Curriculum Reform in Medical Education: Does It Work?

Sarah Leupen, University of Maryland Baltimore County

Discipline-Based Or "Traditional" Curricula:

- Learning was viewed as a simple accumulation of knowledge
- An understanding of *normal* structure and function was viewed as a prerequisite for learning about *abnormal* structure and function
- There was little deliberate instruction in the application of basic science material to clinical problems, particularly during the first years of medical school.

Swanson and Case, Advances in Health Sciences Education, 2:71-84, 1997.

Integrated or "Modern" Curricula:

- There is much greater emphasis on learning basic science material in the context of its clinical application, even in the first year of medical school
- The majority of North American medical schools now report the use of some problem-based learning variant for at least a portion of curricular time, (e.g., case-based learning; learning in small groups)

Swanson and Case, Advances in Health Sciences Education, 2:71-84, 1997.

AMEE GUIDE

The integrated curriculum in medical education: AMEE Guide No. 96

DAVID G. BRAUER[1] & KRISTI J. FERGUSON[2]
[1]Washington University School of Medicine, USA, [2]University of Iowa, USA

2015 Review

Assessing integration

Perhaps the most discouraging commonality observed in the literature on integrated curricula is the scarcity of published long-term effectiveness of such efforts. Useful retrospective reviews are available but are often limited to opinions based on group consensus or surveys (Lowitt 2002; Davis & Harden 2003; Brunger & Duke 2012). Outcomes trials exist despite the inherent challenges in establishing a truly controlled trial of a curriculum and often show at least non-inferiority if not objective benefits for the learner in an integrated setting (Van der Veken et al. 2009; Hirsh et al. 2012).

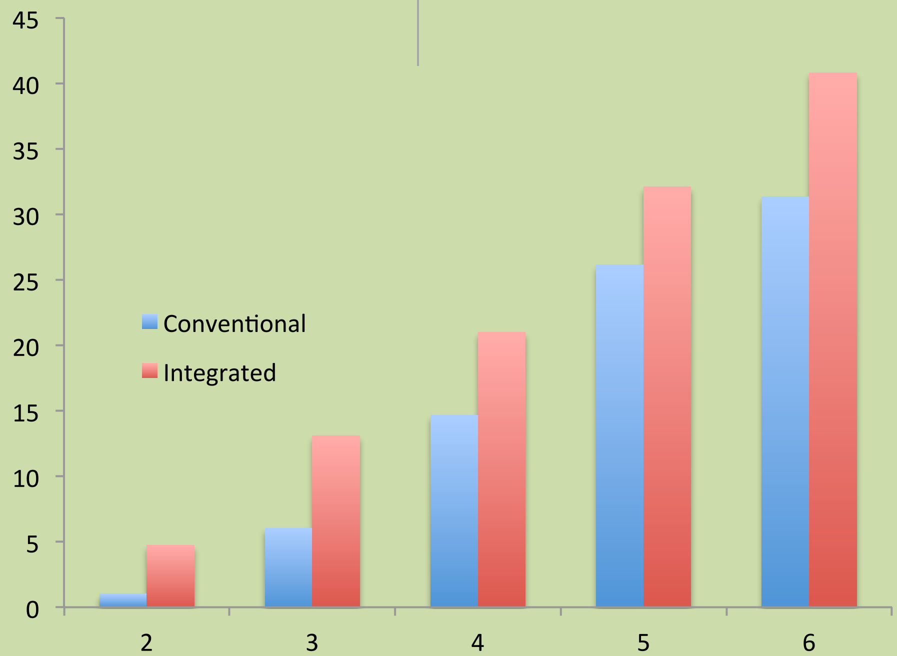
Impact on knowledge acquisition of the transition from a conventional to an integrated contextual medical curriculum

Jos Van der Veken,[1] Martin Valcke,[2] Jan De Maeseneer,[3] Lambert Schuwirth[4] & Anselm Derese[5]

Table 3 Cross-sectional comparison of scores on the Dutch Inter-University Progress Test (PT) (percentage correct-minus-incorrect) for basic and clinical sciences in CMC and ICMC student samples studying at Ghent University from 1999 to 2006 (one-way ANOVA)

	CMC students sample 1		ICMC students sample 2			Effect size
Curricular year	Mean PT score (SD)	Students, *n*	Mean PT score (SD)	Students, *n*	*F*	Cohen's *d*
Basic sciences						
2	9.98 (8.07)	95	14.37 (9.16)	963	20.35†	0.51
3	20.13 (8.81)	107	31.45 (11.69)	720	92.83†	1.09
4	30.15 (11.83)	322	33.46 (11.70)	578	16.52*	0.28
5	34.13 (11.29)	200	37.22 (13.66)	413	7.68*	0.25
6	37.02 (12.61)	330	41.44 (12.63)	239	17.03†	0.35

* $P < 0.01$
† $P < 0.001$

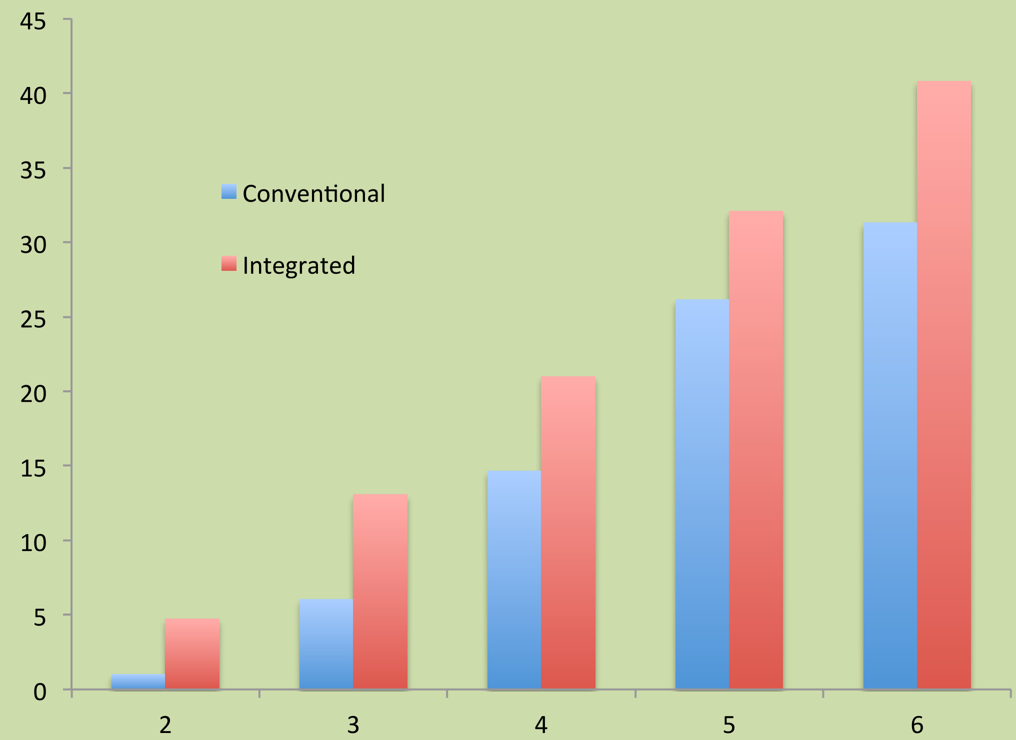


Medical Education 2009 43:704-713.

