Cross-referencing the Scottish Doctor and Tomorrow's Doctors learning outcome frameworks

Rachel Ellaway, Phillip Evans, Jim Mckillop, Helen Cameron, Jill Morrison, Hamish Mckenzie, Gary Mires, Martin Pippard, John Simpson, Allan Cumming, Ronald Harden, Simon Guild

* University of Edinburgh, Scotland, UK  
† University of Glasgow, Scotland, UK  
‡ University of Aberdeen, Scotland, UK  
§ University of Dundee, Scotland, UK  
¶ University of St Andrews, Scotland, UK

First Published on: 22 November 2007

To cite this Article Ellaway, Rachel, Evans, Phillip, Mckillop, Jim, Cameron, Helen, Morrison, Jill, Mckenzie, Hamish, Mires, Gary, Pippard, Martin, Simpson, John, Cumming, Allan, Harden, Ronald and Guild, Simon(2007)'Cross-referencing the Scottish Doctor and Tomorrow's Doctors learning outcome frameworks'.Medical Teacher,29:7,630 — 635

To link to this Article: DOI: 10.1080/01421590701316548

URL: http://dx.doi.org/10.1080/01421590701316548

PLEASE SCROLL DOWN FOR ARTICLE

Full terms and conditions of use: http://www.informaworld.com/terms-and-conditions-of-access.pdf

This article may be used for research, teaching and private study purposes. Any substantial or systematic reproduction, re-distribution, re-selling, loan or sub-licensing, systematic supply or distribution in any form to anyone is expressly forbidden.

The publisher does not give any warranty express or implied or make any representation that the contents will be complete or accurate or up to date. The accuracy of any instructions, formulae and drug doses should be independently verified with primary sources. The publisher shall not be liable for any loss, actions, claims, proceedings, demand or costs or damages whatsoever or howsoever caused arising directly or indirectly in connection with or arising out of the use of this material.
Cross-referencing the Scottish Doctor and Tomorrow’s Doctors learning outcome frameworks

RACHEL ELLAWAY3, PHILLIP EVANS3, JIM MCKILLOP4, HELEN CAMERON3, JILL MORRISON4, HAMISH MCKENZIE1, GARY Mires2, MARTIN PIPPARD2, JOHN SIMPSON1, ALLAN CUMMING3, RONALD HARDEN2 & SIMON GUILD5

1University of Aberdeen, 2University of Dundee, 3University of Edinburgh, 4University of Glasgow, 5University of St Andrews, Scotland, UK

Abstract

Learning outcomes, organised into systems or frameworks which describe and define the output of an educational programme, are being created and used in healthcare education with increasing frequency (Harden 2001, 2002). Medical schools may be required to conform to more than one such outcome framework. For example, both the UK General Medical Council (GMC) and the Scottish Deans’ Medical Curriculum Group (SDMCG) have created and published a systematic learning outcome framework for medical graduates. Although both of these publications are concerned with undergraduate medical education, they differ in their aims, and structure. In order to use, evaluate and validate them, a cross-referencing system which relates each learning outcome statement, term or groups of terms is required.

This paper describes the cross-referencing exercise undertaken by the SDMCG, the philosophy behind it, the practical steps taken, the findings, the lessons learnt and reflections upon how this work may be taken forward. It will be of interest to all those who are involved in curriculum development using outcomes, and especially those who use the GMC’s Tomorrow’s Doctors or the SDMCG’s Scottish Doctor frameworks and those who are interested in education informatics in general.

Introduction

Learning outcomes, expressed as systems or frameworks which describe and define the output of an educational programme, are increasingly common in healthcare education (Harden 2001). They have been developed at local, national, supra-national and global level, and some have become very influential in shaping the process of medical education and directing curriculum development (Wojtczak and Schwarz 2000).

Learning outcomes may be confused with competences. Perhaps the most useful semantic distinction is to consider learning outcomes as pertaining to an education programme and as such are defined by the educators, whereas competencies belong to and can be demonstrated by the graduate. It follows that in the case of successful students at the point of exit, they can be described in terms which are identical and interchangeable (The European Union Tuning Project 2006).

