack of time is an important barrier, because the EBP process is time-consuming and the workload also associated with other courses of the physiotherapy program takes up a considerable part of the students’ time. Statistics and research methodology are the main knowledge-related difficulties; they are complex to learn and easy to forget without continuous practice. The numerous barriers encountered means that the students have difficulty in putting the theory into practice and are therefore left with the feeling that the utility of EBP during the degree course is limited.

Despite difficulties and obstacles, the students do see the utility and importance of EBP, recognising its potential contribution to physiotherapy, similarly to Ilic and Forbes (2010) report on Australian medical students, but the students rarely cite EBP as useful in defining a prognosis and diagnosis. The students confirm that reading papers written in English is difficult and tiring (Letelier et al, 2007). In order to apply the EBP process successfully, the students understand the need to use their knowledge and skills consistently over time but several factors (e.g. the clinical educator who does not practice EBP or the lack of a sufficient amount of knowledge or motivation) make it difficult to satisfy this need. The most difficult EBP step is the critical evaluation of the results and application of evidence to practice.

Some students did not perceive any impact of EBP on their practice or on the practice of the other professionals they met during their internship. The learning process seems to be heavily influenced by the clinical educator, who is the only real connection node between formal education and internship practice. This is similar to the findings from the study of Ilic and Forbes (2010) in which application of EBP was largely tied to the expectations of the clinical educator. Thus clinical educators potentially play a crucial role in stimulating students’ motivation and helping them to overcome the obstacles in practice. In our case the clinical educators, often lacking experience in EBP, would hardly have been able to give feedback for improvement

Table 3. Results from the audit on second and third year ‘‘sets of documents’’.

Item (EBP step)	Components	Presence ^a of components of EBP steps					Correctness criteria	Correctness ^b of use				
		2nd year		3rd year				2nd year		3rd year		
		No n (%)	Can't say n (%)	Yes n (%)	No n (%)	Can't say n (%)	Yes n (%)	Partially n (%)	No n (%)	Can't say n (%)	Partially n (%)	Yes n (%)
1 (1)	Problem description/case description	4 (10%)	1 (2.5%)	35 (87.5%)	0 (0%)	0 (0%)	14 (40%)	NA	4 (11.4%)	NA	17 (48.6%)	22 (68.8%)
2 (1)	Motivation of the choice of a specific case for EBP search	18 (45%)	2 (5%)	20 (50%)	13 (41%)	1 (3%)	1 (5%)	NA	2 (10%)	NA	17 (85%)	17 (94%)
3 (1)	PICO (or PIO)	0 (0%)	0 (0%)	40 (100%)	0 (0%)	0 (0%)	2 (5%)	1 (2.5%)	1 (2.5%)	9 (22.5%)	28 (70%)	23 (72%)
4 (1)	Type of clinical question	0 (0%)	0 (0%)	40 (100%)	0 (0%)	1 (3%)	2 (5%)	0 (0%)	0 (0%)	4 (10%)	34 (85%)	28 (90.3%)
5 (1)	Proper type of study	0 (0%)	0 (0%)	40 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	15 (37.5)	25 (62.5%)	25 (78%)
6 (2)	Sources of information (used for search)	0 (0%)	1 (2.5%)	39 (97.5%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	15 (38.5)	24 (61.5%)	26 (81%)
7 (2)	Reason for choosing the specific sources	10 (25%)	2 (5%)	28 (70%)	11 (34%)	1 (3%)	2 (7.1%)	0 (0%)	0 (0%)	16 (57.1%)	10 (35.8%)	13 (65%)
8 (2)	Search strings (limits/filters included)	3 (7.5%)	1 (2.5%)	36 (90%)	1 (3%)	0 (0%)	2 (5.7%)	10 (28.6%)	NA	23 (65.7%)	1 (3%)	21 (68%)
9 (2)	Search results	3 (7.5%)	1 (2.5%)	36 (90%)	2 (6%)	4 (13%)	NA	NA	NA	NA	NA	NA
10 (2)	Selected article(s)	1 (2.5%)	0 (0%)	39 (97.5%)	0 (0%)	1 (3%)	NA	NA	NA	NA	NA	NA
11 (2)	Quoted references	1 (2.5%)	0 (0%)	39 (97.5%)	0 (0%)	0 (0%)	NA	NA	NA	NA	NA	NA
12 (3)	Judgment on internal validity	14 (35%)	2 (5%)	24 (60%)	14 (43.8%)	5 (15.6%)	NA	NA	NA	NA	NA	NA
13 (3)	Description of the study results	28 (70%)	3 (7.5%)	9 (22.5%)	14 (43.8%)	4 (12.5%)	8 (88.9%)	0 (0%)	0 (0%)	NA	1 (11.1%)	4 (25%)
14 (3)	Characteristics of the real patient	30 (75%)	1 (2.5%)	9 (22.5%)	20 (62.5%)	4 (12.5%)	2 (22.2%)	1 (11.1%)	NA	NA	6 (66.7%)	3 (37.5%)
15 (3)	Level of expertise of the physiotherapist	37 (92.5%)	0 (0%)	3 (7.5%)	27 (84%)	1 (3%)	2 (66.7%)	1 (33.3%)	NA	NA	0 (0%)	2 (50%)
16 (3)	Description of the setting of the specific case	37 (92.5%)	0 (0%)	3 (7.5%)	28 (87.5%)	0 (0%)	3 (100%)	0 (0%)	NA	NA	0 (0%)	2 (50%)
17 (4)	Explanation of what had changed in patient care	37 (92.5%)	0 (0%)	3 (7.5%)	21 (66%)	3 (9%)	NA	NA	NA	NA	NA	NA
18 (4)	Any modification in clinical organisation	40 (100%)	0 (0%)	0 (0%)	30 (94%)	0 (0%)	NA	NA	NA	NA	NA	NA
19 (4)	Any modification in clinical educator's practice	40 (100%)	0 (0%)	0 (0%)	32 (100%)	0 (0%)	NA	NA	NA	NA	NA	NA
20 ^b	Clinical reasoning process	23 (57.5%)	4 (10%)	13 (32.5%)	19 (59%)	4 (13%)	NA	NA	NA	NA	NA	NA