Table 3 Cross-sectional comparison of scores on the Dutch Inter-University Progress Test (PT) (percentage correct-minus-incorrect) for basic and clinical sciences in CMC and ICMC student samples studying at Ghent University from 1999 to 2006 (one-way ANOVA)

	CMC students sample 1		ICMC students sample 2			
Curricular year	**Mean PT score (SD)**	**Students, *n***	**Mean PT score (SD)**	**Students, *n***	***F***	**Effect size Cohen's *d***
Clinical sciences						
2	1.02 (4.11)	95	4.74 (5.03)	963	48.60†	0.81
3	6.04 (4.33)	107	13.09 (7.01)	720	102.20†	1.21
4	14.66 (7.07)	322	21.00 (8.17)	578	136.95†	0.83
5	26.14 (9.95)	200	32.09 (10.57)	413	44.46†	0.58
6	31.32 (9.95)	330	40.82 (10.77)	239	108.16†	0.88

* $P < 0.01$
† $P < 0.001$
Effect size based on Cohen's *d*: small effect (> 0.20); medium effect (> 0.50); large effect (> 0.80)
CMC = conventional medical curriculum; ICMC = integrated contextual medical curriculum; SD = standard deviation



Medical Education 2009 43:704-713.

Graduates from vertically integrated curricula

Marjo Wijnen-Meijer and Olle ten Cate, Center for Research and Development of Education, University Medical Center Utrecht, the Netherlands
Marieke van der Schaaf, Department of Education, Utrecht University, the Netherlands
Sigrid Harendza, Department of Internal Medicine, University Medical Center Hamburg-Eppendorf, Hamburg, Germany

The Clinical Teacher 2013; 10: 155–159

Table 1. Overall table of means (and standard deviations)

	To what extent…	Utrecht	Hamburg
1.	are graduates prepared for the work at your department?	3.47 (0.76)	3.67 (0.72)
2.	have graduates enough biomedical knowledge?	3.12 (0.70)	2.97 (0.80)
3.	have graduates enough clinical knowledge?	3.36 (0.65)	3.31 (0.75)
4.	have graduates enough pathophysiological knowledge of diseases?	3.09 (0.88)	3.11 (0.88)
	Scale for knowledge (2–4)	*3.19 (0.64)*	*3.28 (0.54)*
5.	are graduates capable to work independently?**	3.64 (0.78)	3.00 (0.90)
6.	are graduates capable to solve medical problems?*	3.44 (0.71)	3.05 (0.86)
7.	are graduates capable to manage unfamiliar medical situations?**	3.35 (0.54)	2.64 (0.71)
8.	are graduates capable to prioritise their tasks?**	3.41 (0.61)	2.53 (0.77)
9.	are graduates capable to collaborate with other people?**	4.15 (0.62)	3.64 (0.80)
10.	are graduates capable to judge when they should consult their supervisors?*	3.97 (0.59)	3.50 (0.95)
11.	are graduates capable to reflect on their activities?*	3.72 (0.68)	3.25 (0.87)
12.	are graduates capable to behave professionally with regard to patients?	3.76 (0.61)	3.45 (1.06)
13.	are graduates capable to manage stressful situations?	3.38 (0.65)	3.25 (0.81)
	*Scale for capability (5–13)***	*3.65 (0.49)*	*3.17 (0.46)*

*$p < 0.05$; **$p < 0.01$.

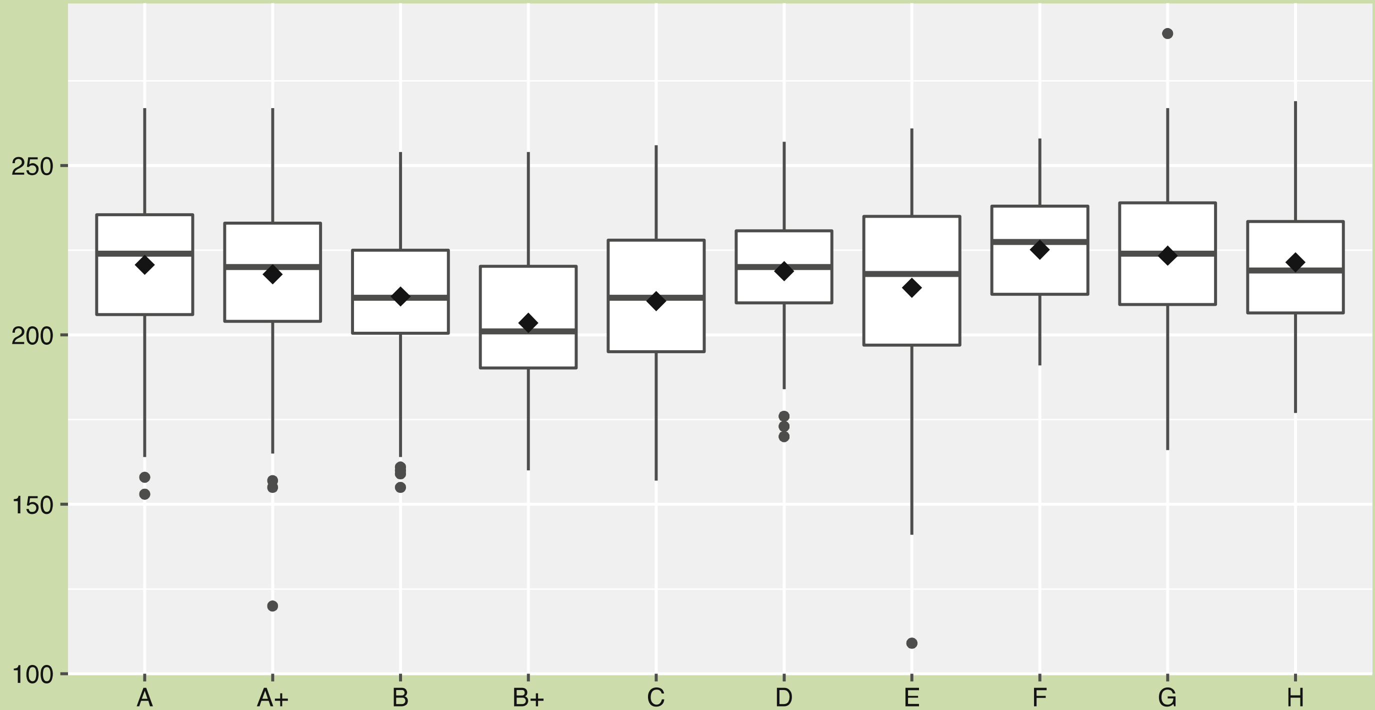
Med.Sci.Educ.
DOI 10.1007/s40670-016-0368-y

ORIGINAL RESEARCH

Curricular Reform in Two Medical School Tracks and the Impact on USMLE Scores

Michele B. Lundy[1] · Cynthia A. Standley[2] · Anton H. Westveld[3,4]

