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Temporal Structure of First-year Courses and Success at Course Exams: Comparison of Traditional Continual and Block Delivery of Anatomy and Chemistry Courses

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Aim To evaluate students' academic success at delivered in a traditional continual course, spread over the two semesters, or in alternating course blocks.

Method We analyzed the data on exam grades for Anatomy and Chemistry courses in the first year of the curriculum for academic year 2001/02, with the traditional continual delivery of the courses (n = 253 for chemistry and n = 243 for anatomy), and academic year 2003/04, with block delivery of the courses (n = 255 for Chemistry and n = 260 for Anatomy). Grades from the final examination were analyzed only for students who sat the exam at the first available exam term and passed the course. For the Anatomy block course, grades at 2 interim written tests and 2 parts of the final exam (practical stage exam and oral exam) in each block were analyzed for students who passed all interim tests and the final exam.

Results There were no differences between two types of course delivery in the number of students passing the final examination at first attempt. There was a decrease in passing percentage for the two Anatomy block course student groups in 2003/04 (56% passing students in block 1 vs 40% in block 2, $P = 0.014$). There was an increase in the average grades from 2001/02 to 2003/04 academic year due to an increase in Chemistry grades ($F_{1,399} = 18.4$, $P < 0.001$, 2 × 2 ANOVA). There was no effect of the sequence of their delivery ($F_{1,206} = 1.8$, $P = 0.182$, 2 × 2 ANOVA). There was also a significant difference in grades on interim assessments of Anatomy when it was delivered in the block format ($F_{3,85} = 28.8$, $P < 0.001$, between-within subjects 2 × 4 ANOVA).

Conclusions The type of course delivery was not associated with significant differences in student academic success in Anatomy and Chemistry courses in the medical curriculum. Students can successfully pass these courses when they are delivered either in a continual, whole year format or in a condensed time format of a course block, regardless of the number and type of courses preceding the block course.

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In the context of medical curriculum reforms within global restructuring and harmonization of higher education (1,2), gross anatomy still has a core position in the education for a future physician. However, anatomy, together with other basic medical sciences, has moved from classical, dissection-based teaching methods toward integration with other basic and clinical courses, problem-based learning, and distinct clinically-oriented approach (3,4). In a restructured medical curriculum, which now includes new courses and new academic activities, anatomy cannot be anymore taught as it was in the past – long dissection laboratories, spread over the semesters of the academic year and with the emphasis on very detailed knowledge of anatomical structures. Many classical anatomists have voiced concerns for the loss of anatomy class hours and declining dissection time in the modern curriculum (5), although systematic review of published research on dissection as a teaching method in gross anatomy demonstrated that there was a lack of objective evidence and that more rigorous and sophisticated research designs were needed to answer the question about the best way to teach anatomy (6).

In addition to issues such as best teaching methodology and quantity and structure of contact hours in an anatomy course, the temporal organization of an anatomy course has emerged as a problem in many medical schools moving away from a traditional European medical curriculum to a restructured integrated curriculum. In the traditional curriculum (7,8), basic medical science courses in the first 3 curriculum years run in parallel during winter and/or summer semesters, and students can sit the exams at a general examination term during winter and summer. In contrast, clinical courses in the final 3 curriculum years have been traditionally delivered in temporal blocks and students had the opportunity to sit the exams both at the end of the course and during general exam terms. With the curriculum change within the Bologna process of harmonization in higher education in Croatia (2,7), most medical schools also switched to block delivery of basic medical courses. Anecdotal reports from teachers suggested that block teaching of basic medical courses did not lead to satisfactory learning outcomes for students. Furthermore, concerns have been raised that the condensation of the same teaching and learning course load into a limited temporal frame would be detrimental for students' psychological well-being and the ability to cope with the burden of the first year of the medical study. The psychological stress of the first curriculum year has been described both in medical (9,10) and non-medical university settings (11), indicating that the students perceive the first year of study as a survival course and use learning strategies suited to such an environment. In medicine, this psychological stress may be particularly related to anatomy, as the first truly medical subject requiring the acquisition of special language with more than 5000 terms of the current anatomical nomenclature (12).