^an = number of set of documents; NA = not applicable.

^bEach item is described for its presence and correctness (absolute and percentage values). ^bItem not related to EBP steps.

and were therefore sometimes perceived by the students as a barrier to EBP.

First year students enjoyed the practical features and working group methodology of the teaching class. Some students had the feeling that EPB classes had been scheduled too early in the course of study, although the literature suggests starting with EBP as soon as possible (Boruff and Thomas, 2011; Schreiber and Stern, 2005). Some other students felt that the lessons were more effective when the number of students was limited: this element should be considered when planning the learning activities related to EBP. The Journal Club, with the exception of a few critical issues, was appreciated especially for the collaboration within the group of participants, a concept proposed by Thomas, Saroyan, and Dauphinee (2010) and a finding confirming the results of previous studies (Lizarondo, Grimmer-Somers, and Kumar, 2011b). Some students reported the feeling of being obliged to perform the internship EBP assignments as an educational task rather than a part of “best” clinical practice patterns. Various proposals, mainly focused on the scheduling of activity and sometimes conflicting, were offered by the students for improving the educational pathways.

In the students’ opinions, the “Impact of EBP on professional practice” is limited because of: professionals’ resistance to change of habits (Grol, 1997); the characteristics of the organisational context (Aarons, Sommerfeld, and Walrath-Greene, 2009; Bartelt et al, 2011); and the shortage of structural resources available in the workplace (Oude Rengerink et al, 2011). Students associated resistance to change of habits to practitioners’ length of service, an issue already reported among the determinants that restrict the adoption of EBP (Bridges, Bierema, and Valentine, 2007; Lizarondo, Grimmer-Somers, and Kumar, 2011a). Likewise, the difficulty in making changes in the organisation has been reported among the barriers to adoption of EBP (Schreiber and Stern, 2005).

The relational network summarises the key concepts and their relationships as they emerge from the focus groups. The geometrical shapes suggest three metaphors: (1) “the net of obstacles”; (2) “the butterfly of theory and practice”; and (3) “the butterfly of fellow travellers” (Figure 2). The obstacles form a system of meshes that is too tight to allow, at present, the full acquisition of: EBP skills; their application in practice; and a satisfying level of the students’ self-confidence. Education effectiveness could be improved by identifying, modifying or eliminating those factors uncovered in this study which prevent translation of EBP skills and knowledge into practice. Otherwise, the two wings of the butterfly of theory and practice will continue to be opposing poles; EBP is perceived as potentially important and useful but apparently not as an essential part of daily practice (that is, “something else”). Moreover, the model acquisition process developed during internship might be, to a large extent, the result of tacit and implicit learning (Reber, 1996); in this sense, an important role is played by the “fellow travellers”, through their example and support. In fact, the driving force for students’ learning and transfer to practice seems to be not so much the teaching strategies but rather the modelling by the professionals that students meet in the clinical context and the ability of these practitioners to motivate and assist students in addressing the methodological difficulties of EBP on the job, similar to what Olsen, Bradley, Lomborg, and Nortvedt (2013) reported.