USMLE Step 1 (Preclinical)



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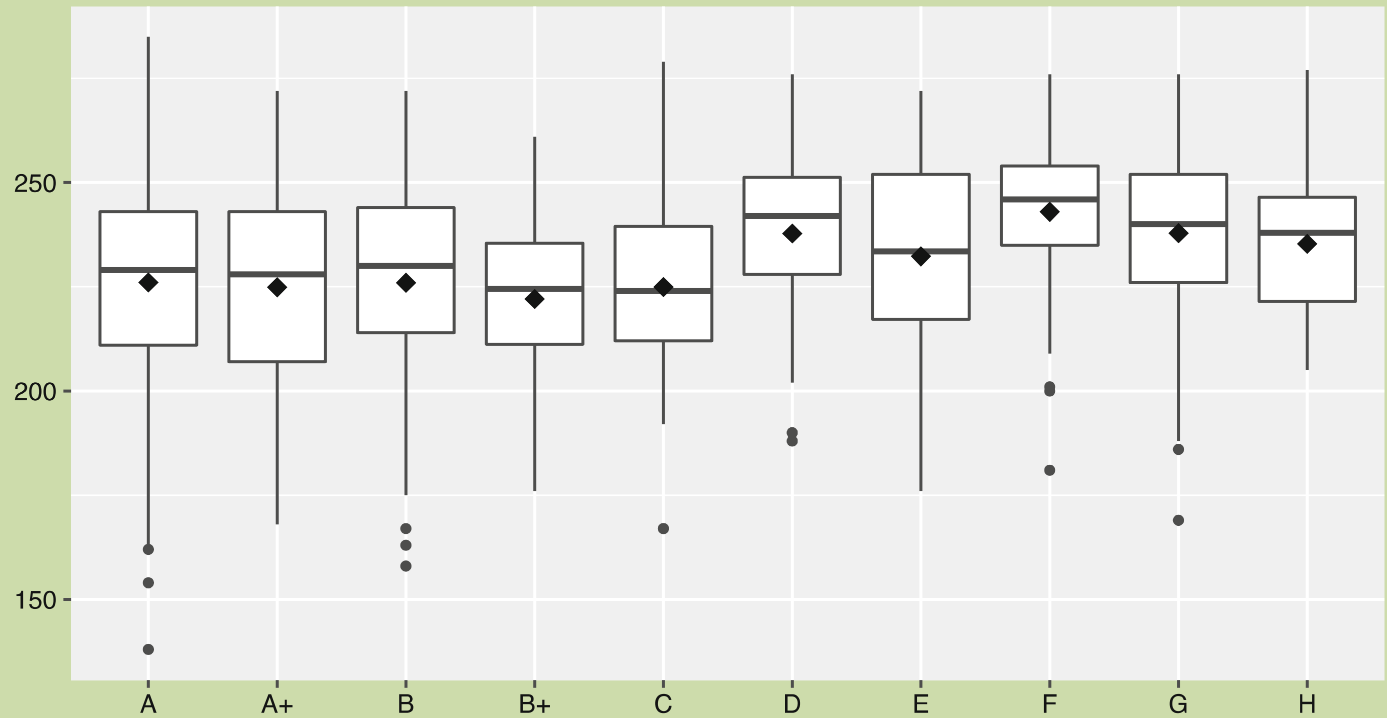
ORIGINAL RESEARCH

Curricular Reform in Two Medical School Tracks and the Impact on USMLE Scores

Michele B. Lundy[1] · Cynthia A. Standley[2] · Anton H. Westveld[3,4]

USMLE Step 2 (Clinical)



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CrossMark

ORIGINAL RESEARCH

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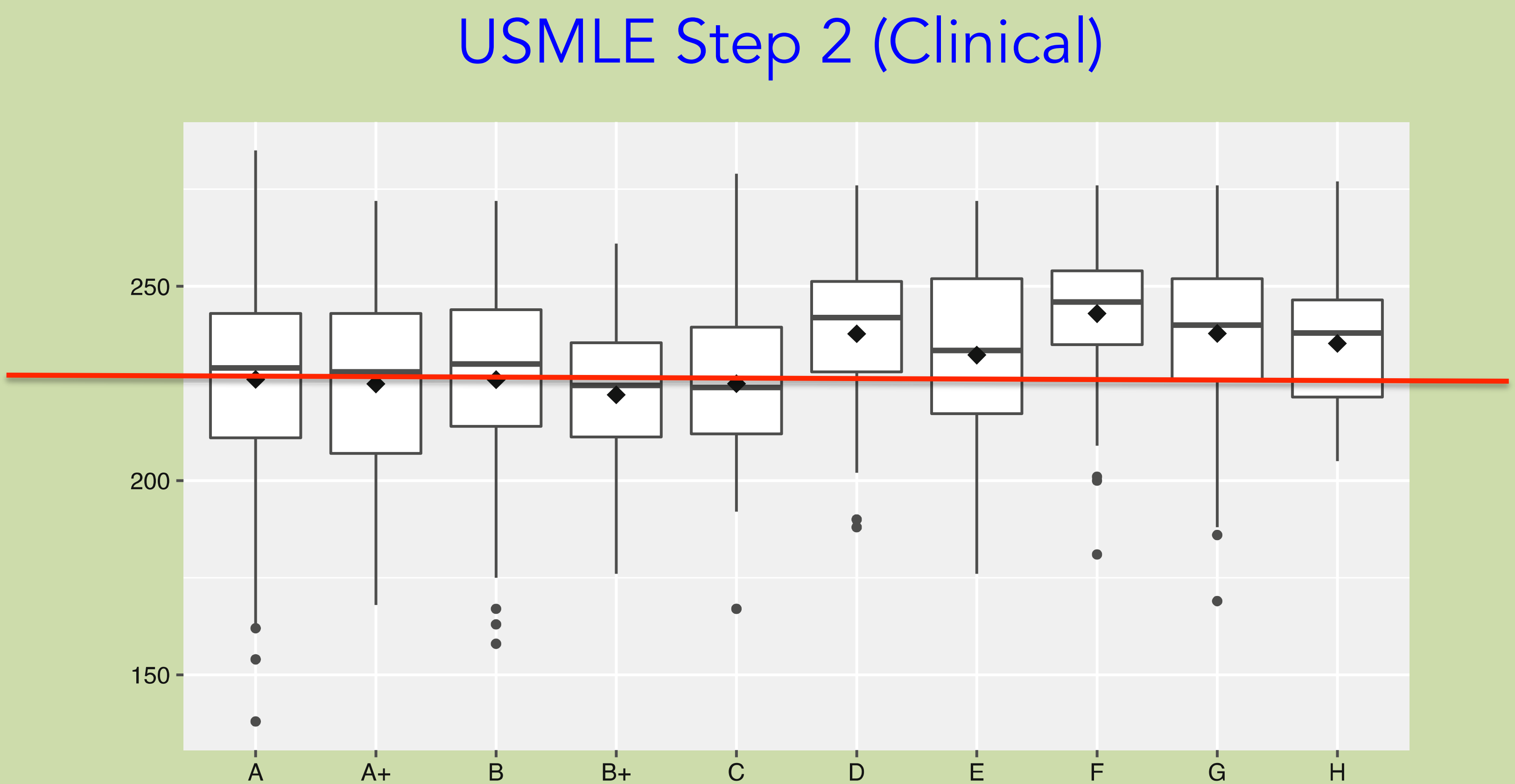


