

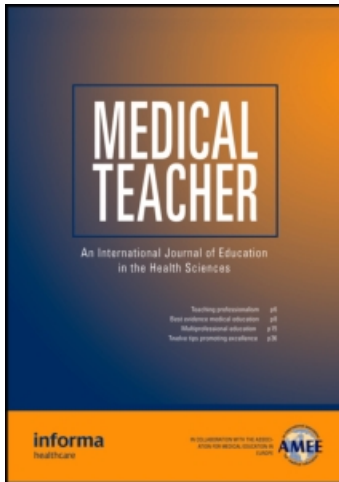
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Dr W. A. Reid <sup>a</sup>; E. Duvall <sup>a</sup>; P. Evans <sup>b</sup>

<sup>a</sup> Pathology, School of Molecular and Clinical Medicine, Royal Infirmary of Edinburgh, UK <sup>b</sup> Medical Teaching Organisation, University of Edinburgh Medical School, UK

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# Can we influence medical students' approaches to learning?

W.A. REID<sup>1</sup>, E. DUVALL<sup>1</sup> & P. EVANS<sup>2</sup>

<sup>1</sup>Pathology, School of Molecular and Clinical Medicine, Royal Infirmary of Edinburgh, UK

<sup>2</sup>Medical Teaching Organisation, University of Edinburgh Medical School, UK

**SUMMARY** Students use three approaches to learning and studying: deep, surface and strategic. These are influenced by the learning environment. In response to the General Medical Council's report 'Tomorrow's Doctors', the second year of the medical course at the University of Edinburgh was changed to promote deep learning, with learning objectives constructed according to the SOLO taxonomy, learning methods such as problem-based learning and constructively aligned written assignments and examinations. The Approaches to Study Skills Inventory for Students (ASSIST) was used to evaluate the effect of these changes. Scores were highest for deep approaches and lowest for surface approaches and showed almost no change during the course.

There are various possible explanations. The students already scored highly on deep approaches at the beginning of Year 2 and it may be difficult to increase the deep scores further, particularly over the relatively short period of the study. Alternatively, the effect of the changes in learning environment may not be strong enough to change entrenched approaches which have hitherto been successful.

## Introduction

The report 'Tomorrow's Doctors' (General Medical Council, 1993) criticized British medical school curricula for overburdening students with factual information and not promoting critical understanding of core material. Much effort has been expended in realigning curricula to meet these criticisms. It is, however, not clear whether this has improved the learning of medical students. In 1998 the first cohort of medical students in the University of Edinburgh entered a redesigned five-year course. The course was deliberately planned to promote desirable approaches to learning and in this study we consider whether these were effective.

### Approaches to learning and studying

Previous work (Marton & Säljö, 1976; Entwistle, 1997a) has described three approaches to learning and studying: deep, surface and strategic. A student with a deep approach seeks to understand, relates new ideas to previous knowledge, relates concepts to experience, examines the logic of the argument and uses evidence critically. In a surface approach, the student's intention is to complete the task, memorize information and focus on individual points, without recognizing the wider context or reflecting on the process or purpose of study. Such students have a fear of failing and lack motivation. Students adopting a strategic approach organize their work, manage time well and aim specially to

pass assessments. The Lancaster study (Entwistle *et al.*, 1979) encompassed these approaches within a more comprehensive model that included study orientations and outcomes.

Further approaches to learning and studying have been identified across a wide range of contexts and methodologies (Biggs, 1999; Entwistle *et al.*, 2000). Several studies have linked students' approaches to their learning outcomes or grades, although the relationships found depend on the forms of assessment considered (Van Rossum & Schenk, 1984; Trigwell & Prosser, 1991; Marton & Säljö, 1997; Provost & Bond, 1997; Tait *et al.*, 1998). It is presumed (Schön, 1977), although not proven, that a deep approach will promote the development of a reflective, adaptable medical practitioner, capable of better medical practice than one with a mainly surface or strategic approach.

The tacit aim of the changes introduced following 'Tomorrow's Doctors' is to promote a deep approach by providing an appropriate learning environment. Students' approaches to learning are influenced by their perception of the learning environment (Entwistle, 1988; Ramsden, 1997; Biggs, 1999a; Prosser & Trigwell, 1999; Lizzio *et al.*, 2002). If they perceive that the learning environment has changed then they may alter their learning approach (Newble & Clarke, 1986; Trigwell & Prosser, 1991; Entwistle, 1997b). Overall, research suggests that a deep approach is encouraged and a surface approach discouraged by:

- appropriate workload, avoiding factual overload.
- clear goals and informative feedback.
- clear, enthusiastic, empathic teaching focused on promoting conceptual change.
- freedom of choice over learning content and method.
- assessment which students perceive to reward understanding.
- assessment through written work rather than multiple-choice questions.

