Twelve Tips for Successful Integration of Foundational Science in the Post-Clerkship Curriculum

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Purpose

Physicians must have strong foundational knowledge of the sciences that underlie clinical practice. Traditional medical curricula generally place most of the foundational science learning into the pre-clerkship years and do not optimally integrate it into the post-clerkship curriculum. Practical solutions are needed to incorporate foundational sciences into the clinical years of undergraduate medical education. Five years ago, Vanderbilt University School of Medicine (VUSM) formally launched "Integrated Science Courses" that combine rigorous training in the foundational sciences with meaningful clinical experiences [Dahlman, KB *et al.* (2018) **28**, 145 *Medical Science Educator*]. Herein, we describe the lessons learned after purposeful integration of foundational sciences with clinical experiences in the post-clerkship curriculum at VUSM.

Integrated Science Courses (ISCs)

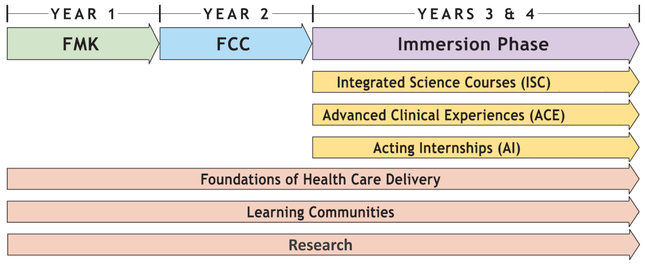

Figure 1. The Immersion Phase Is a Highly Individualized Medical Student Experience. The VUSM undergraduate medical curriculum consists of three phases: Foundations of Medical Knowledge (FMK-pre-clerkship), Foundations of Clinical Care (FCC-clerkship), and the Immersion Phase (IP). There are three main course types in the IP: Advanced Clinical Experiences (ACEs), Acting Internships (AIs), and Integrated Science Courses (ISCs). IP students select from a menu of courses, but are required to take at least four ISCs, four ACEs, and one AI. Foundations of Health Care Delivery, Learning Communities, and Research are three longitudinal courses/activities that span the entire curriculum.

ISC Outcomes

	# of student responses					Mean (95% CI)
	Strongly Disagree (1)	Disagree (2)	Neither Agree nor Disagree (3)	Agree (4)	Strongly Agree (5)	
Foundational science learning was embedded in the clinical experiences	0	3	11	92	115	4.44 (4.35-4.53)
Foundational science learning informed and enriched the clinical experiences	0	6	14	79	122	4.43 (4.33-4.53)
Clinical relevance was provided during non-clinical foundational science learning activities	0	1	13	79	128	4.51 (4.43-4.59)
Clinical experiences informed and enriched the foundational science learning	0	2	10	83	126	4.51 (4.43-4.59)

The mean score from all eleven courses delivered from academic year 2015-2017 are presented for each evaluation question with 95% confidence interval (CI) shown in parentheses. Results are based on 222 medical student responses and a 5-point Linkert scale, with 5 being the best.

Select Student Comments:

- **"Fantastic integration of basic science with clinical medicine"**
- **"Great balance of clinical and didactic learning"**
- **"Good use of tying primary literature to clinical use"**
- **"This was hands down the best class I've taken in my life...Everything we did was relevant"**