Med.Sci.Educ. DOI 10.1007/s40670-016-0368-y

The Strategic Impact of a Changing Curriculum and Learning Environment on Medical Students' Academic Performance

Pamela C. Williams, MD; Anna Cherrie Epps, PhD; Sametria McCammon, MSPH

Table 13. NBME USMLE Step 1 and NBME USMLE Step 2 Clinical Knowledge Scores for the Control and Intervention Groups

	Control Group	
	NBME USMLE Step 1	**NBME USMLE Step 2**
Score	73.7	83.7
National mean	93	96.3
Difference from national mean	19.3% points below	12.6% points below
	Intervention Group	
	NBME USMLE Step 1	**NBME USMLE Step 2**
Score	85	88.7
National mean	93	96.3
Difference from national mean	8% points below	7.6% points below

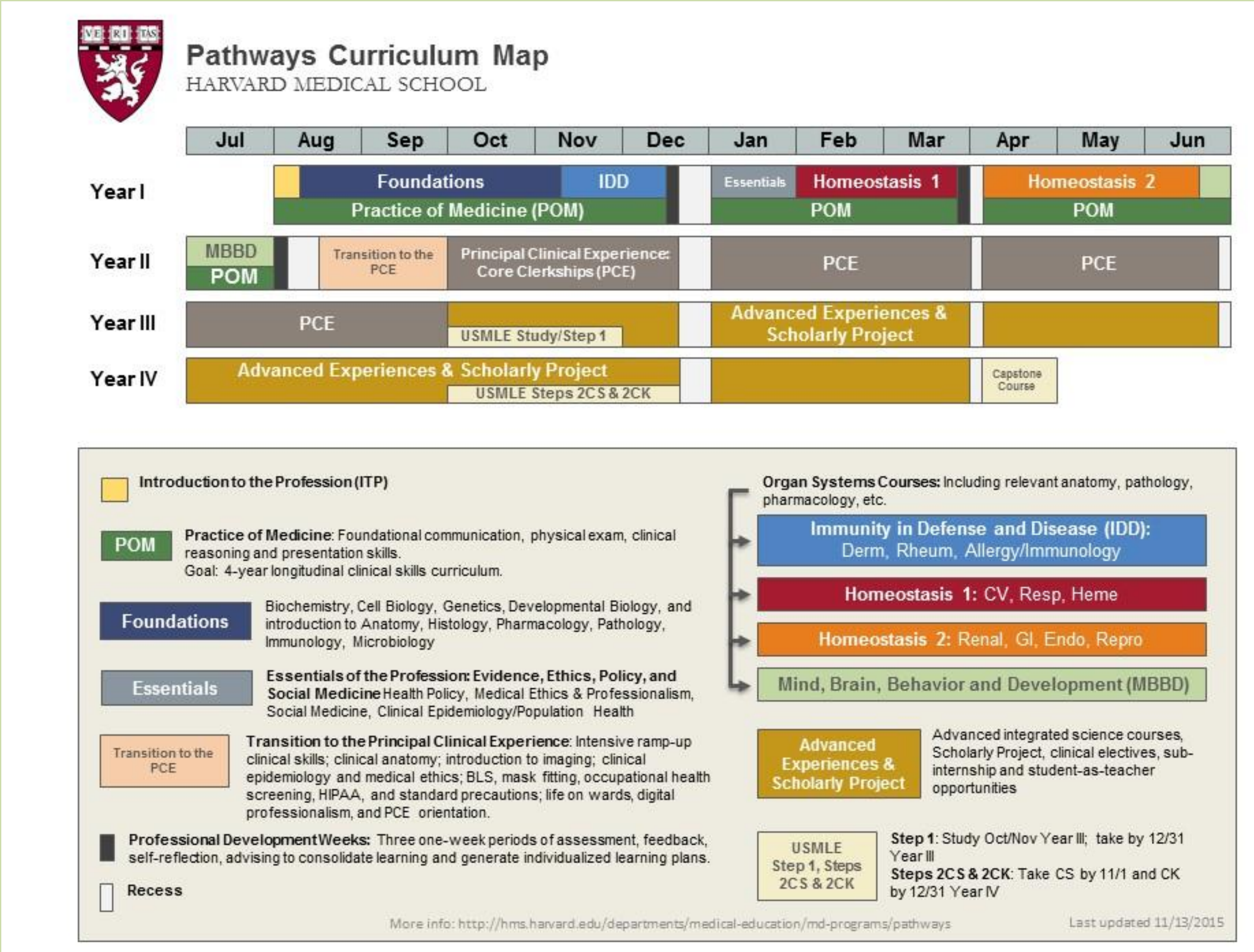
Abbreviations: NBME, National Board of Medical Examiners; USMLE, United States Medical Licensing Examination.

HARVARD
MEDICAL SCHOOL

Pathways

Beginning in August 2015, Harvard Medical School launched an innovative new curriculum – *Pathways*. This bold revision of the MD curriculum incorporates pedagogical approaches that foster active learning and critical thinking; earlier clinical experience; and advanced clinical and student-tailored basic/population science experiences that will provide customized pathways for every student.

HARVARD
MEDICAL SCHOOL



Medical Education at Yale

1. **Integration**: Basic, clinical, and social sciences are integrated throughout all years of the curriculum.

- The design and implementation of the curriculum are interdisciplinary and interdepartmental.
- Basic scientists and clinicians plan and teach together to assure that the curriculum repeatedly emphasizes and demonstrates the importance of the basic sciences in understanding and practicing clinical medicine.
- Educators understand how their teaching fits into the goals and content of the overall curriculum and communicate this perspective to students.
- Residents and faculty model and reinforce the skills and professional attitudes we want our students to emulate.
- Students understand the structure of the curriculum and their professional responsibility within it.
- Students have early clinical experiences to provide inspiration and context for learning the scientific foundations of medicine.

- The curriculum design be flexible and provide opportunities as well as time for students to explore their interests and pursue inpidual goals.
- Students accept their responsibility to actively participate in the curriculum and recognize that certain activities require their presence and engagement in order for effective learning and meaningful assessment to take place. This becomes increasingly important as the curriculum continues to shift toward small groups that rely on interactive discussion and collaborative case-based learning.
- Assessment methods emphasize an ability to correlate and apply knowledge rather than recite information, and include multiple opportunities for direct observation by and feedback from faculty and other educators*. Students embrace the importance of feedback as a means of assuring they have acquired the knowledge, skills, and professional attributes to prepare them for residency and exceptional medical practice.