Medical students have, unfortunately, been shown to score highly for surface learning (Newble & Gordon, 1985). Indeed, many features of medical school teaching, including assessment, might drive students towards surface learning (Newble & Entwistle, 1986; Newble *et al.*, 1988). There is evidence, however, that problem based learning in medicine is more likely to promote a deep approach than

*Correspondence:* Dr W. A. Reid, Pathology, School of Molecular and Clinical Medicine, Royal Infirmary of Edinburgh, 51 Little France Crescent, Edinburgh EH16 4SA, UK. Tel: +44 (0)131 242 7140; fax: +44 (0)131 242 7169; email: Sandy.Reid@ed.ac.uk

conventional teaching (Newble & Clarke, 1986; Brockbank & McGill, 1998). An important factor is 'constructive alignment' to a deep approach (Biggs, 1996, 1999). In the Year 2 course in Edinburgh, the main change in learning environment that might promote this was problem-based learning (PBL), although other changes that might affect it included:

- explicit written learning objectives expressed in Biggs' SOLO (Structure of Observed Learning Outcome) taxonomy (Biggs, 1999).
- alignment of assessment methods to the learning objectives.
- formal self-appraisal in the in-course assignments.
- computer assisted learning-based, directed, self-learning exercises.

This paper reports the effects of exposure to these methods in Year 2 on the students' learning, as measured by an inventory used previously with students of various disciplines, but apparently not with medical students. We were particularly keen to find out if there was any shift in students' approaches over time. There is no published evidence in the literature of a change in ASSIST scores due to curriculum changes. The ASSIST inventory was established following a series of interviews of a range of university students (Tait *et al.*, 1998), but it has not yet been used to measure student development in a medical curriculum (Hounsell *et al.*, 2002). It is a widely held view that student-centred activities such as problem based learning (Norman & Schmidt, 1992) and curriculum alignment (Biggs, 1999) promote deep learning in students and further evidence supports this view (Moore *et al.*, 1994).

## Course structure

### Year 1

Since 1998, students in Year 1 of the medical course at the University of Edinburgh undertake two main courses: 'biomedical science' and 'health and society', and a student-selected component. Teaching methods are relatively didactic, with only a minor problem-based component. Assessment comprises in-course assignments made up of essays and three end-of-term examinations, comprising multiple choice and short answer questions. No explicit emphasis is placed on promoting a deep approach to learning.

### Year 2

Year 2 consists of two courses, the major component being 'biology of disease'; one afternoon per week is 'introduction to clinical practice'. Also included are two four-week student-selected components.

Efforts to promote a deep approach were concentrated on the biology of disease course. The learning methods promoted include small group tutorials and self-access material, such as computer assisted learning programs. There is also a PBL component based on the Maastricht model: students are given clinical problems which they address in groups of nine, which meet twice weekly for 90 minutes, the first meeting each week being with a facilitator and the second without. Problems are considered

over 16 weeks during the three terms. Attempts are made to promote a deep approach to the PBL in the students' guidance on conducting their discussions.

At the start of each term the students receive detailed (10–15 pages) written learning objectives, expressed in the SOLO taxonomy (Biggs, 1999), with an explanation of the imperatives used, e.g. 'list', 'describe', 'explain'. Most of the objectives correspond to Biggs' unistructural, multi-structural and relational levels, with bias towards the higher levels. It is repeatedly stressed that the assessments address these learning objectives and are not restricted to the material covered in any specific learning method, particularly lectures.

## Assessment

The assessments are matched to the higher level learning objectives in an attempt to increase constructive alignment (Biggs, 1996, 1999). Students submit six in-course assignments (related to the first two PBL topics of each term). The genre of the assignment varies and includes traditional essay, script for an interview by a journalist, appraisal of a published paper, or information guide. The students also submit a template in which they self-rate their work against specified criteria, generally measures of higher order understanding. Staff marking the reports also complete these templates, which are returned as feedback to the students. At the end of each term there is a written examination, comprising a multiple choice paper and a modified essay paper based on clinical cases, in which students write answers varying from a few words to discursive explanations. Definite attempts are made to test higher learning objectives, such as understanding and extrapolation.