Knowledge and skills

First section of the A-Fresno test

The first and second year students’ performance in the first section of the A-Fresno test showed a significant and progressive improvement with 76% of the second year students achieving the

pass score. The third year students, who had EBP activities only during their curricular internship in the clinical placements (evidence-based journal club (EJBC) and compilation of “EBP format” and “Patient file”), reported no statistically significant changes in their performance (even if, considering the border line p value and the small sample size, a type II error could have occurred) and 88% of them achieved the pass score. These results suggest that the EBP activities offered during the internship of the third year did not offer a valuable contribution. During the focus group students appreciated the EJBC but reported that the number (one in 14 weeks) was insufficient. Some students said that they felt obliged to compile the “EBP format” and “Patient file” and others referred that even if they were motivated to fill in the documents they could not improve because they received a delayed feedback (or did not receive any feedback at all). The clinical educators were not able to help them and the EBP expert examined the documents only at the end of all the internships.

Overall, an excellent consistency was found between the scores and the educational objectives of the course both for first and second year students. In fact, the first year students achieved the pass score in good percentages only on questions exploring knowledge and skills related to EBP steps one and two (Q1 to Q4). During the focus groups the first year students appreciated the interactivity of the educational activities and although some stated that those activities were proposed too early, the results on the Fresno test confirmed the feasibility of learning these EBP steps. The second year showed a further important average increase of 35.1 points (95% CI 23.2 to 47.1) (Q1, Q4–Q7) but the pass score achievement was limited in Q5 and Q7 to 29% for each (relevance of study and elements of statistical and clinical significance). At a single question level, the performance of the third year students improved in Q1 (defining a clinical question), perhaps because of the students’ increased clinical experience, and Q3 (best study design). As for the second year, the percentage of achievement of the pass score in Q5 and Q7 was limited (38% and 31% respectively). For the first section findings the poor improvement in both second and third year in Q5 and Q7 might suggest that additional or alternative intervention measures may be needed to improve the statistical interpretation (Q7) and clinical relevance (Q5) of the findings.

Second section of the A-Fresno test

This section (not validated in Italian) mainly explores advanced abilities related to EBP steps three and four. Students’ improvements were small and only 24% of second year students and 19% of third year students achieved the pass score. We noticed a good performance of the second year students only in Q12 and Q13; both of these questions may be easy because they explore only students’ knowledge on best study design for diagnosis and prognosis. All the students showed difficulties in understanding, calculating and interpreting statistics, as evidenced by the scores on Q9, Q10 and Q11 (the best performance was an achievement of the pass score on Q9 by the 24% of the second year students). The difficulties reported by students during the focus groups are consistent with the objective assessment offered by the A-Fresno test. The educational activities seem to be ineffective or insufficient to facilitate the students’ understanding and calculation of diagnostic accuracy and efficacy indexes and their implication in deciding clinical significance. Education should perhaps focus more on an understanding of the significance and implications of these indexes in practice rather than on their calculation.

The comparisons made to verify the permanence of learning (first year T_1 versus second year T_0 , second year T_1 versus third year T_0), albeit with the limitation due to the comparison between

different groups of students, seem to indicate the maintenance of the level reached by the students in the previous academic year (i.e. stable learning). Considering that in the focus groups some students complained that “I forgot what I had learned the year before so I had to do it again...”, the hypothesis of stability of learning should be tested in a longitudinal study lasting at least three years.

In our opinion the improvements seen in students’ performance on the A-Fresno test can be reasonably traced to the educational activities carried out. In fact, the time between T₀ and T₁ (170–205 days) may be sufficient to limit the learning effect of the test, considering that the students had no further contact with the A-Fresno test, and the clinical scenarios at T₀ and T₁ were different.

Generally speaking, we should be questioning the feasibility of a three-year degree course to provide the skills required to perform all five EBP steps autonomously. The minimum expected level could be “evidence-user” (Straus et al, 2004; Tilson et al, 2011) and greater emphasis might be placed on interpretation of the results of pre-appraised literature in order to make a clinical decision. “Pre-appraised” resources, as defined by Dicenso, Bayley, and Haynes (2009) in the “6S model”, could facilitate ready access to high quality research, overcoming most of the well known barriers in EBP implementation. The user always must retain responsibility for use of evidence in a given clinical decision, so that the competencies related to the fourth step of EBP remain fundamental to acquire at undergraduate level. Whenever the entry-level education would be at master level or of higher duration, the acquisition of a complete autonomy in the five EBP steps would become feasible.