University of BRISTOL

- Early clinical exposure in hospital and community settings
- A blend of lectures, case-based learning and practical work
- State of the art anatomy facilities including cadaveric prosections
- Inter-professional working with students of nursing, pharmacy and physiotherapy
- Integration of basic science and clinical learning throughout the course
- A substantial student choice programme to explore personal interests in more detail and to experience potential career options
- Completion of a research project of your choice
- An exciting opportunity to study abroad as part of our final year elective
- A final year that is constructed explicitly to prepare you for your first job as a foundation doctor

Curriculum or Pedagogy?

- Emphasis of reform can be curricular, pedagogical, or both

- Because of data on **pedagogy** (not curriculum), ***American medical schools can no longer be reaccredited*** if they use primarily lectures

Curriculum or Pedagogy?

- Emphasis of reform can be curricular, pedagogical, or both

- Because of data on **pedagogy** (not curriculum), ***American medical schools can no longer be reaccredited*** if they use primarily lectures

- **Pedagogical changes that have been shown to improve learning:**
  - Students *use* information in class to consider conceptual or realistic problems
  - Students work in teams
  - Students receive frequent feedback about their understanding before the exams

Problem-Based Learning Outcomes: Ten Years of Experience at the University of Missouri—Columbia School of Medicine

Kimberly Hoffman, PhD, Michael Hosokawa, EdD, Robert Blake Jr., MD,
Linda Headrick, MD, MS, and Gina Johnson

USMLE Step 1 (Preclinical)

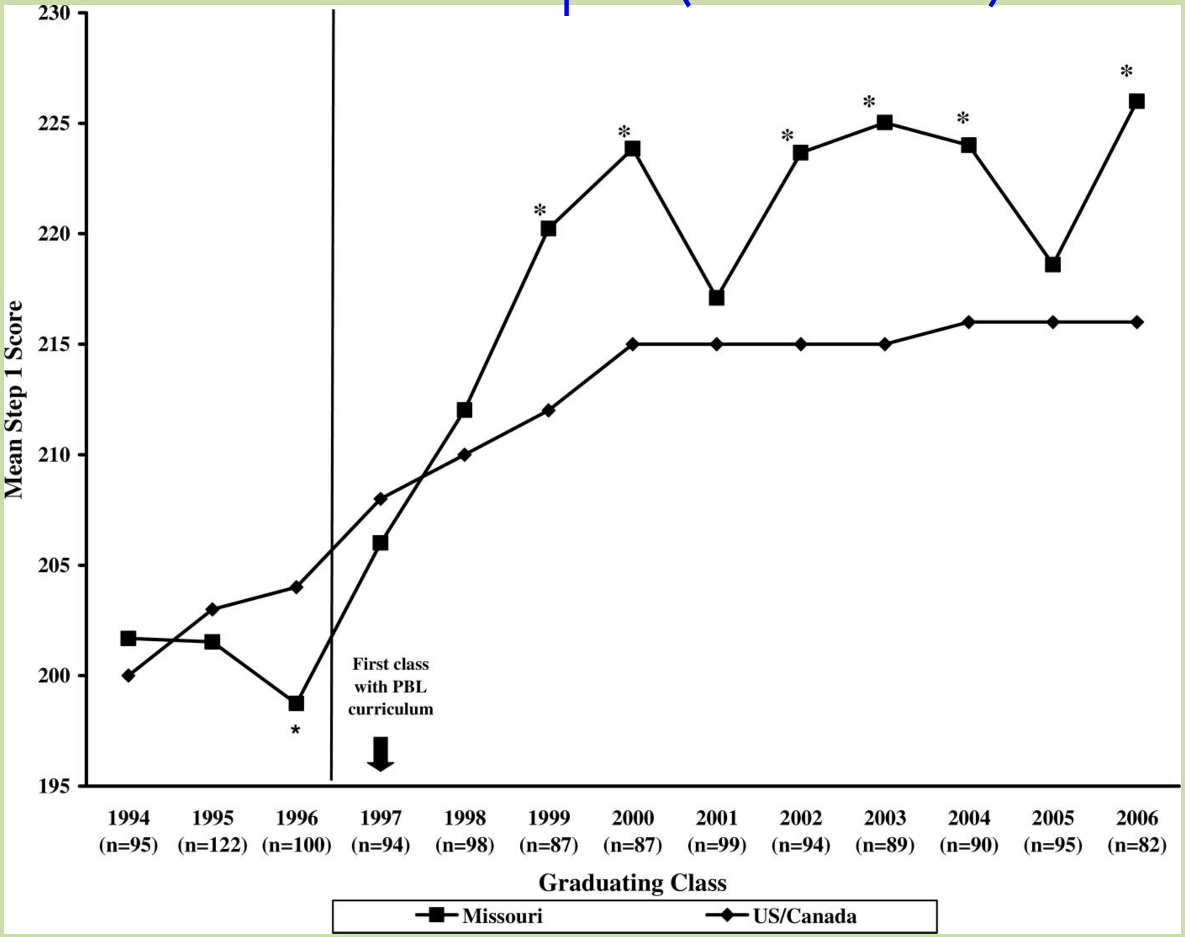


Figure 2 Mean scores for Step 1 of the United States Medical Licensing Examination (USMLE) for graduating classes 1994–2006, University of Missouri—Columbia School of Medicine, and corresponding U.S. and Canadian scores. Scores for both groups are for first-time test takers. *Indicates $p < .01$ for difference between means.

Academic Medicine, Vol. 81(7):617-625, 2006

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Kimberly Hoffman, PhD, Michael Hosokawa, EdD, Robert Blake Jr., MD,
Linda Headrick, MD, MS, and Gina Johnson

USMLE Step 2 (Clinical)