## Aim of study

This study was undertaken to determine to what extent the early medical course succeeded in promoting a deep approach and deterring a surface approach to learning. We compared the learning approach profile of the medical class at the start of the academic session and towards the end of Year 2.

## Methods

### Learning approaches: data collection

We used the Approaches and Study Skills Inventory for Students (ASSIST) (Tait *et al.*, 1998; Entwistle *et al.*, 2000). This comprises 52 questions, each scored 1 to 5. The responses were aggregated in sets of four to yield 13 subscales, which were grouped to give a score for each individual in terms of deep, strategic and surface approach. The score for deep approach is the aggregate of scores for four subscales: seeking meaning, relating ideas, use of evidence and interest in ideas. Strategic approach aggregates five subscales: organized studying, time management, alertness to assessment, achievement and monitoring effectiveness. Surface approach aggregates four subscales: lack of purpose, unrelated memorising, syllabus-boundedness and fear of failure.

Three cohorts of students were studied, those who entered year 2 in 2001 (cohort 1), in 2002 (cohort 2) and in 2003 (cohort 3). Each completed the inventory early in year 2 and again at the end of it, eight months later. In addition, cohort 3 also completed the inventory in the first few days of year 1. Students gave signed consent and supplied their matriculation number, to allow comparison of paired results. The students were asked to complete each inventory with regard to their approaches to their recent studies.

### Statistical analysis

The responses were analysed using the Statistical Package for the Social Sciences (SPSS). Scores were aggregated as above. The results were checked for reliability (internal consistency) by calculating the Cronbach alpha scores (Bland & Altman, 1997). The differences between paired scores across time were tested for normal distribution by the Kolmogorov-Smirnov test and Q-Q plots; paired *t*-tests were then applied. Factor analysis was by maximum likelihood and principal components analysis.

## Results

Tables 1–3 show the profiles for the three cohorts as the scores for the scales and subscales. The scores are those for those students who completed both inventories. The distribution of scores for the whole student population completing one inventory did not differ significantly from the distribution for the subpopulation who completed both. All three cohorts had similar profiles of scores on each scale and subscale at the beginning and end of year 2.

### Reliability

All the scales achieved alpha scores over 0.75 and the subscales scores over 0.5, except the subscale *use of evidence* in five out of seven test administrations, where the score was low (0.34–0.49). Lack of purpose, unrelated memorizing and monitoring effectiveness each scored 0.46–0.5 on one occasion.

### Factor analysis

Factor analysis conducted on the various cohorts confirmed that the subscales aggregate into meaningful scales for this group of students. In most cohorts this gave best results with three factors by maximum likelihood analysis and direct oblimin rotation, although the Year 1 02–03 cohort gave clearer three factors with principal components analysis and varimax rotation. If the scores for a set of subscales show high loadings for an individual factor, it suggests that the attributes measured by each subscale are associated in this population.

### Comparison between profiles over time

The differences between the paired scores for individual students for the three scales at different times were in each case normally distributed (Normal Q-Q plots and Kolmogorov-Smirnov test). This validates use of a paired *t*-test to compare the two sets. Not all students who answered both questionnaires completed every item, thus yielding slightly different numbers of paired observations (not included).

During the second year course there was a slight, but statistically significant at the 0.05 level, fall in the scores for the strategic approach for all three cohorts (Tables 1–3). There was a slight fall in the deep score for the first

**Table 1.** Cohort 1 (Year 2, 2001–02): comparison of scores for students (157 out of 213) who completed both inventories at beginning (Q1) and end (Q2) of year 2. Mean and standard deviation of scores for each test for each scales and subscale, with differences between the two (Q1 – Q2, paired *t*-tests), confidence intervals (CI) and significance.