The first aim of this study was to investigate possible differences in the outcomes of two preclinical medical courses, Anatomy and Chemistry, between continual and block systems of curriculum delivery. The Chemistry course was chosen for 2 reasons. One was that Chemistry course is considered similar to Anatomy course in its importance and difficulty, at the same time being a subject with which most of the students had been familiar already from their pre-university education. The other reason was the temporal sequence of the two courses during block delivery: the two courses were delivered to 2 groups of students, so that one group first attended the Anatomy and then the Chemistry block course and the other group first attended the Chemistry and then the Anatomy block course. This course setting allowed the investigation of possible association between the timing of the courses and their outcomes for students, which was the second aim of this study.

METHODS

Courses

Traditional continual delivery. Until 2002/03 academic year, the first-year courses at the Zagreb University School of Medicine had been continually taught throughout the year, divided into 2 semesters (Figure 1). All students attended courses running in parallel, which had different total duration and different weekly class hour loads for students.

The Anatomy course was taught twice a week and had a total of 210 class-hours in 2 semesters (27 hours of lectures, 15 hours of seminars, and 48 hours of laboratory practice in the first; and 28 hours of lectures, 35 hours of seminars, and 57 hours of laboratory practice in the second semester). Students' knowledge acquisition during the academic year was monitored at 4 interim written tests during the 2 semesters (A1 – locomotor system, A2 – head and neck, A3 – thorax and abdomen, and A4 – central nervous system and organs of sensation). The course finished at the end of the second semester and the students took the final examination during the summer term exam period in late June. The final examination consisted of 3 consecutive parts: written (100 multiple choice questions; pass level 65% cor-

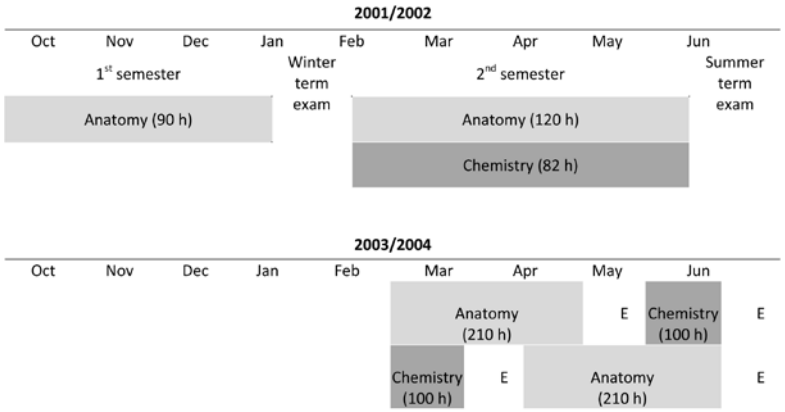
rect answers), practical (30-item stage exam; pass level 21 answers), and oral (set of questions asked by the examiner). Students who had passing grades at all interim tests during the course were waived the written part of the exam. A passing grade from a preceding exam part was required to progress to the next exam part. Students failing the exam had 4 more chances to sit the exam until the beginning of the next academic year.

The Chemistry course in the traditional curriculum, Medical Chemistry and Biochemistry I, had a total of 82 class-hours, all in the second semester (30 hours of lectures, 28 hours of seminars, and 24 hours of laboratory practice). This was the first part of the course, where only chemistry was taught; it was followed by a separate course on biochemistry (Medical Chemistry and Biochemistry II) in the second year of the curriculum. The exam term for the Chemistry course was scheduled during the summer term exam period, and the requirement for the students to sit the exam was to pass a stehiometry colloquium. The final exam consisted of a written multiple-choice test with 60 questions and pass level of 60% correct answers.

Block delivery of courses. In 2002/03 academic year, the change in the medical curriculum according to the Bologna harmonization process in European higher education (7) introduced the delivery of premedical courses in blocks or modules, where students attended a single course at one time, followed by the final examination after the course, usually in two weeks (Figure 1). In the 2002/03 academic year, all courses were delivered in a single block for 3 alternating student groups, but in 2003/04 academic year that was changed to block course delivery for 2 groups of students. Because the 2002/03 academic year was the experimental year for the introduction of block teaching, we analyzed the 2003/04 academic year as the first year with a fully implemented course teaching in blocks.