The Scottish Doctor (SD) learning outcomes framework was published in 2001 by the Scottish Deans’ Medical Curriculum Group (SDMCG) as a consensus statement from the five Scottish Medical Schools (Aberdeen, Dundee, Edinburgh, Glasgow and St Andrews) regarding their exit learning outcomes for undergraduate medical education (Simpson et al. 2002). The document was developed in the light of the GMC’s guidance document to UK medical schools, Tomorrow’s Doctors (TD) (General Medical Council 1993), which had influenced curriculum development in all five schools during the previous nine years, and had been used by the GMC as a tool in the quality

Practice points

- Learning outcomes frameworks (and any subsequent cross-referencing) between them are inherently subjective.
- The use of information science principles, in particular employing abstract and modular information architectures, is an essential step in handling and managing semantically rich systems such as learning outcome frameworks.
- Cross-referencing learning outcomes frameworks can be an invaluable mechanism for analysing them, thereby identifying omissions, differences in emphasis or contradictions.
- Cross-referencing learning outcomes frameworks should be undertaken with care, with a critical awareness of the tolerance of the results, and by a sufficiently expert and representative group to invest it with the authority and validity it requires.

Correspondence: Rachel Ellaway, Northern Ontario School of Medicine, 935 Ramsey Lake Road, Sudbury, Ontario P3E 2C6. Email: rellaway@gmail.com
assurance of UK medical schools. Following publication of a revised, extended edition of TD (General Medical Council 2002), it became clear that a lack of congruence between the SD and TD documents might present significant challenges for any school wishing to use the SD outcomes framework to define their output, and at the same time demonstrate that their programme met the GMC requirements. The SDCMG recognised that a mechanism was required to enable the TD recommendations to be correlated with the SD statements. To this end the authors set out to develop such a mechanism, and to determine whether or not it would be useful for curriculum developers. This paper describes the methods, results and conclusions drawn from this exercise.

Scottish Doctors and Tomorrow’s Doctors

The GMC’s Tomorrow’s Doctors document sets out recommendations and directions on curriculum structure and content as well as guidance related to student admissions, teaching, learning, assessment, student health and conduct for all UK undergraduate medical schools. It also refers to the statutory framework and the responsibilities of the schools with respect to the delivery of medical education. The GMC, in its role as assessor and guarantor of the quality of undergraduate medical education in the UK, provides TD as a framework by which all UK medical schools’ degree programmes are evaluated.

The Scottish Doctor framework, on the other hand, describes the learning outcomes that define the output of an undergraduate medical curriculum. These are based on three core elements (Level 1) of a competent and reflective practitioner: ‘What the doctor is able to do’ (the technical intelligences); ‘How the doctor approaches their practice’ (the intellectual, emotional, analytical and creative intelligences); and ‘The doctor as a professional’ (the personal and professional intelligences). These top-level elements encompass 12 Level 2 sub-domains (see Table 1). Each of the 12 domains in Level 2 is again subdivided into a number of Level 3 outcomes, at an increasing level of detail, based on a consensus among the five Scottish medical schools. For example, Personal Development includes six sub-divisions at Level 3: self-awareness, self-directed learning, self-care, career choice, motivation, and commitment.

Further specificity and detail is given in the Level 4 sub-domains. However, significant divergence between the aspirational spirit and the practical reality of the statements emerged at this level, and not all Level 4 domains were agreed by all five schools. This was due, in part, to the predictable diversity of curricula in the five schools, and also a desire to avoid setting out a prescriptive and limiting list of specific learning objectives. Level 4 statements are therefore recorded as illustrative examples of what the graduating outcomes of a medical curriculum could include (see Table 2).

Neither the TD recommendations nor the SD outcomes advocate or require a particular curriculum format or structure; indeed the variety of curricular styles has been celebrated as a richness and strength of the UK medical community. Both documents make reference to assessment, and the Scottish Doctor provides examples of the range of assessments which might be used for individual domains. Neither document advocates a particular pathway for student progression nor do they define standards of performance. However, both documents do seek to describe the range of relevant achievements and attributes of a medical graduate, and these can and have been used as a component of quality assurance of undergraduate medical education.