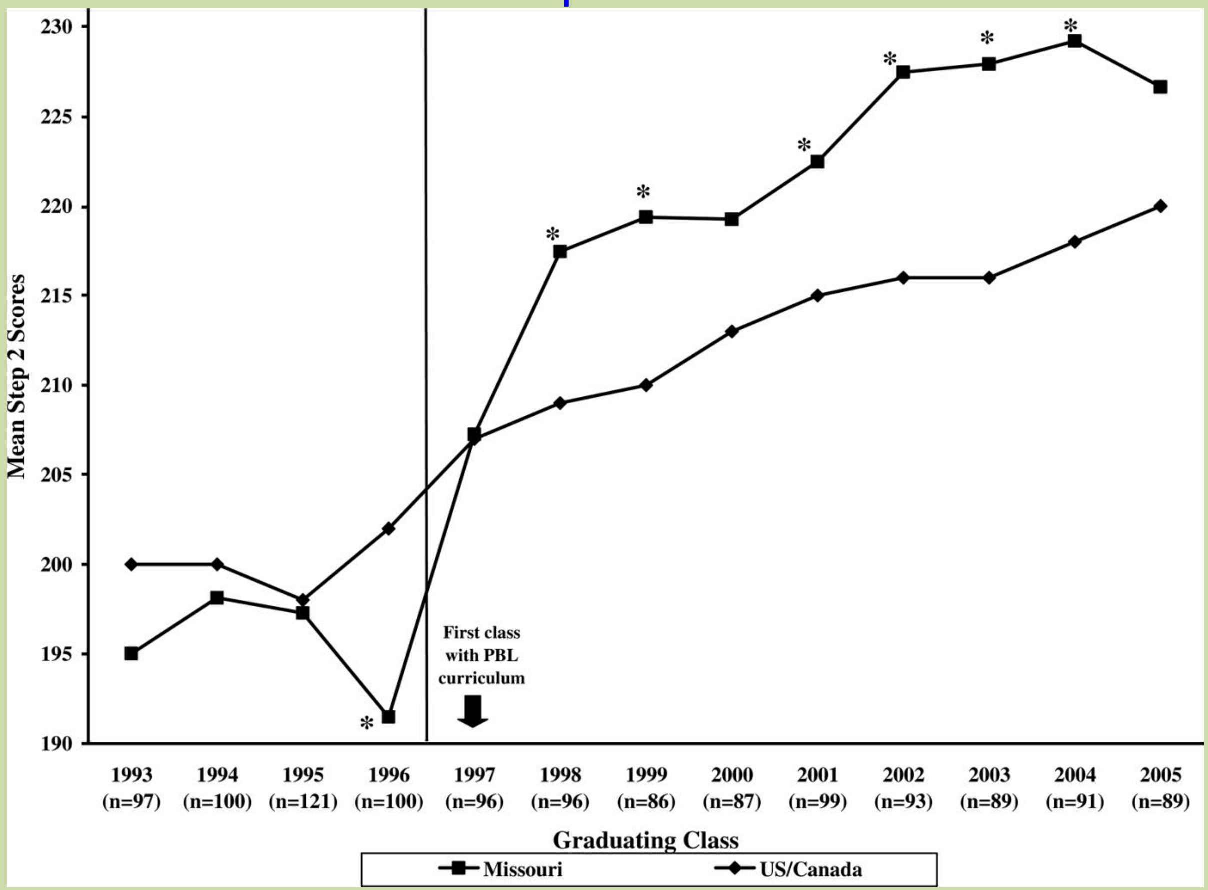


Figure 3 Mean scores for Step 2 of the United States Medical Licensing Examination (USMLE) for graduating classes 1993–2005, University of Missouri—Columbia School of Medicine, and corresponding U.S. and Canadian scores. Scores for both groups are for first-time test takers. *Indicates $p <. 01$ for difference between means.

Academic Medicine,
Vol. 81(7):617-625,
2006

Effects of problem-based learning: a meta-analysis

Filip Dochy [a,b,*], Mien Segers [b], Piet Van den Bossche [b], David Gijbels [b]

[a] *University of Leuven, Afdeling Didactiek, Vesaliusstraat 2, 3000 Leuven, Belgium*
[b] *University of Maastricht, The Netherlands*

Table 1
Main effects of PBL

Outcome[b]	Sign.+[c]	Sign.−[c]	Studies *N*[d]	Average *ES* Unweighted	Average *ES* Weighted (CI 95%)	*Qt*
Knowledge	7	15	18	−0.776	−0.223 (+/−0.058)	1379.6 (*p*=0.000)
Skills	14	0[a]	17	+0.658	+0.460 (+/−0.058)	57.1 (*p*=0.000)

[a] Two-sided sign-test is significant at the 5% level.
[b] All weighted effect sizes are statistically significant.
[c] +/− number of studies with a significance (at the 5% level) positive/negative finding.
[d] the number of total nonindependent outcomes measured.

Learning and Instruction 13 (2003) 533–568

Assessing the effectiveness of problem-based learning in physical diagnostics education in China: a meta-analysis

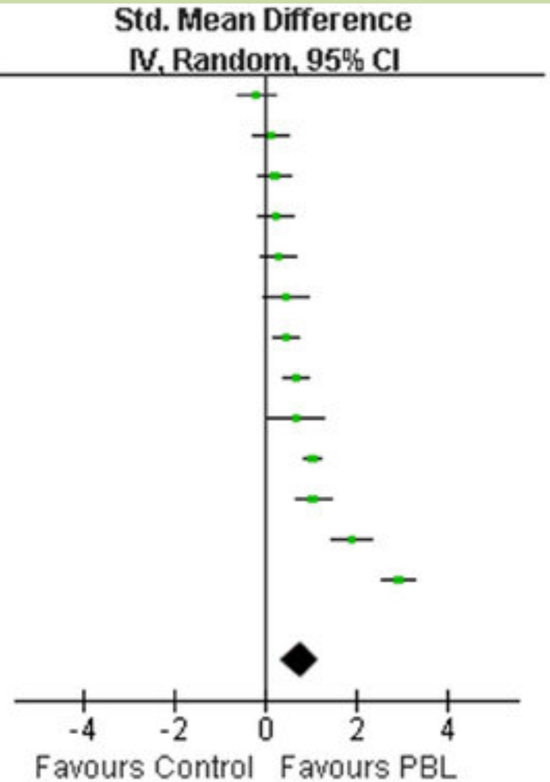
2016 Study

Figure 3: Forest plot for the effects of PBL on knowledge scores compared with the traditional teaching.

Study or Subgroup	PBL Mean	PBL SD	PBL Total	Control Mean	Control SD	Control Total	Weight	Std. Mean Difference IV, Random, 95% CI
Xu 2013	70.4	2.3	40	71.2	5.4	40	7.6%	-0.19 [-0.63, 0.25]
Zuo 2011	83.7	10.4	32	82.4	10.7	210	7.7%	0.12 [-0.25, 0.49]
Wu 2012	62.81	7.78	60	61.15	7.87	60	7.8%	0.21 [-0.15, 0.57]
Mo 2011	59.7	6.43	54	58.35	4.55	52	7.7%	0.24 [-0.14, 0.62]
Guan 2007	47.31	6.82	48	45.26	7.63	46	7.7%	0.28 [-0.13, 0.69]
An 2012	87.2	9.1	30	83.2	8.9	30	7.4%	0.44 [-0.07, 0.95]
Lai 2012	83	0.21	100	82	3.1	100	7.9%	0.45 [0.17, 0.73]
Liu 2007	79.86	8.31	93	73.19	11.29	95	7.9%	0.67 [0.38, 0.96]
Liu 2014	74.2	5	20	70.2	6.2	25	7.1%	0.69 [0.08, 1.30]
Nie 2012	76.83	8.21	230	67.19	10.12	229	8.1%	1.04 [0.85, 1.24]
Hou 2012	36.92	5.4	60	30.75	6.3	60	7.7%	1.04 [0.66, 1.43]
Chen 2014	82.4	3.7	60	76.7	2.1	60	7.6%	1.88 [1.45, 2.31]
Li 2007	85.7	2.42	130	76.68	3.65	122	7.8%	2.92 [2.57, 3.28]
Total (95% CI)			**957**			**1129**	**100.0%**	**0.76 [0.33, 1.19]**

Heterogeneity: $Tau^2 = 0.59$; $Chi^2 = 233.56$, df = 12 ($P < 0.00001$); $I^2 = 95\%$

Test for overall effect: Z = 3.44 (P = 0.0006)



Sci. Rep. 6, 36279; doi: 10.1038/srep36279 (2016).