The Anatomy course in the 2003/04 academic year was offered in a single block for 2 groups of students. Each block lasted 10 weeks, with 210 total class hours as in the traditional continual course in 2001/02, with an average of 4 classes per working day. The content of the course was similar to that in 2001/02, and the knowledge acquisition during the course was monitored at 2 interim written tests, each with 50 multiple-choice questions (pass level: 65% correct answers). The course exam was scheduled in the second week after the end of the course block (Figure 1) and its structure and organization remained the same as in 2001/02.

Figure 1.



Organization of Anatomy and Chemistry courses at the Zagreb University School of Medicine, Zagreb, Croatia, in 2001/02 and 2003/04 academic years. In the second semester of 2001/02 academic year, all students attended the Anatomy and Chemistry courses at the same time. In 2003/04 academic year, one half of the students attended first the Anatomy and then the Chemistry course, and the other half first the Chemistry and then Anatomy course. Numbers in brackets indicate the number of direct teaching hours for each course or its parts. E – final examination from a course.

Medical Chemistry and Biochemistry I was also delivered in a single block, each lasting 4 weeks, for 2 groups of students. The course had 100 class hours (20 hours of lectures, 44 hours of seminars, and 36 hours of laboratory practice), with an average of 5 classes per working day. The course was followed by a written multiple-choice test in the second week after the end of the block (50 questions, pass level: 60% correct answers) and a final oral exam.

The Anatomy and Chemistry course blocks alternated, so that the students who attended first the Anatomy course moved to the Chemistry course. At the same time, the second group of students attended first the Chemistry and then the Anatomy course (Figure 1). The block courses were held in spring of 2004 and were preceded by the following courses, each delivered in a single block for 3 student groups: Biology (4 weeks), Physics (2 weeks), Social Medicine (2 weeks), Elective Courses (2 weeks), and First Aid (1 week).

Data collection

Data on students' success at exams from the two courses in 2 academic years were collected from the student logs of the Department of Anatomy and Department of Chemistry and Biochemistry. For the Anatomy course, the data were available for 243 students in 2001/02 academic year and 260 students in 2003/04 academic year

(n = 132 for the first block and n = 128 for the second block). The data included the grades from two interim tests, practical test, and final oral exam (as a summative grade for the course). The passing grades at Croatian universities range from 2 –satisfactory to 5 – excellent. The data for the Chemistry course included the final exam grades. Only the data for students who passed the course exam at first possible exam term (the first summer exam term for the 2001/02 academic year and the exam after the respective block course for the 2003/04 academic year) were analyzed.

Statistical analysis

As most of the data had normal distribution, they were presented as means ±95% confidence intervals (CI) and parametric procedures were used for the analyses. Although grades are categorical variables, they were presented as means ±95% CI and with two decimal places, as is customary for presenting grade point average in Croatia (8).

Chi square test for comparison of two proportions was used to investigate the differences in proportions of students passing the exam on the first possible exam term between the continual and block delivery format and between the 2 student groups for each course.

We used 2×2 ANOVA to investigate the main effects of two independent variables – curriculum delivery format (continual or block) and courses (Anatomy or Chemistry) on students' grades. The interaction of the two independent variables was also investigated. The same procedure was used to investigate the main effects of the courses (Anatomy or Chemistry) and their temporal sequence during block delivery (Anatomy before Chemistry or Anatomy after Chemistry) on students' grades. Again, the interaction between the two independent variables was also assessed.

Finally, we used mixed between-within subjects 2×4 ANOVA to investigate the differences between students from two blocks (block 1 – Anatomy before Chemistry and block 2 – Anatomy after Chemistry) in grades from 4 different tests in a single anatomy course (interim test 1, interim test 2, practical, and oral exam). *t* test for independent samples was used to separately test pair-wise differences between students from the two blocks in their grades on interim exams. Analyses were performed using SPSS for Windows, version 16 (SPSS Inc., Chicago, IL, USA) and MedCalc statistical software (MedCalc, Mariakerke, Belgium).

