RESEARCH ARTICLE

COACTION PUBLISHING

Medical students' approaches to learning over a full degree programme

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Students take three approaches to learning and studying: deep, surface and strategic, influenced by the learning environment. Following the General Medical Council's report "Tomorrow's Doctors," a deep approach was cultivated in Years 1 and 2 of a university undergraduate medical programme by introducing explicit written learning objectives constructed according to Biggs' SOLO taxonomy, problem-based learning and constructively aligned in-course assignments and examinations. The effect of these changes was measured with the Approaches to Study Skills Inventory for Students (ASSIST). Scores were highest for a deep approach and lowest for a surface approach and showed relatively little change during the degree programme, apart from a slight fall in the scores for a surface approach, particularly for students undertaking an intercalated science degree. Possible explanations include: students' approaches may be established prior to university entry; deep scores were already high at the beginning of the programme and may be difficult to increase further; the changes in learning environment may not be strong enough to alter approaches which students perceive as having been successful.

Keywords: *Approaches to learning*; *medical education*; *medical students*; *study skills*

Received: 11 January 2012; Accepted: 4 July 2012; Published: 24 August 2012

Following three editions of the report 'Tomorrow's Doctors' (1), UK medical schools have put much effort into realigning their curricula by reducing factual content and encouraging understanding. Problem-based learning (PBL) and other methods now have an established place in many curricula, and schools are inspected regularly to ensure that they comply with recommendations. It might be hoped that this would improve the ways in which medical students approach their learning and studying, but it is not clear that this is the case.

Aim of the study

The aim of this study was to investigate the hypothesis that the redesigned curriculum was successfully promoting a deep approach to learning and studying and deterring a surface approach in undergraduates during Years 1 to 5 of a medical degree programme.

The curriculum

This medical school implemented significant reforms to its MBChB programme, largely in response to the recommendations in the report 'Tomorrow's Doctors' (2) that medical schools adopt learner-centred and problem-based approaches that promote self-directed learning. This envisaged a core and options model based on a series of integrated body-systems in Years 1 and 2 and clinical systems in Years 3, 4 and 5. The multifaceted approach adopted to teaching and learning retained the familiar lectures, formal tutorials, skills-teaching and practicals, but embraced learner-centred and problem-based approaches by developing e-learning and including regular problem-based learning sessions. The term 'blended-approach' was sometimes used to describe the curriculum, as the taught content and the prepared self-study packages were co-ordinated into a clinically relevant contextual framework of predetermined learning objectives defined in module study-guides.

At the end of Year 2 around 40% of each cohort chose to take an intercalated degree, one consequence of which was that Year 3 had a substantial proportion of students who, it might be assumed, had benefited from an additional and intensive learning experience.

 Citation: Med Educ Online 2012, **17**: 17205 - http://dx.doi.org/10.3402/meo.v17i0.17205

The ASSIST inventory

The intention to establish a 'foundation for competent and reflective practitioners' (3) was one that required evaluation to establish if the aspiration was being fulfilled. The Approaches and Study Skills Inventory for Students (ASSIST) was chosen as a credible instrument for the purpose (4).

The underlying philosophy comprises three approaches to learning and studying: deep, surface and strategic (5, 6). Students taking a *deep* approach try to understand material, relate new ideas to prior learning and look for evidence. With a *surface* approach, students memorise information by rote, often concentrating on individual points, without recognising the wider context, and they may be relatively poorly motivated. Students adopting a *strategic* approach organise their work, manage their time effectively and aim to do well in assessments (7). The score for deep approach aggregates the scores for four subscales: seeking meaning, relating ideas, use of evidence and interest in ideas. The score for strategic approach aggregates five subscales: organised studying, time management, alertness to assessment, achievement and monitoring effectiveness. The surface approach score aggregates four subscales: lack of purpose, unrelated memorising, syllabus-boundedness and fear of failure. One might optimistically hypothesise that the experience of being in higher education would tend to promote the deep and perhaps strategic approaches and diminish the surface approach.

One key factor that may affect students' approaches to learning is their *perception* of the learning environment (8–12). A change in this perception may lead them to alter their learning approach (13–15). Furthermore, several studies have linked students' approaches to learning and studying to their learning outcomes or grades, although the relationships found depended on the forms of assessment considered (7, 15–18).