Assessing the effectiveness of problem-based learning in physical diagnostics education in China: a meta-analysis

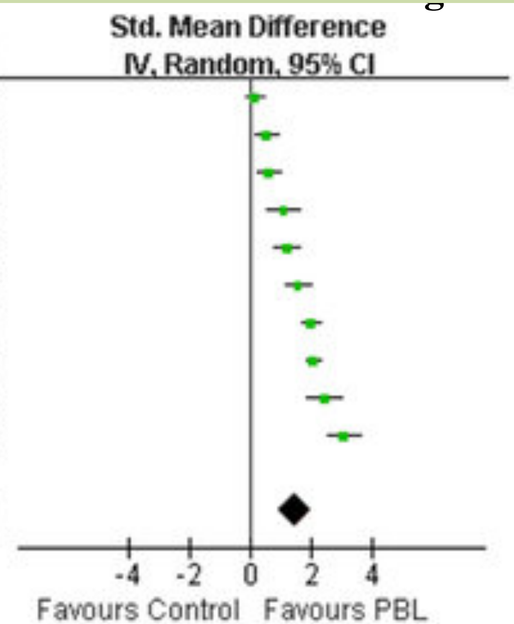
2016 Study

Figure 4: Forest plot for the effects of PBL on skill scores compared with the traditional teaching.

	PBL			Control				Std. Mean Difference
Study or Subgroup	**Mean**	**SD**	**Total**	**Mean**	**SD**	**Total**	**Weight**	**IV, Random, 95% CI**
Liu 2007	95.95	3.83	93	95.42	3.15	95	10.3%	0.15 [-0.14, 0.44]
Mo 2011	24.15	5.64	54	21.4	5.12	52	10.1%	0.51 [0.12, 0.89]
Hou 2012	50.46	8.4	60	45.68	7.4	60	10.1%	0.60 [0.23, 0.97]
An 2012	90.4	9.3	30	81.5	6.7	30	9.6%	1.08 [0.54, 1.63]
Guan 2007	28.5	1.04	48	25.72	3.1	46	9.9%	1.20 [0.76, 1.64]
Wu 2012	26.68	2.35	60	21.86	3.63	60	10.0%	1.57 [1.16, 1.98]
Li 2007	17.66	1.78	130	13.87	2.03	122	10.3%	1.98 [1.68, 2.29]
Nie 2012	85.85	3.82	230	78.42	3.32	229	10.4%	2.07 [1.85, 2.30]
Xu 2013	86.7	6.2	40	73.2	4.6	40	9.5%	2.45 [1.86, 3.04]
Chen 2014	88.5	4.9	60	75.3	3.6	60	9.7%	3.05 [2.52, 3.58]
Total (95% CI)			**805**			**794**	**100.0%**	**1.46 [0.89, 2.02]**

Heterogeneity: $Tau^2 = 0.79$; $Chi^2 = 212.01$, $df = 9$ ($P < 0.00001$); $I^2 = 96\%$

Test for overall effect: $Z = 5.03$ ($P < 0.00001$)



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The Impact of Team-Based Learning on Medical Students' Academic Performance

Paul G. Koles, MD, Adrienne Stolfi, MSPH, Nicole J. Borges, PhD, Stuart Nelson, PhD, and Dean X. Parmelee, MD

Table 3

Comparison of the Performance of 178 Second-Year Medical Students on Pathology-Based Exam Questions (PBQs), Boonshoft School of Medicine, 2003–2005*

Group of PBQs	No. of questions	DI: Mean (SD)	Score: Mean % (SD)	Score: Range %	*P* value†
All CCEs					
TR With TBL	243	0.20 (0.12)	83.6 (6.1)	64.0–96.1	<.00
TU Without TBL	462	0.22 (0.13)	77.7 (6.9)	59.7–91.3	

The Impact of Team-Based Learning on Medical Students' Academic Performance

Paul G. Koles, MD, Adrienne Stolfi, MSPH, Nicole J. Borges, PhD, Stuart Nelson, PhD, and Dean X. Parmelee, MD

Table 4

Performance of Second-Year Medical Students in the Highest Academic Quartile (n = 45) Versus Those in the Lowest Academic Quartile (n = 45) on Pathology-Based Examination Questions (PBQs), Boonshoft School of Medicine, 2003–2005*

Academic quartile and group of PBQ	Score on all exams		Difference in scores[†]	
	Mean % (SD)	Range %	Mean % (SD)	Range %
Highest quartile				
TR	89.3 (4.0)	80.6 to 96.1	3.8 (5.4)[‡]	−7.7 to 13.3
TU	85.5 (3.2)	78.8 to 91.3		
Lowest quartile				
TR	77.5 (5.8)	64.0 to 86.8	7.9 (6.0)[‡]	−5.1 to 20.6
TU	69.6 (4.5)	59.7 to 77.5		

* TBL, team-based learning; TR, TBL-related PBQ; TU, TBL-unrelated PBQ.

† TR versus TU scores.

‡ *P* = .001 for two-way ANOVA interaction comparing the difference in mean scores on TR and TU questions for highest- versus lowest-quartile students.

Academic Medicine, Vol. 85, No. 11 / November 2010

The effectiveness of team-based learning on learning outcomes in health professions education: BEME Guide No. 30

MIM FATMI, LISA HARTLING, TRACEY HILLIER, SANDRA CAMPBELL & ANNA E. OSWALD
University of Alberta, Edmonton, Canada

Table 5. Summary of findings.

			Findings: Any significant difference			
Outcome	Intervention	Comparator	No statement	$p > 0.05$	$p < 0.05$	Study design and number of participants enrolled
Knowledge	TBL	CBGD		No difference		RCT ($n = 83$)
					Favours TBL	NCC ($n =$ unclear)
		SGL			Favours TBL	NRCT ($n = 112$)
					Favours TBL	NRCT ($n = 167$)
		Mixed Active Learning			Favours TBL	CC ($n = 64$)
		Independent Study	Favours TBL			PC ($n = 1417$)
		Traditional Lecture		No difference		NCC ($n =$ unclear)
					Favours TBL	RC ($n = 186$)
			Favours TBL			NCC ($n = 280$*)
					Favours TBL	NCC ($n = 306$)
				No difference		NCC ($n = 143$)
					Favours TBL	NCC ($n = 371$)
			Favours TBL			NCC ($n =$ unclear)
				No difference		PC ($n = 121$)
Reaction	TBL	CBGD		No difference		RCT ($n = 83$)
		SGL		No difference		NRCT ($n = 112$)
					Favours SGL	NRCT ($n = 167$)
		Mixed Active Learning		No difference		CC ($n = 64$)
		Traditional Lecture	Favours TBL			NCC ($n =$ unclear)
			Favours lecture			NCC ($n = 280$*)
					Favours TBL	NCC ($n = 306$)

Fatmi et al. Medical Teacher 2013: 35 (1608-1624)

Perspect Med Educ (2014) 3:222–232
DOI 10.1007/s40037-014-0129-9

ORIGINAL ARTICLE

What would happen to education if we take education evidence seriously?