Table 1. Successful passing of the final examination from the Anatomy and Chemistry courses in academic years delivering courses either as a continual (2001/02) or a block course (2003/04)

Academic year and type of course delivery	No. (%) students* attending course/block	No. (%) students* passing final exam
Chemistry:		
2001/02	253	96 (38)
2003/04:	255	87 (34)
student group 1	128	41 (32)
student group 2	127	46 (36)
Anatomy:		
2001/02	243	97 (40)
2003/04:	260	123 (47)
student group 1	132	72 (56)
student group 2	128	51 (40)†

*The number of first-year students attending Anatomy or Chemistry course differed, depending on the attendance requirements for students who did not pass the examination in the previous academic year and had to repeat the course.

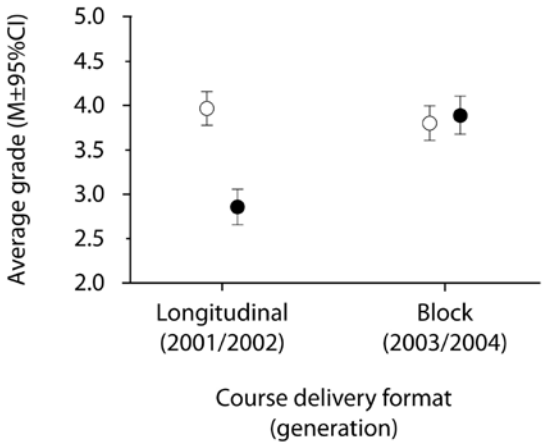
†Significantly different from percentage of students passing Anatomy course exam at the first possible term in block 1 ($P = 0.004$, χ^2 test for comparison of two proportions).

RESULTS

As the aim of the study was to explore the association between the duration of the courses and their temporal delivery, we analyzed the exam success only for students who sat the exam at the first possible term after the course: first summer exam term in 2001/02 and the exam right after the course block in 2003/04. The number of students who successfully passed the final examination at the first possible term from either Anatomy or Chemistry course did not differ between the 2001/02 academic year, when the courses were delivered in a continual format, and the 2003/04 academic year, when similar content and size of the courses were delivered in a condensed form of a course block (Table 1). The fraction of students passing the final exam at the first possible exam term was higher for the Anatomy than Chemistry course in 2003/04 academic year (47% vs 34% students, $P = 0.004$, χ^2 test; Table 1). When we analyzed the number of students who successfully passed the course exams in student group 1, which first attended the Anatomy and then the Chemistry block course, or group 2, which first attended the Chemistry and then the Anatomy block course (Figure 1), the number of students from the group 2 who successfully passed the exam was significantly lower in the Anatomy than in the Chemistry course (Table 1).

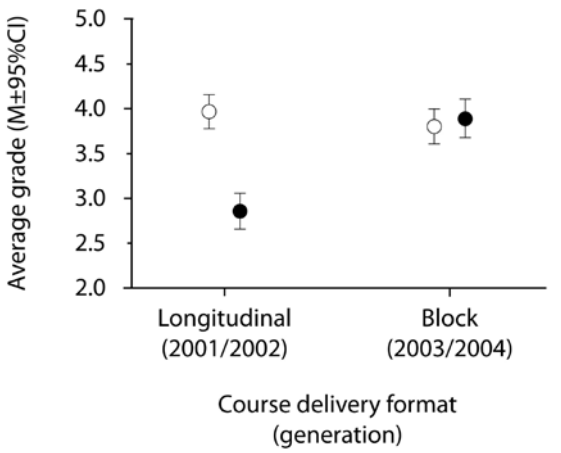
We found significant main effects of both course ($F_{1,399} = 25.1$, $P < 0.001$, 2×2 ANOVA) and delivery format

Figure 2.



Average grades (mean [M]±95% confidence interval [CI]) at final examination from the Anatomy – open circles and Chemistry course – closed circles courses in academic years delivering courses either as a continual (2001/02) or a block course (2003/04). Passing examination grades at Croatian universities range from 2 – satisfactory to 5 – excellent.

Figure 3.