Behaviours

EBP step one (question formulation)

During the internship in clinical placements the students carried out this step, but only half of them provided a rationale for choosing their PICO. This finding suggests that some students used the internship tools in a pedantic or mandatory manner, as also stated by some of them in the focus groups. Some shortcomings were noted in the correctness of use and it seems that despite the excellent results in the A-Fresno test the clinical setting created some difficulties for the students.

EBP step two (literature search)

Most of the students reported the sources of information, the strings of keywords used and the references retrieved, but about 30% of them did not explain the reason for their choice. A variable and sometimes considerable percentage of the students reported problems in doing this step correctly, once more in partial contrast with the results of the A-Fresno test, where students had very positive outcomes. Dissociation between theoretical and practical capability appears to occur when the students have to make a real clinical choice. They tend to adopt standard solutions learned in the formal courses, without adapting them to the specific context. In the qualitative part of this study the students expressed their difficulties in transferring their abilities to practice.

EBP step three (critical appraisal of internal validity)

Sixty percent (second year) and 40% (third year) of the sets of documents (Table 3) contained a report on the internal validity of the selected studies, and in over 90% appropriate validated instruments were used. Higher percentages of students (67% for the second year and 75% for the third year) showed sufficiently critical appraisal skills in the A-Fresno test. The students rarely compared the physiotherapists’ expertise and the setting of the study examined for use as a comparison with their own situation,

expertise and current clinical setting. The focus groups emphasised difficulties that were both methodological and related to the time necessary to accomplish these tasks. Difficulty in retrieving full-text articles (Iles and Davidson, 2006) and in comprehension of the English language may also have limited some students, together with the difficulties in understanding and interpreting statistics, as reported by the students and as evidenced by the scores in Q7, Q9, Q10 and Q11 of the A-Fresno test. The perception of having to comply with an obligation may have led some students to ignore the more difficult and time-consuming parts of the process. Moreover the students, not having received formative feedback from the clinical educators or from the EBP expert, were not encouraged toward reflection or might have not received those facilitations that would have made their process of critical appraisal of the clinical context less burdensome.

EBP step four (application of evidence to practice)

The focus groups showed that this step was considered as one of the most difficult and the results concerning the students’ behaviours are consistent with this. Thus, there is still great difficulty for the students to consider relevant information (patient characteristics, practitioner’s expertise and clinical setting) and to link and match it to their practice, since the clinical educators are not sufficiently prepared to give them adequate guidance and feedback (Olsen, Bradley, Lomborg, and Nortvedt, 2013). So, we can understand why the clinical educator is perceived as a barrier, but also as a potential resource to facilitating students’ learning and metacognition in a complex environment. The metaphor of “the butterfly of the fellow travellers” is quite appropriate. Transition to practice may be difficult not only because of the limited knowledge and clinical experience of the students, but also as a result of the intrinsic complexity of physiotherapy and the fact that students occupy the “lowest position in the social hierarchy in the clinical placements” (Cronje and Moch, 2010). Students do not decide on the interventions chosen for the patient and may, therefore, be less motivated to spend their time on clinical reasoning that they are unable to translate into practice.

Limitations of the study

Our study has several limitations. The qualitative part investigated the perceptions of third-year students (considered the best witnesses because they have experienced the full path of EBP education) in a potentially complete way, but only partially explored the perceptions of first and second year students. It is not possible to determine whether the sampling procedure resulted in the loss of potentially important information in regards to the first two years of the degree. The focus groups, being offered to students only once, at the conclusion of the academic year, merely provide a “snapshot” of students’ perceptions and do not tell us about their evolution over time.

Standardised assessment of EBP knowledge and skills through the A-Fresno test can be considered as a before-after, observational and pragmatic evaluation. There was no control group and it would be difficult to include one as the EBP education is part of the curriculum in our physiotherapy degree. Without a control group it is not possible to identify a direct cause-effect relationship between education and results, even if the score changes in the A-Fresno test are highly consistent with the objectives of teaching/learning activities. The evaluator, although blinded as to year, was not blinded as to administration (T₀ and T₁), thus introducing a potential bias.

Only the first section of the A-Fresno test used has been validated in Italian and therefore the results of the second section should be considered with caution. However, inclusion of the second section was considered useful for the exploration of

advanced skills in EBP, not taken into account in the first part, and for examining the feasibility of a future Italian validation.