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12 Tips

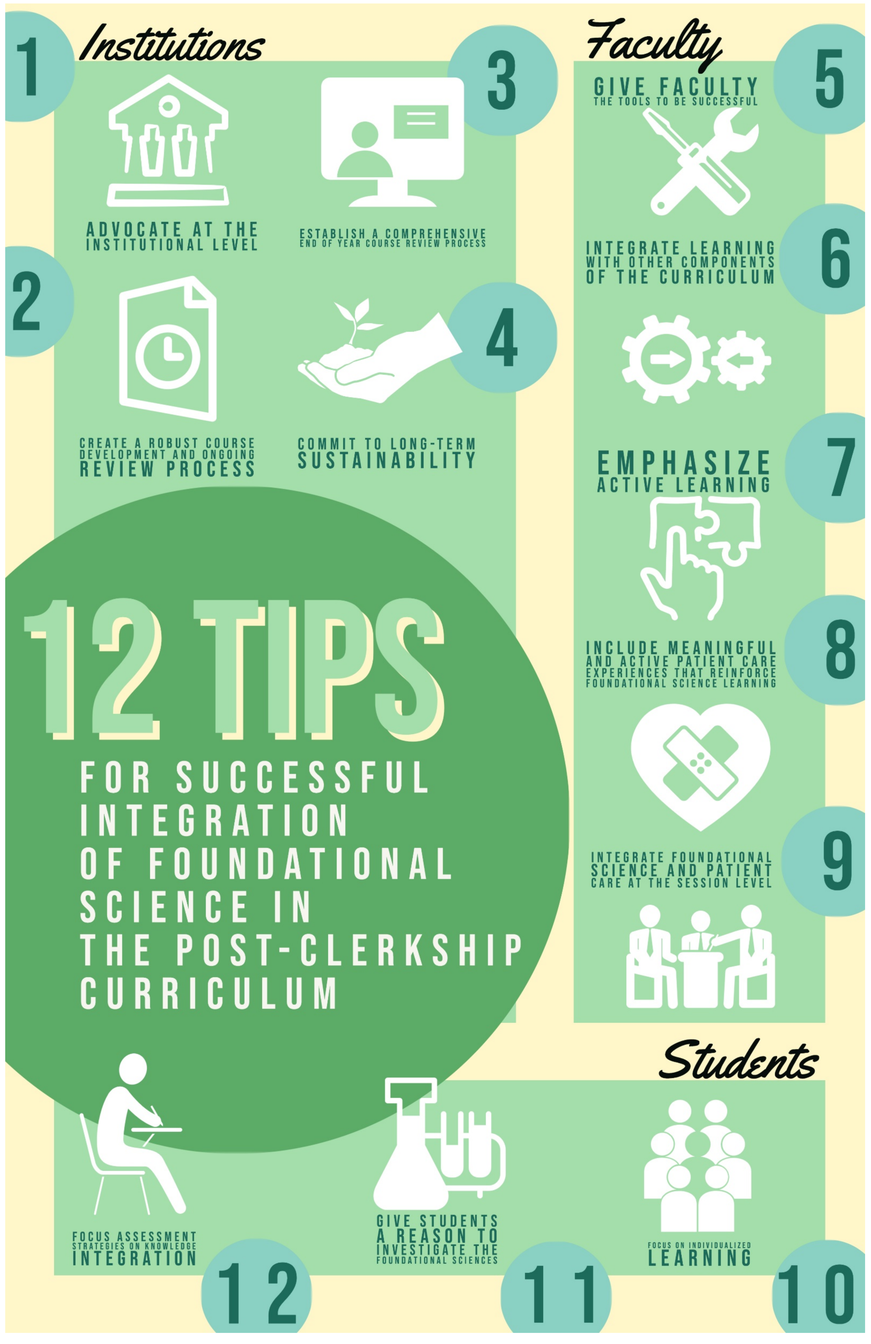

Figure 2. 12 Tips for Successful Integration of Foundational Science in the Post-Clerkship Curriculum. The 12 tips can be divided into three themes: Institutional, Faculty, and Student commitment.

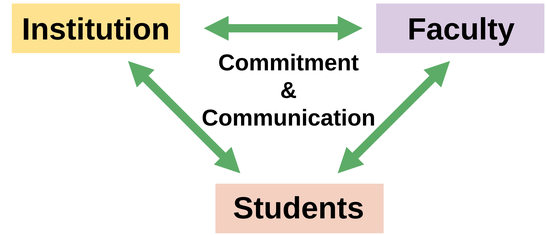

Figure 3. Commitment and Communication Are Key Components of Success. Achievement of effective foundational science integration requires strong commitment by the institution, faculty, and students, and clear and frequent communication between these three groups.

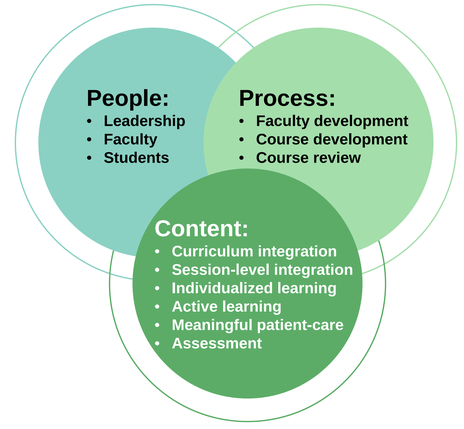

Figure 4. The People, Process, and Content Are What Drives Foundational Science Integration. People: Stakeholders should be engaged from the beginning. Processes: The appropriate processes need to be in place to support the faculty in being successful. Content: The content should be integrated at the program and session level and should be individualized, active, and meaningfully assessed.

Conclusions

Teaching of foundational sciences in the clinical workplace in the post-clerkship medical curriculum is challenging and resource-intensive, yet feasible. Course enrollment data and results from the course evaluation process drove faculty development and refinement of the ISCs to better meet the needs of educators and students.

Acknowledgements

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