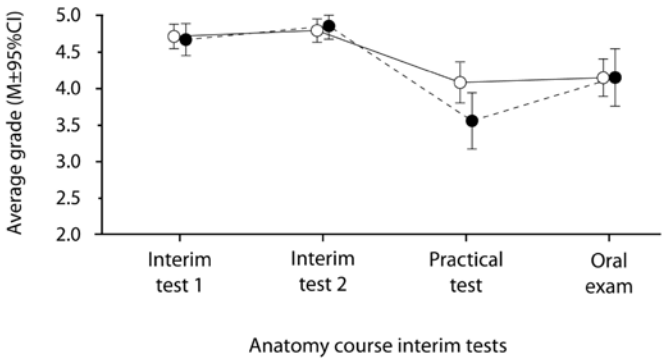
Average grades (mean [M] ±95% confidence interval [CI]) at final examination from the Anatomy – open circles and Chemistry course – closed circles block courses delivered in 2 different sequences to two group of students blocks in 2002/04 academic year. Passing examination grades at Croatian universities range from 2 – satisfactory to 5 –excellent.

($F_{1,399}=18.4$, $P<0.001$, 2×2 ANOVA) on obtained grades, indicating that they were generally lower in the Chemistry than in Anatomy course and also generally lower in continual than in block delivery format. However, the significant interaction between the course and delivery format ($F_{1,399}=35.1$, $P<0.001$, 2×2 ANOVA) revealed that both main effects were due to lower Chemistry course grades obtained by students to whom it was delivered in continual format (Figure 2).

We found no significant main effect of either course format ($F_{1,206}=0.6$, $P=0.442$, 2×2 ANOVA) or the sequence of courses in block format ($F_{1,206}=1.8$, $P=0.182$, 2×2 ANOVA). There was also no significant interaction effect ($F_{1,206}<0.1$, $P>0.950$, 2×2 ANOVA; Figure 3).

Finally, we analyzed all knowledge assessment tests during and at the end of the Anatomy course for students who qualified for the final examination by passing 2 interim written tests and being waived the written part of the final exam (Figure 4). The number of such students was significantly lower in group 2 (Anatomy after Chemistry block) than in group 1 (Anatomy before Chemistry block): 21% vs 47% ($P<0.001$, test of proportions). We found no differences in grades between students from the two blocks ($F_{1,87}=1.0$, $P=0.313$, between-within subjects 2×4 ANOVA). There was a significant difference in their grades on

Figure 4.



Final examination success of students who qualified for final practical and oral exam by passing 2 interim tests from Anatomy block course delivered to 2 student groups in 2003/04 academic year. Passing examination grades at Croatian universities range from 2 – satisfactory to 5 – excellent. Marks are expressed as means (M)±95% confidence interval (CI). Open circles – student group 1 (Anatomy before Chemistry); closed circles – student group 2 (Anatomy after Chemistry).

the interim assessments ($F_{3,85}=28.8$, $P<0.001$, between-within subjects 2×4 ANOVA), with grades from practical test and oral exam being significantly lower than grades on 2 interim tests ($P<0.001$ for all pair-wise comparisons; Figure 4). Within subjects contrasts analysis of the interim test grades revealed a significant decreasing

linear trend ($F_{1,87}=48.2$, $P<0.001$, between-within subjects 2×4 ANOVA). Although students from group 2 obtained lower grades on the practical test than their peers from group 1 ($P=0.036$, independent samples ***t*** test; Figure 4); the interaction effect between tests and student groups was not significant ($F_{3,85}=2.4$, $P=0.070$, between-within subjects 2×4 ANOVA).

DISCUSSION

Our study demonstrated that the outcome of the Anatomy and Chemistry courses in the first-year curriculum generally did not differ between the academic years when these courses were delivered in alternating temporal blocks or when they were spread over the academic year. Furthermore, the outcome of the courses were similar when they were delivered as course blocks to 2 student groups in an alternating sequence in the same academic year. These findings imply that the type of temporal delivery of a basic course in a medical curriculum is not a major determinant of students' academic courses, especially as the two types of delivery were related to the similar examination success in these structure and teachers involved, as well as the content of the course.

The findings of the study have to be evaluated in the view of study limitations, primarily its observational design, which does not allow us to make conclusions about causative relationship between the type of temporal delivery of the course and its outcome for students. We used a historical control of a different academic year with the traditional delivery of the courses for comparison with courses delivered in time blocks. These student cohorts differed not only in the type of course delivery, but in many other factors that could possibly influence the outcome of the course, such as exact instruction time, teachers' involvement, availability of textbooks and other teaching materials, and general change in the medical curriculum. This was the reason why we did not compare the success at Anatomy interim exams for the 2 academic years, as the number and timing of the interim exams differed, which would even more preclude the making of meaningful conclusions about knowledge acquisition during the continual or block course delivery.