Methods: outcome coding

To cross-reference one outcomes framework with another, both systems required discrete coordinates for every point that was to be referenced: outcome A in framework X and outcome B in framework Y needed to be uniquely identifiable before

| Table 1. The core elements and top domains for the Scottish Doctor outcome. |
|---|---|
| **Level 1** | **Level 2** |
| 1. What the doctor is able to do | 1. Clinical skills |
| 2. Practical procedures | 2. Patient investigation |
| 3. Patient management | 3. Health promotion and disease prevention |
| 5. Communication | 5. Medical informatics |
| 6. Medical informatics | 7. Basic, social and clinical sciences and underlying principles |
| 8. Basic, social and clinical sciences and underlying principles | 9. Attitudes, ethical understanding and legal responsibilities |
| 9. Attitudes, ethical understanding and legal responsibilities | 10. Decision making skills and clinical reasoning and judgement |
| 10. Decision making skills and clinical reasoning and judgement | 11. The role of the doctor within the health service |
| 11. The role of the doctor within the health service | 12. Personal development |
| 12. Personal development | |
they could be linked. To that end, information models were created for the two frameworks by breaking each one down into its fundamental component statements and giving each statement a unique identifier. The resulting information models also included the text of the statement, a note of the framework from which the statement came, the date of its last update, and its level within the hierarchy of its parent framework.

For the SD framework an information structure was implemented as a hierarchical model following the existing four-level structure. Each outcome identifier was made up of five pairs of numbers, each indicating its ordinal location within the hierarchy, as follows:

- 0100000000: Level 1
- 0101000000: Level 2
- 0101010000: Level 3
- 0101010100: Level 4
- 0101010101: Level 5

These identifiers are primarily designed for use in computer-based information systems. Level 5 was added to the four-level model to accommodate lists and bulleted points within the Level 4 outcomes.

Encoding the Tomorrow's Doctors framework involved changing a series of prose statements with little internal information structure (other than statements being grouped into ten top level sections) into a hierarchical structure. A similar model to that used for SD was developed with each outcome identifier prefixed with ‘TD’. This model also had 5 hierarchical levels:

- TD0100000000: Level 1
- TD0101000000: Level 2
- TD0101010000: Level 3
- TD0101010100: Level 4
- TD0101010101: Level 5

Because TD is in a prose format and uses document-style item numbering with sub-sections that have numbers, letters or roman numerals as prefixes. These were represented separately from the outcome statements in each term’s associated metadata (data that further describe the term’s properties) in order that statements could be viewed independently of each other and be aggregated to recreate the format of the original TD document.

**Methods: tools**

Once the SD and TD outcome models were coded they were then entered into a relational database (Microsoft SQL Server) with separate table-rows for the SD and TD models. A typical SD outcome dataset row is shown in Table 3.

The two outcome frameworks were accessed by group members through the SDMCG’s on-line collaborative working environment using referencing tools that were built to allow users to browse and display outcomes from both systems simultaneously. These tools allowed authorised users to search for, identify and then record equivalent pairs of outcomes from each system. By displaying one term in each framework at a time (with links to its parent and child terms together with all of the terms that had been cross-referenced from the other model – see Figure 1) users were able to locate the outcome terms they needed to link together and, when ready, record these mappings between the two frameworks.

Each mapping or cross-reference consists of the unique identifiers for each term, the identity of the individual making the mapping plus an optional comment or note (as shown in Table 4). The mappings are stored in a separate table in the database.