We have previously reported an evaluation of learning in *early-years* medical students and found that they had high scores for deep and strategic approaches and relatively lower scores for a surface approach (19). The results showed little change in students' learning approaches during an academic year, even though efforts were made to encourage a deep approach through learning experiences that were linked to assessments (20).

It has been suggested that the approaches to learning might, however, change over the five years of a medical degree program, if suitable efforts were made to promote such changes (21). It is, moreover, a widely held view that student-centred activities such as problem-based learning (22) and curriculum alignment (10) promote deep learning in students (23). There still appears to be no published evidence of a change in ASSIST scores in medical undergraduates due to the influence of curriculum development.

Methods

Data collection

The Approaches and Study Skills Inventory for Students (ASSIST) (7, 24) was used. It comprises 52 questions, each scored 1 (low) to 5 (high). The scores for sets of four questions were combined to yield subscales, and the resultant 13 subscales were then grouped to give each respondent a score for deep, strategic and surface approaches.

Successive cohorts of students in the study population were those who entered Year 1 in 2003–2005. Each individual completed a paper version of the inventory early in Year 1 or 2. Students gave signed consent and supplied their matriculation number to allow comparison of paired scores. The students were asked to complete each inventory with regard to their approaches to studying in the preceding months. Later, the students, by then in Year 4 or 5, were asked to complete the inventory electronically. The results were imported into the Statistical Package for the Social Sciences (SPSS) and matched by matriculation number with the same students' scores when they were in Year 1 or 2. As approximately 90 students intercalated after Year 2, their position in the later MB ChB programme varied. For logistical reasons we did not collect data in 2006 and 2007, but were able to use an electronic method from 2008 onwards.

Statistical analysis

The responses were imported into SPSS 14 and checked for reliability by calculating the Cronbach alpha scores (25) and for normality with QQ plots and Kolgomorov–Smirnov tests. Responses between different cohorts were compared with paired t-tests.

Results

The scores for the scales and subscales for those students who completed both inventories are shown (Tables 1–5). All the scales achieved alpha scores over 0.79, and the subscales' scores were over 0.5, except the subscale *syllabus boundness* in Year 5, 2008–09, which was 0.42.

Comparison between profiles over time

Normality tests (Q–Q plots, one-sample Kolmogorov–Smirnov tests) showed that the differences between the paired scores of individual students for the three scales at different times were normally distributed. This validated use of paired t-tests to compare the two sets. The slightly different numbers of paired observations is because not all students completed every item. In the cohort starting 2004 (Table 1) there was no significant change in the score for learning approach by the beginning of academic year 2008 (Year 5; for intercalating students, Year 4), although the fall in surface score almost achieved significance. In the surface subscales, the scores for

Citation: Med Educ Online 2012, **17**: 17205 - http://dx.doi.org/10.3402/meo.v17i0.17205

Table 1. Year 1, 2004–05 scores: paired t-tests with 2008–09 scores

	N	Y1 Mean	Y1 SD	2008 Mean	2008 SD	Y1-2008	95% CI of difference: lower	95% CI of difference: upper	Signif. (2-tailed)
Deep	**25**	**58.760**	**6.876**	**58.000**	**9.251**	**0.760**	**−2.997**	**4.517**	**0.680**
Seeking meaning	26	15.539	2.140	15.269	2.864	0.269	−0.842	1.380	0.622
Relating ideas	25	14.040	2.685	13.640	3.390	0.400	−1.221	2.021	0.615
Use of evidence	26	15.385	2.401	15.192	2.713	0.192	−0.886	1.270	0.716
Interest in ideas	26	14.000	3.098	14.308	3.308	−0.308	−1.938	1.323	0.701
Strategic	**25**	**68.880**	**9.066**	**68.360**	**14.405**	**0.520**	**−3.940**	**4.980**	**0.812**
Organised studying	26	12.385	1.981	12.192	3.980	0.192	−1.230	1.615	0.783
Time management	26	12.346	3.059	13.192	4.290	−0.846	−2.424	0.731	0.280
Alertness to assessment	26	14.539	2.970	14.269	3.661	0.269	−1.156	1.694	0.700
Achieving	25	14.200	2.533	12.880	3.734	1.320	−0.414	3.054	0.129
Monitoring effectiveness	25	15.560	2.311	16.120	3.180	−0.560	−1.550	0.430	0.255
Surface	**25**	**45.654**	**8.400**	**42.269**	**8.137**	**3.385**	**−0.114**	**6.884**	**0.057**
Lack of purpose	26	6.500	2.249	8.192	2.684	−1.692	−2.963	−0.421	0.011
Unrelated memorizing	26	11.923	3.486	9.654	2.911	2.269	0.939	3.599	0.002
Syllabus boundness	26	13.962	2.959	13.692	2.739	0.269	−1.192	1.730	0.708
Fear of failure	26	13.269	4.396	10.731	3.842	2.538	0.640	4.437	0.011