C. P. M. van der Vleuten · E. W. Driessen

"We should forget about comparing curriculum X versus Y to see which is superior. Instead we should acquaint ourselves with evidence and theory from the educational sciences, perhaps even participate and contribute to the scholarly work. Then we should engage ourselves in creatively designing educational strategies that make optimized translations from theory to education practice. We should exchange our best practices and learn from each other."

Recommendations

1. Design your curriculum and pedagogy so that students are <u>using</u> the information. Any information "learned" without context is not deeply learned and quickly forgotten.

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1. Design your curriculum and pedagogy so that students are <u>using</u> the information.
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2. Use cooperative groups or teams; the evidence is overwhelming.
3. Provide frequent feedback to students (at least partly formative (not an exam)).
4. Train and involve faculty: change the culture

Perspect Med Educ (2014) 3:222–232
DOI 10.1007/s40037-014-0129-9

ORIGINAL ARTICLE

What would happen to education if we take education evidence seriously?

C. P. M. van der Vleuten · E. W. Driessen

"The learning evidence on student learners equally applies to our teachers. Simply telling them to change will be the best recipe for disaster. We will need to involve them, allow them to experience working in different ways, having a change leader or manager who is entrusted, who coaches, who helps. By doing this well, teachers will also become engaged and this will fuel the change process."

Curriculum reform at Chinese medical schools: What have we learned?

LEI HUANG[1], LIMING CHENG[1], QIAOLING CAI[2], RUSSELL OLIVE KOSIK[3], YUN HUANG[2], XUDONG ZHAO[2], GUO-TONG XU[2], TUNG-PING SU[4], ALLEN WEN-HSIANG CHIU[4] & ANGELA PEI-CHEN FAN[4]

Table 5. Chief difficulties of instituting medical curriculum reform.

	Extremely difficult		Relatively difficult		Hard to say		Almost no difficulty		No difficulty	
Items	Number of schools	Percent (%)	Number of schools	Percent (%)	Number of schools	Percent (%)	Number of schools	Percent (%)	Number of schools	Percent (%)
Obtaining financial support	0	0	10	40.0	2	8.0	12	48.0	1	4.0
Training and organizing faculty	1	4.0	12	48.0	1	4.0	10	40.0	1	4.0
Increasing interdisciplinary coordination	5	20.0	14	56.0	1	4.0	5	20.0	0	0.0
Changing the mindset of faculty accustomed to antiquated techniques	2	8.0	12	48.0	4	16.0	7	28.0	0	0
Adaptation by students	0	0	3	12.0	9	36.0	12	48.0	1	4.0
Integration of teaching content	2	8.0	9	36.0	2	8.0	12	48.0	0	0
Application of various instructional methods	1	4.0	4	16.0	4	16.0	16	64.0	0	0
Implementation of a formative evaluation system	0	0	9	36.0	7	28.0	9	36.0	0	0
Preparing lecture materials	1	4.0	6	24.0	8	32.0	10	40.0	0	0

Discussion: Medical curricular reform is still in its infancy in China. The republic's leading medical schools have engaged in various approaches to bring innovative teaching methods to their respective institutions. However, due to limited resources and the shackle of traditional pedagogical beliefs among many faculty and administrators, progress has been significantly hindered. Despite these and other challenges, many medical schools report positive initial results from the reforms that they have enacted.

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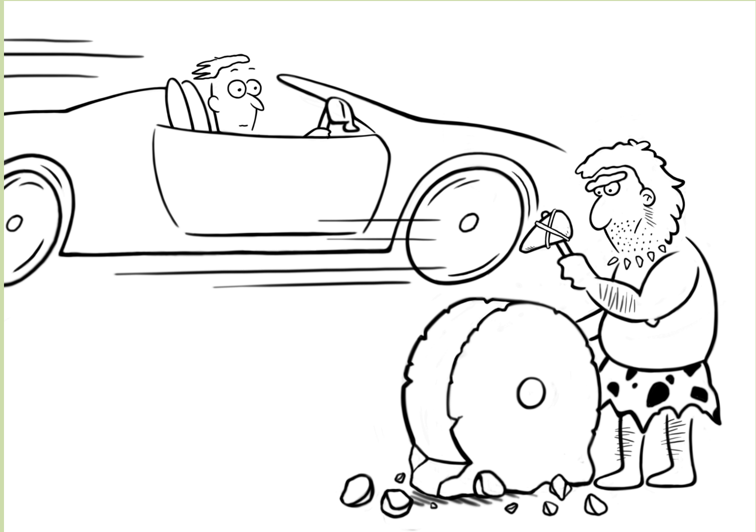
Recommendations

1. Design your curriculum and pedagogy so that students are <u>using</u> the information.
2. Use cooperative groups or teams
3. Provide frequent feedback to students
4. Train and involve faculty: change the culture
5. Use existing expertise and models



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Taylor & Francis healthsciences

Pros and cons of vertical integration between clinical medicine and basic science within a problem-based undergraduate medical curriculum: examples and experiences from Linköping, Sweden

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Lessons learned about integrating a medical school curriculum: perceptions of students, faculty and curriculum leaders

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RESEARCH IN EDUCATION

The Center for Research and Development of Education conducts scientific research in the field – and for the purpose – of improving healthcare education.

Some major areas of research are:

- Vertical integration of medical curriculum
- Determinants for the careers of doctors in training
- Competency-based medical education

Recommendations

1. Design your curriculum and pedagogy so that students are <u>using</u> the information.
2. Use cooperative groups or teams
3. Provide frequent feedback to students
4. Train and involve faculty: change the culture
5. Use existing expertise and models
6. Measure the results!

Recommendations

AMEE GUIDE

The integrated curriculum in medical education: AMEE Guide No. 96

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literature has suggested that many aspiring curricular innovations are failing the test of time due to a simple failure as early as the planning and development stage: many groups report goals and expectations for their new curriculum but few describe methods of evaluation for gathering objective data to evaluate whether these goals are met. We hypothesize that this could be due to a lack of understanding of available standards of evaluation. The large literature review by Kulasegaram et al. (2013) suggests that " . . . assessing how students use that basic science content in clinical reasoning or in the perform-

Measure the Results!

Use *already validated* tools: Progress Tests (especially Dutch), or established tests of clinical reasoning or other skills

Appendix 2

Examples of Questions and Answers on a Clinical Data Interpretation Test Administered to 2,394 Medical Students With Zero, One, Two, or Three Years of Training at Five Schools, 2008

Skin Lesions

Clinical Vignette: A 58-year-old female presents with a chief complaint of a skin rash.

Item number	If you were thinking of:	And then the patient reports or you find on clinical or laboratory examination:	This diagnostic hypothesis becomes:					Correct answer
134	Drug eruption	Recent changes in blood pressure medication	A	B	C	D	E	D
135	Urticaria	Transient erythematous patches	A	B	C	D	E	E
136	Herpes zoster	Asymptomatic blistering rash on chest	A	B	C	D	E	A

A = the hypothesis is almost eliminated, B = the hypothesis becomes less probable, C = the information has virtually no effect on the hypothesis, D = the hypothesis becomes more probable, E = the hypothesis is almost certainly correct.

Resources for Moving Forward