**The cross-referencing process**

The cross-referencing exercise was undertaken in two phases between July 2004 and July 2005 by individual members of the Scottish Dean’s Medical Curriculum Group. The first phase involved individual Group members working independently to

---

**Table 2. An example of the levels of specificity of the Scottish Doctor outcome categories.**

<table>
<thead>
<tr>
<th>Level 1: What the Doctor is able to do</th>
<th>New medical graduates cannot be expected to have had unsupervised experience of all aspects of patient management as many are restricted by law, e.g. drug prescribing. However, it is reasonable to expect that they will have a demonstrable knowledge of the important aspects of management in the areas outlined below and that they will have had supervised involvement in such activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 2: Outcomes for Patient Management:</td>
<td>Consideration for: patients age; nature of chronic disease; effect on patient e.g. loss of mobility, psychological impact</td>
</tr>
<tr>
<td>Level 3: Chronic care</td>
<td>Appropriate use of drugs</td>
</tr>
<tr>
<td>Level 4: This could include</td>
<td>Note that other Level 3 outcomes in this section include general principles of patient management, nutrition and pain control.</td>
</tr>
</tbody>
</table>

**Table 3. A typical Scottish Doctor learning outcome dataset.**

<table>
<thead>
<tr>
<th>Term ID</th>
<th>Term text</th>
<th>Term level</th>
<th>Term source</th>
<th>Term date</th>
</tr>
</thead>
<tbody>
<tr>
<td>0901010400</td>
<td>Practice of medicine in a multicultural society</td>
<td>3</td>
<td>SD</td>
<td>21-05-2003</td>
</tr>
</tbody>
</table>
create their own set of cross-references. When the results from this first pass were analysed it became apparent that the individuals’ assessments of equivalence were as likely to be contradictory as they were to be in agreement. A common discontinuity was the level of detail selected as the mapping point in either system; while some individuals made links between very general terms or between very detailed terms, others linked broader terms in one framework with more detailed terms in the other. In order for these inconsistencies to be addressed and for a consensus cross-referencing to be generated, a second phase was needed.

This second phase was completed collaboratively in two passes to achieve a consensus among the membership of the Group. In the first pass of this second phase the SD elements were cross-referenced to each of the outcomes in TD Sections 3 and 4 (the sections in which learning outcomes are described). The second pass of the second phase involved identifying those remaining un-referenced Level 3 SD outcomes and mapping them back to the appropriate parts of TD. Notes and comments made by the referencing group were stored with each cross-referenced pair where appropriate. It was during this process that the Group defined SD Level 3 as their default mapping level as it was felt to have the optimal compromise between detail.

The cross-referenced data was displayed using either the TD or SD models as the authority framework shown on the left-hand side of the interface (see Figure 1) with the cross-referenced terms from the other framework, along with comments and other relevant information, shown on the right-hand side of the interface.

Cross-referencing outputs

The mapping exercise was successful in cross-referencing every level 3 SD outcome with its equivalent statement in TD. The cross-referencing process also identified a number of issues and clarifications that needed to be addressed within SD. These were resolved as a series of action points, which are currently being incorporated into the next edition of the Scottish Doctor. Similarly, a number of perceived omissions in the Tomorrow’s Doctors outcome model were identified from the cross-referencing process. These were resolved as a series of action points, mostly concerned with lack of detail or the absence from TD of what were regarded as key elements present in SD. They have also been passed to the GMC. Because the level of detail was quite high in both sets of action points they have not been reproduced here since it is the process and the issues arising from it that are the main focus for this paper.

Issues emerging from the process

A number of issues were identified as affecting the quality of the cross-referencing output and the processes involved in creating it, the degree to which the output represented the views of the participants, and the extent to which the mappings were meaningful. First, structural differences between the systems created a number of problems. For example, SD has an explicit system of levels and hierarchical relationships between them, whereas TD is a set of prose statements with little hierarchical structure. Furthermore, while...
the SD document consists entirely of graduating learning outcomes, only a part of TD is so structured. The rest consists of recommendations on medical school governance, recruitment and other operational issues. Creating a coding system for TD provided the relevant sections with a hierarchical structure, thereby allowing it to be cross-referenced with SD.

Another significant issue was that neither system attempted to establish internal equivalence or consistency in terms of the importance or the dimensions of outcomes at the same level across the framework. A Level 3 outcome in one part of the framework may be significantly more or less important, or demand much more curriculum time to support it, than a Level 3 outcome in another part of the framework. As such, there are no isobars of significance, weighting or any other measure that can be drawn around either system or their subsequent cross-referencing.