Scale subscale	Q1 mean	Q1 SD	Q2 mean	Q2 SD	Q1 – Q2	95% CI of difference: lower	95% CI of difference: upper	Significance
Deep (maximum score 80)	57.77	7.60	56.50	7.43	1.27	0.27	2.27	0.013
Seeking meaning	14.78	2.66	14.81	2.30	–0.038	–0.42	0.35	0.847
Relating ideas	13.76	2.69	13.64	2.47	0.11	–0.30	0.53	0.59
Use of evidence	14.81	2.26	14.26	2.51	0.55	0.15	0.95	0.008
Interest in ideas	14.46	2.77	13.78	2.90	0.67	0.28	1.06	0.001
Strategic (maximum score 100)	70.55	11.52	69.25	10.47	1.30	0.035	2.57	0.044
Organized studying	13.11	2.965	12.94	3.01	0.175	–0.20	0.55	0.36
Time management	12.70	4.04	12.80	3.64	–0.10	–0.55	0.349	0.66
Alertness to assessment	14.52	2.97	14.195	2.61	0.32	–0.15	0.79	0.18
Achieving	14.81	3.02	14.25	2.89	0.56	0.24	0.89	0.001
Monitoring effectiveness	15.41	2.66	14.99	2.35	0.42	0.036	0.80	0.03
Surface (maximum score 80)	45.24	9.74	44.26	9.06	0.98	–0.021	1.98	0.055
Lack of purpose	7.46	2.82	7.56	3.015	0.10	–0.49	0.29	0.61
Unrelated memorizing	11.79	3.05	11.62	2.71	0.17	–0.22	0.56	0.40
Syllabus boundness	13.85	3.32	13.52	2.87	0.33	–0.08	0.74	0.11
Fear of failure	12.27	4.42	11.69	4.04	0.58	0.11	1.05	0.016

**Table 2.** Cohort 2 (Year 2, 2002–03): comparison of scores for students (143 out of 210) who completed both inventories at beginning (Q1) and end (Q2) of year 2. Mean and standard deviation of scores for each test for each scales and subscale, with differences between the two (Q1 – Q2, paired *t*-tests), confidence intervals (CI) and significance.

Scale subscale	Q1 mean	Q1 SD	Q2 mean	Q2 SD	Q1 – Q2	95% CI of difference: lower	95% CI of difference: upper	Significance
Deep (maximum score 80)	58.42	8.20	56.65	8.06	1.77	0.72	2.82	0.001
Seeking meaning	15.11	2.67	14.79	2.41	0.32	–0.095	0.73	0.13
Relating ideas	13.93	2.79	13.48	2.68	0.45	0.061	0.84	0.024
Use of evidence	15.05	2.30	14.39	2.42	0.67	0.25	1.07	0.002
Interest in ideas	14.49	3.03	14.18	3.04	0.31	–0.08	0.70	0.119
Strategic (maximum score 100)	72.78	11.23	70.13	11.24	2.66	1.43	3.88	0.000
Organized studying	13.48	3.11	12.89	3.18	0.59	0.16	1.015	0.008
Time management	13.37	3.65	12.99	3.95	0.38	–0.070	0.84	0.096
Alertness to assessment	15.37	2.71	14.37	2.63	1.00	0.54	1.46	0.00
Achieving	15.18	2.92	14.52	2.76	0.66	0.29	1.04	0.001
Monitoring effectiveness	15.57	2.57	15.44	2.290	0.13	–0.260	0.516	0.514
Surface (maximum score 80)	47.24	7.77	47.63	8.22	–0.38	–1.57	0.80	0.52
Lack of purpose	7.135	2.24	7.31	2.94	–0.18	–0.64	0.28	0.45
Unrelated memorizing	12.15	2.45	12.75	2.66	–0.60	–1.01	–0.19	0.004
Syllabus boundness	14.39	2.91	14.24	2.98	0.15	–0.32	0.61	0.53
Fear of failure	13.55	3.67	13.54	3.94	0.007	–0.50	0.51	0.98

**Table 3.** Cohort 3 (Year 2, 2003–04): comparison of scores for students (125 out of 220) who completed both inventories at beginning (Q1) and end (Q2) of year 2. Mean and standard deviation of scores for each test for each scales and subscale, with differences between the two (Q1 – Q2, paired *t*-tests), confidence intervals (CI) and significance.