unrelated memorising and fear of failure fell significantly. Curiously, the score for lack of purpose rose significantly.

In the cohort starting academic year 2005 (Table 2) there was likewise no significant change in the score for learning approach by 2008 (Year 4; intercalating students in Year 3). In the subscales for strategic approach there was a significant fall in the scores for alertness to assessment, achieving and a rise in monitoring effectiveness. In the surface subscales there was a significant rise in syllabus boundness and fall in fear of failure. When this cohort was tested the following year (Table 3) the rise in alertness to assessment and monitoring effectiveness persisted, but a fall in achieving was no longer evident; in the surface subscales there was a fall in fear of failure, but the slight rise in syllabus boundness did not achieve significance.

Table 2. Year 1, 2005–06 scores: paired t-tests with Years 3 and 4, 2008–09 scores

	N	Y1 Mean	Y1 SD	08 Mean	08 SD	Y1-08	95% CI of difference: lower	95% CI of difference: upper	Signif. (2-tailed)
Deep	**66**	**59.7879**	**7.64101**	**60.2121**	**10.47270**	**−0.42424**	**−2.75403**	**1.90554**	**0.717**
Seeking meaning	66	15.1818	2.35933	15.5303	3.15848	−0.34848	−1.07325	.37628	0.340
Relating ideas	66	14.2424	2.70077	13.6061	3.52956	0.63636	−0.22783	1.50056	0.146
Use of evidence	66	15.1212	2.22928	15.5606	2.86157	−0.43939	−1.17768	0.29889	0.239
Interest in ideas	66	15.2424	2.39269	15.5152	3.17801	−0.27273	−1.09718	0.55172	0.511
Strategic	**66**	**74.4545**	**8.70576**	**75.2879**	**11.81494**	**−0.83333**	**−3.69778**	**2.03111**	**0.563**
Organised studying	66	14.7121	2.31892	14.5000	3.63424	0.21212	−0.59405	1.01829	0.601
Time management	66	14.6970	2.79543	15.1667	0.53178	−0.46970	−1.48577	0.54638	0.359
Alertness to assessment	66	13.8485	3.33855	15.2424	3.17713	−1.39394	−2.34641	−0.44147	0.005
Achieving	66	15.9242	2.16483	14.1364	2.85488	1.78788	1.05543	2.52033	0.000
Monitoring effectiveness	66	15.2727	2.59909	16.2424	2.82331	−0.96970	−1.72398	−0.21542	0.013
Surface	**66**	**43.2727**	**7.45973**	**42.4545**	**8.96520**	**0.81818**	**−1.46722**	**3.10359**	**0.477**
Lack of purpose	66	6.4697	1.85820	6.2879	2.48544	0.18182	−0.48470	0.84833	0.588
Unrelated memorizing	66	11.4091	2.67166	10.6667	3.12476	0.74242	−0.05772	1.54257	0.068
Syllabus boundness	66	11.8939	2.90955	13.2273	2.90779	−1.33333	−2.09785	−0.56881	0.001
Fear of failure	66	13.5000	2.88897	12.2727	3.98669	1.22727	0.23286	2.22169	0.016