A third area of concern was concerned with the stylistic differences between the SD and TD frameworks. TD has a more complex linguistic structure than SD, for example, it contains many more verbs. The TD outcomes are in prose format, while SD outcomes are formatted as an itemised list. SD often employs a greater degree of generalisation than TD, even around the same essential themes. For instance, the Level 3 SD outcome ‘general principles of patient investigation’ was mapped to TD’s ‘interpret the results of commonly used investigations’, ‘make clinical decisions based on the evidence they have gathered’ and ‘assess a patient’s problems and form plans to investigate and manage these, involving patients in the planning process’. These issues make it difficult to assess equivalence of meaning and intent. Evaluating equivalence involves more than matching terms in each framework; it requires a degree of interpretation and inference to establish links between outcomes described in different ways.

Fourthly, the relative positions of the outcome statements in their respective frameworks also generated difficulty, in particular where similar underlying concepts were surfaced in quite different contexts and formats. An example of this is the outcome relating to the graduate as a teacher. In TD this appears in Section 1: ‘the principles of professional practice’, Section 8: ‘teaching and training’ and Section 24: ‘teaching skills’. In SD this outcome also appears in three locations, but at different levels and also at different points in the hierarchy: Level 2 ‘5: outcomes for communication’; Level 3 ‘6: communicating as a teacher’, Level 2 ‘8: outcomes for basic, social and clinical sciences’; Level 3 ‘education’; Level 4 ‘1: knowing about and applying the basic theories of learning and teaching’, plus Level 4 ‘2: basic organisation of medical teaching and training in the UK’, and Level 2 ‘11: outcomes for the role of the doctor within the health service’; Level 3 ‘5: the doctor as teacher and mentor’. Such multiple instances of outcome statements, expressed at different hierarchical levels, mean that broad statements are cross-referenced to more detailed statements and vice versa.

A final issue concerns the inherent subjectivity of any such cross-referencing process. The SDMCG based their cross-referencing of these two frameworks around a two-phase approach. The first phase allowed participants to familiarise themselves with the process and generate some measure of the degree of agreement between them. At this stage, although there was a high degree of general agreement, there were also clear differences in relation to matters of detail and equivalence. The second phase generated the cross-referencing output, and involved a collaboration of twelve or so individuals meeting face-to-face and discussing each mapping over a number of sessions. Each mapping is therefore the refined opinion of those taking part at a certain point in time. It is possible, even likely, that different individuals would produce a different set of mappings. Indeed even those who made the mappings may change their perspectives over time. As with any such activity, there is therefore a tolerance factor or qualifier that should be associated with the mapping that reflects the authority and objectivity of the process which generated it. In this instance, 12 senior curriculum managers and medical educators from five different medical schools used a colloquium format to create this consensus mapping, and the output of this and other similar processes should be viewed and evaluated in this light.

**Conclusions**

Curriculum managers in medicine are increasingly faced by a range of guidance documents and quality standards from a variety of sources, which can become confusing or even overwhelming. The learning outcomes approach is useful in helping to ensure that graduates from a medical degree programme have been prepared for all the appropriate aspects of medical practice, and that significant domains of teaching, learning and assessment have not been omitted. Having generated a consensus statement of learning outcomes for Scottish medical graduates, The Scottish Doctor, the Scottish medical schools received a set of recommendations, including learning outcomes, stipulated by the General Medical Council and linked to the formal GMC process of Quality Assurance of Basic Medical Education (QABME). There was then clearly a need to reconcile the two frameworks, and this gave rise to the project described here. We found that the process, in addition to achieving that initial purpose, was extremely useful as an analytical approach to both documents and has illuminated and informed our ongoing work on learning outcomes.

Despite its utility, the exercise described here illustrates the inherent subjectivity of outcomes frameworks and the ways in which they can be cross-referenced. Although they may have an implicit logical arrangement, they often lack the explicit objective characteristics that underpin Linnaean classifications and taxonomies. Despite this, cross-referencing can be an invaluable mechanism for analysing these complex information models and for identifying apparent omissions, differences in emphasis or mutual contradictions.