Scale subscale	Q1 mean	Q1 SD	Q2 mean	Q2 SD	Q1 – Q2	95% CI of difference: lower	95% CI of difference: upper	Significance
Deep (maximum score 80)	58.96	7.72	58.78	7.99	0.181	–1.002	1.364	0.762
Seeking meaning	15.50	2.390	15.176	2.468	0.324	–0.138	0.786	0.167
Relating ideas	13.95	2.670	14.009	2.569	–0.064	–0.491	0.36	0.766
Use of evidence	15.00	2.327	14.88	2.239	0.12	–0.313	0.56	0.581
Interest in ideas	14.51	2.30	14.778	3.02	–0.2685	–0.821	0.28	0.337
Strategic (maximum score 100)	74.99	12.16	73.06	11.87	1.93	0.325	3.537	0.019
Organized studying	14.193	3.087	13.76	3.124	0.431	–0.099	0.96	0.110
Time management	13.533	4.087	13.299	4.133	0.234	–0.295	0.76	0.383
Alertness to assessment	15.762	2.844	14.70	2.990	1.057	0.583	1.53	0.000
Achieving	15.257	3.110	15.092	3.012	0.165	–0.283	0.61	0.466
Monitoring effectiveness	16.32	2.328	16.222	2.393	0.102	–0.31	0.51	0.625
Surface (maximum score 80)	44.33	10.34	43.90	10.09	0.435	–0.963	1.83	0.538
Lack of purpose	6.514	2.676	6.624	2.924	–0.110	–0.559	0.34	0.628
Unrelated memorizing	11.578	3.098	11.642	2.936	–0.064	–0.54	0.41	0.790
Syllabus boundness	13.55	3.290	13.55	3.326	0.000	–0.50	0.50	1.000
Fear of failure	12.639	4.197	11.982	4.021	0.657	0.0678	1.247	0.029

two cohorts. The scores for the surface approach did not alter significantly over the year for any cohort.

Although the cohorts showed the same overall pattern for the scales there was more variation between cohorts in the changes in subscales. Cohort 1 showed a small but significant fall in scores for use of evidence, interest in ideas, achieving, monitoring effectiveness and fear of failure. Cohort 2, on the other hand showed a small but significant fall in relating ideas, use of evidence, organized studying,

alertness to assessment and achieving and a rise in unrelated memorizing whilst Cohort 3 showed a fall in both alertness to assessment and fear of failure.

Cohort 3 were also tested at the beginning of Year 1 to assess the effect on learning approaches, if any, of a course that was not intentionally designed to promote a deep approach (Table 4). They showed, over the first year, a small but statistically significant fall in the score for deep and strategic approaches but no change in the score for

**Table 4.** Cohort 3: comparison of scores for students (153 out of 226) who completed both inventories at beginning of year 1 (Y1Q1) and beginning (Y2Q2) of year 2. Mean and standard deviation of scores for each test for each scales and subscale, with differences between the two (Y1Q1 – Y2Q2, paired *t*-tests), confidence intervals (CI) and significance.

	Y1 Q1 Mean	Y1 Q1 SD	Y2 Q1 Mean	Y2 Q1 SD	Y1Q1 – Y2Q1	95% CI of difference: lower	95% CI of difference: upper	Significance
Deep (maximum score 80)	60.87	7.35	59.61	7.93	1.27	0.048	2.48	0.042
Seeking meaning	16.24	2.04	15.71	2.49	0.53	0.14	0.91	0.008
Relating ideas	14.28	2.56	14.08	2.62	0.20	-0.22	0.63	0.35
Use of evidence	15.71	2.06	15.21	2.28	0.497	-0.10	0.89	0.013
Interest in ideas	14.697	2.76	14.55	2.91	0.14	-0.36	0.65	0.57
Strategic (maximum score 100)	77.83	10.37	75.09	12.46	2.73	1.26	4.20	0.00
Organized studying	14.42	2.92	14.03	3.07	0.39	-0.065	0.84	0.093
Time management	14.76	3.50	13.38	4.07	1.38	0.82	1.94	0.00
Alertness to assessment	15.979	2.36	15.986	2.69	-0.007	-0.449	0.435	0.975
Achieving	15.83	2.44	15.29	3.09	0.538	-0.11	0.97	0.014
Monitoring effectiveness	16.92	2.21	16.36	2.53	0.56	0.18	0.94	0.004
Surface (maximum score 80)	45.55	8.45	44.86	10.02	0.69	-0.76	2.13	0.35
Lack of purpose	6.645	2.51	6.83	2.85	-0.18	-0.666	0.297	0.45
Unrelated memorizing	11.99	2.98	11.75	3.06	0.24	-0.27	0.76	0.35
Syllabus boundness	13.19	3.05	13.63	3.16	-0.43	-0.93	0.06	0.085
Fear of failure	13.82	3.93	12.66	4.25	1.15	0.59	1.72	0.00

a surface approach. The subscales showed falls in seeking meaning, use of evidence, time management, achieving, monitoring effectiveness, and fear of failure.

## Discussion

The high alpha scores within scales and subscales confirm that the inventory is internally consistent (Hair *et al.*, 1995). The reason for the lower alpha scores for *use of evidence* is not clear: perhaps some students did not understand this question. Factor analysis with three factors showed that subscales associated with the same scale share high loadings for the same factor. These results are similar to those published for students of disciplines other than medicine and support the view that this analysis of learning approaches is valid for this population.