The increase in the average exam grade observed for the Chemistry course between the students cohorts with continual and block delivery may be related to several factors other than the temporal type of course delivery. One of them may be the change in the exam structure because the final exam in the 2001/02 academic year was based only on a written test, whereas in the 2003/04 academic year it included both a written test and final oral exam. The increase in the average exam grade between these two years may thus be related to decreased expectations of examiners, as it has been shown for anatomy courses in 8 medical schools from The Netherlands, where the anatomy teachers had the lowest expectations about students' knowledge of clinical anatomy, compared with clinicians, recent graduates, and students from higher years of study (13). The increase in average grades may also be a part of a general trend of grade increase reported for some courses at the Zagreb University School (14). Finally, possible limitation of the study could be the choice of the study sample, which included only students who passed the course exams at the first possible exam term after the end of the course (about a third for Chemistry course students and about a half for Anatomy course students). Our primary aim was to assess how the temporal delivery of the courses and their place in the academic year calendar affected the outcome of the studying during the course, and not the overall impact of course delivery on the requirements for the enrolment in the next year. Students had at least 3 more opportunities to sit the exams until the end of the academic year, but analysis of success at these exams would introduce more confounding factors, including difference in the difficulty of the written or practical part of the exam, number of students sitting for the exams, and attitudes of the teachers toward students coming to different exam terms. Our current research is focused on a more comprehensive analysis of the type of course delivery and academic success of all students after the change from continual course delivery to block course delivery.

The comparison between 2 different student groups which attended the Anatomy and Chemistry block courses in alternating sequence was performed on the same cohort of students but was limited by its quasi-experimental design because the students were not randomly allocated to the groups. The difference in grades for the 2 students groups of the Anatomy block course was found only for the practical test grade. The significance of this finding should be interpreted with caution as there is no evidence on the reliability of the scores or grades from practical laboratory examinations (tag tests) in Anatomy (6). It may also be related to the choice of structures for the test by the examiners.

The limitation of the study was that we used a single and summative assessment measure of the course outcome – grade at the final examination. Examination grade is not a

true reflection of a specific learning outcome of the course, but rather a reflection of students' ability to pass an examination (6). It has been documented that students usually compensate for any educational intervention, driven by their wish to pass the course and receive good grades (6). A true learning outcome from a course would depend on a number of factors, including, but not limited to, the prior knowledge of the students; their intelligence; emotional concerns; self-instruction time; quality of lectures, seminars, and practical laboratories; quality of course materials; teacher performance; teacher-to-student ratio and cadaver-to-student ratio; active dissection time; and quality of cadaver material for the anatomy course (6). Some of these factors are difficult to measure and others vary from an academic year to another, so it would be virtually impossible to account for all of them in most experimental research designs.

Given these methodological constraints, it can be concluded that there is no sufficient evidence that the type of temporal framework for course delivery and time sequence of Anatomy and Chemistry courses influence students' grades in general. More methodologically rigorous studies are needed to address this complex issue but the decision on the best timing and duration of an individual course should be based on best available evidence and not on educational tradition or fashion of the day.

For individual students, coping with the time allocated for the Anatomy course was not easy. The analysis of grades in the sequence of interim knowledge test and final exam for the students with best academic performance showed a significant decreasing trend from the beginning to the end of the block course, regardless of its timing with other courses, especially the Chemistry course. This finding indicates that the Anatomy course, regardless of the number, duration, or difficulty of the preceding courses, is an intellectually demanding task, even for the academically most successful students. Faced with such a physically and psychologically demanding course (15), students may change their learning strategies (11), reflected in the change in grades obtained at sequential knowledge tests, as observed in this study. Differences in the type of examination (written multiple-choice test vs practical stage exam) and their importance (interim tests vs summative grades on the final exam) may have also contributed to the decreasing trend in course grades.