Conclusions

Our study suggests that multi-modal EBP education in a physiotherapy bachelor degree is perceived as important by the students, but is unlikely to change practice, due to the presence of many barriers, similar to those previously reported in the literature. Education seems to improve knowledge and skills significantly, but some (especially the interpretation of data and statistics and the analysis of the external validity of a study) are more difficult to achieve. The integration of EBP into student practice during internship seems to be hampered by the absence of a direct example by the clinical educators and the lack or delay of feedback. The improvement process should reconsider the minimum expected level for the bachelor degree at the different levels of the modified Kirkpatrick scale, perhaps focusing more on the ability to use pre-appraised evidence for improving clinical behaviours. Alternatively teaching and training opportunities may need to focus on improving areas where there is currently poor progression of skills, knowledge and behaviours. Educational strategies, always multimodal and multifaceted, should offer the student the opportunity to improve EBP skills on a regular basis. The Journal Clubs could be more frequent and ‘mixed’, with the participation of students and professionals.

In order to facilitate a change in professional behaviour, it might be useful to strengthen the ongoing reflection and feedback, in addition to the specific requirement that students should provide evidence to justify their evaluation and treatment choices. The barriers susceptible to change should be identified and possibly removed, and students should be assigned to professionals willing or able to use EBP. The key element would seem to be the environment that students encounter in their internship as well as the possibility of continuous practice. A longitudinal study and the use of validated tools for the evaluation of all the outcomes may provide clearer indications.

Declaration of interest

The authors report no declarations of interest.

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Appendix

Table A1. Super-codes and code families resulting from the analysis of the focus group transcriptions.

Super-codes and code Families	
Super-Codes	<p>Super-Code: Difficulty related to knowledge Quotations: 14 TERM: (“difficulty related to knowledge” {13-0} “many things to know” {5-0})</p> <p>Super-Code: Future Quotations: 36 TERM: (“learning for the future” {7-1} “projection into the future” {29-1})</p> <p>Super-Code: Journal Club Quotations: 23 TERM: (“JC issues” {7-0} “usefulness of JC” {16-1})</p> <p>Super-Code: Lessons Quotations: 20 TERM: (“number of students” {3-0} (“practical lessons using PCs” {8-0} “teaching scheduled too early” {9-1})</p> <p>Super-Code: Motivation Quotations: 39 TERM: (“motivation for doing research” {18-1} “willingness/interest/curiosity” {22-2})</p>
Code Families	<p>Code Family: Difficulties perceived by the students Codes (10): difficulty in linking theory and practice {16-1}; difficulty in finding the right article {29-4}; difficulty related to knowledge {*-3}; experienced or perceived difficulties {64-4}; fatigue/tiredness {12-1}; insecurity {12-0}; uselessness of EBP {24-4}; obstacles to EBP process {27-3}; not core {6-1}; time {55-2}. Quotation(s): 246</p> <p>Code Family: Methodology of EBP process Codes (10): study characteristics limiting application {14-0}; importance of EBP {19-2}; access to full-texts {15-3}; English language {18-2}; Motivation {*-1}; payment/money {9-2}; foreign reality {8-0}; articles' evaluation instruments {5-0}; time for searching and appraisal {10-2}; usefulness of EBP {32-3}. Quotation(s): 170</p> <p>Code Family: Transition from theory to practice in the internship Codes (8): complexity of physiotherapy practice {10-2}; knowledge/skills that limit EBP application {6-1}; knowing the EBP process methodology {14-1}; putting the EBP process in practice {13-2}; no effects on the internship {10-5}; no effects on the clinical practice {22-6}; relationship with other professionals {9-0}; practising is necessary {16-1}. Quotation(s): 97</p> <p>Code Family: Methodology of education in EBP Codes (13): no correction maintains error {12-2}; collaboration/comparison with others {16-1}; correction leads to improvement {8-3}; to be obliged to do {19-1}; Journal Club {*-1}; failure is demoralising {9-1}; specialist/expert figure {20-2}; Lessons {*-0}; suggestions {28-1}; suggestions to students {14-1}; time for learning {5-0}; clinical educator as a barrier {36-5}; clinical educator as a resource {16-2}. Quotation(s): 214</p> <p>Code Family: Impact of EBP on professional practice Codes (5): personal upgrading {11-3}; changing is difficult {5-3}; Future {*-1}; reference model {5-3}; organisation of work and facilities {10-1}. Quotation(s): 67</p>

Quotation = number of citation in text; TERM = primary code; | = AND boolean operator; {x-y} x = number of citations and y = density of relationships; * = For super-codes number of citation is not reported.