The results are remarkably consistent from cohort to cohort with relatively high scores for deep and strategic approaches. Medical students at Edinburgh are highly selected for academic performance and might be expected to score highly for deep approach. It is also not surprising that this population also scored highly for strategic learning and relatively lower for surface learning.

Disappointingly, the students' learning approaches did not show any increase in deep approach during year 2. In fact, there tended to be a slight falling off in both deep and strategic scores. Although these changes are statistically significant at the 0.05 level, they are small relative to the total scores; their educational significance is unclear. The inconsistency of the pattern of the changes in different subscales with different cohorts tends to support this. Other possible explanations are increased student cynicism, particularly with regard to completing questionnaires, perceived lack of relevance, or diminution in student studying, although we have not explored these further. It might also be that the pace of learning in the medical school was

greater than in institutions in which ASSIST was developed and thus failed to drive students towards deep learning. There is, at least, no evidence that the course was driving students further towards either a surface or strategic approach. This is, in itself, consoling, as there is some evidence that the longer students stay at university the less deep and more surface orientated they become (Entwistle & Ramsden, 1983). The third cohort was also assessed at the beginning of Year 1 and it is of interest that this year, which was not explicitly designed to promote a deep approach, appeared to have no deleterious effect on the cohort's profile (Table 4). The small but significant fall in the fear of failure possibly indicates a rise in the students' confidence as they progress through the course.

Why, however, did the scores for a deep approach not increase, despite concerted efforts to promote a learning environment that should have fostered it? There are several possibilities. Firstly, the measures taken to encourage a deep approach may have been insufficient to bring about the desired change. The students either missed the cues, or did not perceive any benefit in responding to them, or were unable to alter their learning approaches or were inhibited from adopting strategies for deep-learning because the structure of the course retained some element of prescriptive-learning. We purposefully did not promote the concept of learning approaches too explicitly when administering the inventory, as this might have biased their completion of subsequent inventories. Students entering medicine have presumably found the balance of learning approaches with which they start year 1 successful so far and may see little point in changing it, especially if it is reinforced by success in Year 1 at university. Even those who have been less successful may not see a need to change their approach, or even know how to alter it.

Secondly, the timescale of measurement may not have been long enough to induce any changes. It is notoriously

difficult to change students' learning approaches during a course (Case & Gunstone, 2002). It is possible the 7–8 months of the study period were not long enough to influence their learning approaches.

Thirdly, these students already displayed high scores on deep scales on entry to university and the headroom for improvement may be limited. We might, however, have expected to see some reduction in the scores for a surface approach.

It may also be that the timetable imposes a routine pattern of teaching and it is likely that the students also establish a routine of learning behaviours to accommodate it. The time apportioned to activities that promote deep learning is not sufficient to overcome the weighting placed on superficial learning. One additional factor may be the suitability of the instrument itself. ASSIST was developed in a more general educational environment, and it may not be sensitive or specific enough to identify 'deep learning', in a clinical context.

### Conclusion

This study has shown that early medical students have high scores for deep and strategic approaches to learning and lower scores for a surface approach, but little change in students' learning approaches occurred during an academic year when strenuous efforts were made to encourage a deep approach. If deep approaches are to be fostered and surface approaches discouraged by changing the learning environment, it may be necessary to adopt more radical strategies for teaching and assessment than hitherto, in order to alter the students' perception sufficiently to change their approaches. Only then will the medical course improve educationally along the lines required by the GMC.

### Practice points

- Medical students' approaches to learning and studying can be consistently quantified.
- Medical students in the first two years of their course have high scores for deep and strategic approaches to learning and low scores for a surface approach.
- These scores did not alter substantially during the first year at university.
- Efforts to encourage a deep and deter a surface approach during the second year did not alter the scores substantially.

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### Ethical approval

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

### Conflicts of interest

None.

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### Notes on contributors

WILLIAM A. REID is senior lecturer in pathology in the University of Edinburgh and has a special interest in dermatopathology. He has taught pathology for over 30 years and is director of the second year of the medical course in Edinburgh.

EDWARD DUVAL is senior lecturer in pathology in the University of Edinburgh with a special interest in gynaecological cytopathology. He has taught pathology to medical undergraduates for over 20 years.

PHILLIP EVANS is curriculum development officer of the medical course in the University of Edinburgh. He has an interest in various aspects of medical education, including problem based learning.

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