Table 3. Year 1, 2005–06 scores: paired t-tests 2009–10 scores

	N	Y1 Mean	Y1 SD	2009 Mean	2009 SD	Y1-2009	95% CI of difference: lower	95% CI of difference: upper	Signif. (2-tailed)
Deep	**46**	**60.326**	**8.584**	**60.910**	**9.709**	**−0.587**	**−3.183**	**2.009**	**0.651**
Seeking meaning	46	15.217	2.260	15.570	2.527	−0.348	−1.125	0.430	0.372
Relating ideas	48	14.479	3.087	14.790	3.358	−0.313	−1.280	0.655	0.519
Use of evidence	48	15.438	2.296	15.150	2.903	0.292	−0.564	1.147	0.496
Interest in ideas	48	15.021	2.717	15.250	2.950	−0.229	−1.161	0.703	0.623
Strategic	**48**	**74.458**	**8.488**	**76.920**	**12.445**	**−2.458**	**−6.273**	**1.356**	**0.201**
Organised studying	48	14.729	2.430	14.520	3.537	0.208	−0.682	1.099	0.640
Time management	48	14.271	3.187	14.850	4.222	−0.583	−2.007	0.840	0.414
Alertness to assessment	48	14.021	3.159	15.210	2.721	−1.188	−2.210	−0.165	0.024
Achieving	48	15.979	2.159	15.960	3.128	0.021	−0.968	1.010	0.966
Monitoring effectiveness	47	15.458	2.526	16.560	2.736	−1.104	−2.169	−0.039	0.042
Surface	**48**	**43.417**	**7.618**	**41.400**	**9.535**	**2.021**	**−0.913**	**4.954**	**0.172**
Lack of purpose	48	6.604	1.888	6.750	1.962	−0.146	−0.943	0.651	0.714
Unrelated memorizing	48	11.000	2.982	10.130	3.246	0.875	−0.303	2.053	0.142
Syllabus boundness	48	12.125	2.885	12.580	3.689	−0.458	−1.533	0.616	0.395
Fear of failure	48	13.688	3.088	11.940	4.029	1.750	0.678	2.822	0.002

The students who started in 2004 and then intercalated (Table 4) showed a significant fall in the surface score. Within this, the subscales for unrelated memorising, syllabus boundness and fear of failure all declined highly significantly. The strategic score increased by 6.57 and almost reached significance at 0.051. The deep score increased, but did not achieve significance, although the rise in the score for one of its subscales, interest in ideas, did.

The students who started in 2005 (Table 5) also showed a fall in the surface score, but this did not quite achieve significance, although its subscale, fear of failure, did.

Discussion

The evidence to support the hypothesis that deep learning may be promoted by a curriculum designed with that purpose in mind is worthy of discussion and includes

Table 4. Year 1, 2004–05 scores: paired with 2009–10, intercalating students

	N	Y1 Mean	Y1 SD	2009 Mean	2009 SD	Y1-2009	95% CI of difference: lower	95% CI of difference: upper	Signif. (2-tailed)
Deep	**16**	**59.880**	**6.830**	**64.060**	**9.118**	**−4.188**	**−9.999**	**1.624**	**0.145**
Seeking meaning	16	15.250	2.236	16.250	2.955	−1.000	−3.210	1.210	0.350
Relating ideas	16	14.630	2.778	15.380	3.403	−0.750	−2.777	1.277	0.443
Use of evidence	16	15.560	2.097	16.560	2.756	−1.000	−2.804	0.804	0.256
Interest in ideas	16	14.440	2.250	15.880	2.655	−1.438	−2.867	−0.008	0.049
Strategic	**14**	**76.430**	**8.993**	**83.000**	**11.832**	**−6.571**	**−13.177**	**0.034**	**0.051**
Organised studying	14	13.930	2.868	16.140	3.505	−2.214	−4.111	−0.317	0.026
Time management	16	13.500	3.406	16.690	3.219	−3.188	−5.276	−1.099	0.005
Alertness to assessment	16	16.000	2.966	17.060	2.792	−1.063	−2.993	0.868	0.259
Achieving	16	15.380	2.277	16.940	2.048	−1.563	−2.823	−0.302	0.018
Monitoring effectiveness	16	16.940	1.879	17.440	2.943	−0.500	−2.081	1.081	0.510
Surface	**16**	**46.380**	**7.438**	**36.380**	**9.619**	**10.000**	**4.971**	**15.029**	**0.001**
Lack of purpose	16	6.310	2.243	6.750	2.978	−0.438	−1.854	0.979	0.520
Unrelated memorizing	16	12.310	2.358	8.750	2.696	3.563	1.889	5.236	0.000
Syllabus boundness	16	13.750	2.955	10.060	3.568	3.688	1.774	5.601	0.001
Fear of failure	16	14.000	3.406	10.810	4.167	3.188	1.145	5.230	0.005

Citation: Med Educ Online 2012, **17**: 17205 - http://dx.doi.org/10.3402/meo.v17i0.17205