In conclusion, there is little evidence that focusing on the duration and best timing of preclinical courses is relevant for a successful change in a medical curriculum, at least within the framework of an academic setting following the central European tradition in medical teaching (7). What we can recommend on the basis of the general findings of this study is that medical educators should focus more on the content, size, and quality of their basic medical courses such as Anatomy and Chemistry (15,16). To achieve this commendable goal, educators should focus on how much knowledge should be acquired in a course (13) and pursue scientifically rigorous research into curricular interventions to promote high-quality learning relevant for the practice of medicine.

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References

1 Prideaux D. Think global, act regional: promoting change in medical education. Med Educ. 2005;39:756-7. Medline:16048614 doi:10.1111/j.1365-2929.2005.02240.x

2 European University Association. Activities. Bologna Process. Joint Declaration of the European Ministers of Education convened in Bologna on 19 June 1999. Avaliable from: http://www.eua.be/eua/jsp/en/upload/OFFDOC_BP_bologna_declaration.1068714825768.pdf. Accessed: December 29, 2008.

3 Azer SA, Eizenberg N. Do we need dissection in an integrated problem-based learning medical course? Perceptions of first- and second-year students. Surg Radiol Anat. 2007;29:173-80. Medline:17318286 doi:10.1007/s00276-007-0180-x

4 McKeown PP, Heylings DJ, Stevenson M, McKelvey KJ, Nixon JR, McCluskey DR. The impact of curricular change on medical students' knowledge of anatomy. Med Educ. 2003;37:954-61. Medline:14629407 doi:10.1046/j.1365-2923.2003.01670.x

5 Granger NA. Dissection laboratory is vital to medical gross anatomy education. Anat Rec B New Anat. 2004;281:6-8. Medline:15558779 doi:10.1002/ar.b.20039

6 Winkelmann A. Anatomical dissection as a teaching method in medical school: a review of the evidence. Med Educ. 2007;41:15-22. Medline:17209888 doi:10.1111/j.1365-2929.2006.02625.x

7 Likic R, Dusek T, Horvat D. Analysis and prospects for curricular reform of medical schools in Southeast Europe. Med

Educ. 2005;39:833-40. Medline:16048626 doi:10.1111/j.1365-2929.2005.02228.x

8 Lukic IK, Gluncic V, Katavic V, Petanjek Z, Jalsovec D, Marusic A. Weekly quizzes in extended-matching format as a means of monitoring students' progress in gross anatomy. Ann Anat. 2001;183:575-9. Medline:11766531

9 Aktekin M, Karaman T, Senol YY, Erdem S, Erengin H, Akaydin M. Anxiety, depression and stressful life events among medical students: a prospective study in Antalya, Turkey. Med Educ. 2001;35:12-7. Medline:11123589 doi:10.1046/j.1365-2923.2001.00726.x

10 Wolf TM, Scurria PL, Webster MG. A four-year study of anxiety, depression, loneliness, social support, and perceived mistreatment in medical students. J Health Psychol. 1998;3:125-36. doi:10.1177/135910539800300110

11 Zeegers P. Approaches to learning in science: a longitudinal study. Br J Educ Psychol. 2001;71:115-32. Medline:11307704 doi:10.1348/000709901158424

12 Federative Committee on Anatomical Terminology. Terminologia anatomica. International anatomical terminology. Stuttgart, New York: Thieme; 1998.

13 Prince KJ, Scherpbier AJ, van Mameren H, Drukker J, van der Vleuten CP. Do students have sufficient knowledge of clinical anatomy? Med Educ. 2005;39:326-32. Medline:15733169 doi:10.1111/j.1365-2929.2005.02096.x

14 Bergovec M, Kuzman T, Rojnic M, Makovic A. Is there grade inflation at medical schools? Case study of the Zagreb University School of Medicine. Croat Med J. 2003;44:92-7. Medline:12590436

15 Mattick K, Knight L. High-quality learning: harder to achieve than we think? Med Educ. 2007;41:638-44. Medline:17614883 doi:10.1111/j.1365-2923.2007.02783.x

16 Chowdhury R, Wilson ID, Oeppen RS. The departments of radiology and anatomy: new symbiotic relations? Clin Radiol. 2008;63:918-20. Medline:18625358 doi:10.1016/j.crad.2008.03.004