A number of generalisable issues have been identified in undertaking this activity:

- Typically, learning outcomes statements do not indicate relative levels of importance for medical graduates in practice, or their implications for teaching or assessment. As such they should be viewed as general thematic descriptors, rather than prescriptive templates for curriculum design.
Cross-referencing the Scottish Doctor and Tomorrow’s Doctors learning outcome frameworks

The use of information science principles, in particular employing abstract and modular information architectures, is an essential step in handling and managing semantically rich systems such as outcome frameworks. These practices are part of the emerging domain of education informatics (Ellaway 2006) where abstraction, architecture and connectivity are among the core principles.

Care with the authoring process and a critical awareness of the tolerance of the results are of key importance. The process should be undertaken by a sufficiently expert and representative group to provide it with the authority and validity it requires. At the same time the inevitable limitations of the process should be clearly documented to enable subsequent users to assess its provenance and accuracy.

This can also be used cross-referencing mechanism for local, national and international activities. Both the software tools and the process as described may be used to cross-reference one set of outcomes with any other outcome framework. Examples include cross-referencing the outcomes from a particular medical school with Tomorrow’s Doctors, or one school’s outcomes framework with that from another school. It is possible to cross-reference the outcomes statements of institutions that are collaborating in shared curriculum initiatives (such as inter-professional learning), or to compare outcomes for medical graduates with those for post-graduate medical education (such as the Foundation Programme for medical graduates in the UK). The use of cross-referencing is also being explored in an international context as part of the European Tuning Project for medicine, which aims to define learning outcomes for medical degree courses in Europe (Cumming et al. 2006).

The exercise in cross-referencing the Scottish Doctor with Tomorrow’s Doctors provided evidence that the core learning outcomes agreed by the five Scottish medical schools conform closely to the GMC’s recommendations. Furthermore, the process led to the identification of a number of issues that are being addressed in the next iteration of the SD framework, and a number of issues related to TD, which have been passed to the GMC. It has generated outputs that can be of considerable value in the ongoing developments of these as ‘living documents’. The facility which was developed to allow electronic tagging and linking of outcome statements has proven to be a valuable tool, and could be used to compare and evaluate other frameworks and structures, such as curriculum maps or assessment models (Harden 2001). However this work proceeds, it needs to be carried out in a methodical, transparent and technically robust fashion.

Notes on contributors

RACHEL ELLAWAY is the e-Learning Manager for the College of Medicine and Veterinary Medicine at the University of Edinburgh and provides informatics support to the SDMCG.

PHILLIP EVANS is the Curriculum Development Officer for the Medical Teaching Organisation at the University of Edinburgh and is Project Co-ordinator for the SDMCG.

JM MCKILLOP is Muirhead Professor of Medicine, Associate Dean for Medical Education at the University of Glasgow and is the current Convener of the SDMCG.

HELEN CAMERON is the Director of the Medical Teaching Organisation at the University of Edinburgh.

JILL MORRISON is Professor of General Practice and the Deputy Head of Undergraduate Medical School at the University of Glasgow.

HAMISH MCKENZIE is Associate Dean for Undergraduate Medicine at the University of Aberdeen.

GARY MIRES is Professor of Perinatal Health and Education and Undergraduate Teaching Dean in the School of Medicine at the University of Dundee.

MARTIN PIPPARD is Professor of Haematology and Head of Medical Education at the University of Dundee.

JOHN SIMPSON is Former Associate Dean (Medical Education) at the University of Aberdeen and was the Convener of the SDMCG at the time the cross-referencing exercise was undertaken.

ALLAN CUMMING is Professor of Medical Education and the Director of Undergraduate Teaching and Learning for the College of Medicine and Veterinary Medicine at the University of Edinburgh.

RONALD HARDEN is Director of Education with the International Virtual Medical School (IVIMEDS).

SIMON GUILD is Head of Undergraduate Learning and Teaching, Bute Medical School, University of St Andrews.

References


Postscript

The two outcomes frameworks and the cross-referencing are available online from the Scottish Doctors Website at http://www.scottishdoctor.org/node.asp?id = links