Table 5. Year 1, 2005–06 scores: paired with 2009–10 scores, intercalating students

	N	Y1 Mean	Y1 SD	2009 Mean	2009 SD	Y1-2009	95% CI of difference: lower	95% CI of difference: upper	Signif. (2-tailed)
Deep	**23**	**60.391**	**8.711**	**61.700**	**10.133**	**−1.304**	**−5.046**	**2.437**	**0.477**
Seeking meaning	23	15.087	2.295	15.740	2.240	−0.652	−1.771	0.466	0.239
Relating ideas	24	14.375	3.214	14.710	3.155	−0.333	−1.576	0.910	0.584
Use of evidence	24	15.292	2.440	15.420	2.620	−0.125	−1.360	1.110	0.836
Interest in ideas	24	15.292	2.851	15.830	3.031	−0.542	−1.917	0.834	0.424
Strategic	**24**	**74.375**	**9.440**	**77.580**	**14.154**	**−3.208**	**−9.297**	**2.880**	**0.287**
Organised studying	24	14.875	2.252	15.040	3.593	−0.167	−1.441	1.107	0.789
Time management	24	14.250	3.287	14.960	4.695	−0.708	−2.752	1.336	0.481
Alertness to assessment	24	13.958	3.483	15.080	3.161	−1.125	−2.563	0.313	0.119
Achieving	24	15.750	2.454	16.460	3.401	−0.708	−2.281	0.864	0.361
Monitoring effectiveness	24	15.542	2.654	16.080	3.361	−0.542	−2.212	1.129	0.509
Surface	**24**	**43.458**	**6.234**	**39.830**	**9.640**	**3.625**	**−0.056**	**7.306**	**0.053**
Lack of purpose	24	6.417	1.909	6.540	2.085	−0.125	−1.147	0.897	0.802
Unrelated memorizing	24	11.125	2.525	9.830	3.171	1.292	−0.291	2.874	0.105
Syllabus boundness	24	12.125	2.610	11.380	3.645	0.750	−0.638	2.138	0.275
Fear of failure	24	13.792	2.782	12.080	3.900	1.708	0.171	3.246	0.031

three key points: the validity of the inventory and reliability of the results, the emergent trends about the student's approaches to learning and the likely influences of the curriculum.

The inventory, ASSIST, is valid and internally consistent, as is born out by the high alpha scores within scales and subscales. It was, however, originally developed for a more general educational environment and may not be sensitive or specific enough to measure adequately the constructs of a deep approach to learning in the context of the medical curriculum. It is also possible that the way in which students completed the inventory did not reflect their true approaches to learning, especially if they answered the questions in a way that they thought would have been the approved answers. The inventory is a self-reporting instrument, with some of the inherent flaws that self-reporting brings. However, the possibility that their approaches may have changed but not their recognition of the fact seems less likely, as the high Cronbach alphas scores indicate a consistent pattern of response that would not occur if this was the case.

The emerging trends show that scores for deep and strategic approaches were relatively high and those for surface approach low at the start of the medical programme. There was a slight trend towards a rise in scores for deep and strategic approach, and fall in those for surface approach over Years 1–5, but in only some cohorts were these statistically significant. This suggests that the students' approaches have changed, albeit slightly. Whilst the cause of this is not clearly understood, the most likely explanations are found within the learning environment of the students themselves, and more specifically, the curriculum.

The assertion that the curriculum has encouraged desirable approaches towards learning is based on a fundamental belief that the ethos of the school and the quality of the curriculum does make a difference to the outcomes of the students after any psychosocial factors have been taken into account (26). Any interpretation of the results, therefore, must be seen from the perspective that the educational experience does shape the student to an indeterminate extent. In addition, it has been established that medical students are highly conscientious (27), which supports the view that the nature of the curriculum must be a fundamental influential factor. However, the degree of influence remains uncertain.

With respect to Years 1 and 2 of the medical programme, it was suggested that measures to encourage students to adopt a deep approach to learning were not sufficient, and that the course retained too strong an emphasis on prescriptive-learning (19). However, this does not account for the slight trend towards deep learning in Years 3–5, which are the clinical rotations, and where 'organised learning' is reduced and there is no PBL. Learning takes place in and around a clinical environment, which is more 'true to life' for a doctor than the atmosphere of the university. The implication is that the balance between the students' approach towards learning continues to be restrained to some degree by the nature of the curriculum and the assessment strategy. Further uncertainty about this arises, as it is not clear why the alpha scores for *syllabus boundness* were lower than 0.5. The students are part of a composite course where openly

declared written learning objectives provide guidance for teachers and students and in assessment.

The substantial fall in surface learning in students who intercalated is of interest, although tempered by the small numbers. The students allowed to opt for an intercalated degree are selected on academic merit and whilst they are clearly able to learn the factual material, the results show that they do not follow the trend towards surface learning.

If it is in the nature of the students to adopt a deep approach to learning, why, then, did the scores for a deep approach not increase with a higher level of significance, despite concerted efforts to promote a learning environment that fosters the deep approach? There are several possibilities. Whilst certain measures for promoting a deep approach have been suggested in the literature (21), these have not been shown conclusively to work (28). Even though efforts were made to encourage a deep approach to learning, it may be that the patterns of teaching and learning may be so ingrained in a relatively traditional medical school and that attempts to change the style of the curriculum to a less didactic approach were insufficient to overcome a cultural inertia.

There is a possibility that the students' approaches to learning and studying may have consolidated before they reach the age of entry to university (typically about 18 years of age). If this is so, then students who enter Year 1 of a medical programme tend to continue to use their study skills as a teleonomic or Pavlovian habit and do not wish or even know how to change them and a student's approach to learning is a fixed entity and capable of only limited change, irrespective of environment. The students have entered what has been described as a 'hybrid curriculum', with varied teaching and learning methods. Such a curriculum would accommodate the students' existing approaches and provide sufficient flexibility for them to perpetuate their familiar approach, but not enable them to adapt to a new approach. However, the results show that some change has occurred, which is against this assertion. There is evidence that, over time at university, students develop a less deep and more surface-orientated approach (29). If this is the case, then the results suggest that the curriculum design has been successful in overcoming this trend and has modified the established habits of learning to a small degree. It is also the case that the timetable imposes a routine pattern of teaching and that students establish learning behaviours to accommodate it. The time apportioned to activities that promote deep learning may not be sufficient to overcome the weighting that the student places on surface learning. The approach to learning and studying that students adopt is, of course, determined, not by the learning environment, but by students' *perceptions* of the learning environment. These are difficult to predict. For example, in a study (30) using semi-structured interviews with Year 2 medical students, it was found that self-directed, problem-based and vocationally relevant activities promoted high-quality learning, but this was restricted by various factors, including perceived lack of useful feedback and the quantity of information to be assimilated. Study strategies are, of course, determined by the students' own cognitive and metacognitive strategies (31).

The role of PBL may not be as straightforward as once thought. In one study (32) it was found that when PBL was introduced into a course, students' approaches to learning changed in a complex way, some students being driven towards a surface approach and some towards a deep approach. Conversely, in another study (33) it appeared that deep and strategic students preferred PBL. The mode of curriculum delivery shifts when students leave Year 2 (a university-based environment, with a mixed mode of teaching, that includes PBL) and enter Year 3 (a clinical environment, without PBL), but the results do not suggest that the absence of PBL causes the change in the student's individual approach.

Conclusion

This study has shown that medical students have high scores for deep and strategic approaches to learning and studying and lower scores for a surface approach, but that, even when efforts were made to promote a deep approach, little significant change in these scores occurred during the whole of the medical degree programme, apart from some tendency for the surface approach to lessen. Either their approaches are not susceptible to change or else the learning environment may need to alter more drastically than hitherto. Further studies should be undertaken in schools that declare themselves to be 'PBL' or 'traditional' to explore further the influence of the style of the curriculum.

Acknowledgements

The authors are grateful to Catriona Smith, Carole-Anne Marshall, Lindsay Dalziel, Katie Morgan, Keith Wylde, College of Medicine and Veterinary Medicine, University of Edinburgh; Arek Juszczyk, Learning Technology Section (data entry).

Conflict of interest and funding

The authors have not received any funding or benefits from industry or elsewhere to conduct this study.

Ethical approval

Ethical permission was sought from the Lothian Area Ethics Committee, which did not consider permission to be necessary.

Citation: Med Educ Online 2012, **17**: 17205 - http://dx.doi.org/10.3402/meo.v17i0.17205

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