
From the Classroom

Open content textbooks: Educating the next generation of bioentrepreneurs in developing economies

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Abstract

Bioclusters, formal and informal networks devoted to the commercial development of life science invention and discoveries, are growing throughout the world, including many developing economies. As these clusters evolve, there will be an increasing need for scientific and leadership talent. Bioentrepreneurship educational programmes require access to high quality, relevant textbook and case materials at a reasonable cost. In addition, since biobusinesses are affected by globalisation like other industries and since life sciences businesses are often 'born global', future bioentrepreneurs and knowledge workers need an international perspective. We describe an open content textbook project that includes a textbook of bioentrepreneurship. The textbook site provides materials that are intended to be free, easily accessible and updated on a regular basis by content experts, students and practitioners. Bioentrepreneurship education around the world is still unstructured and developing. Instructional materials are difficult or impossible to obtain in some regions of the world. The Global Text Project provides materials to faculty and students anywhere in the world for free.

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OVERVIEW

There is a growing global demand for bioentrepreneurship talent, but a serious hurdle to educating future bioentrepreneurs is the lack of current, high-quality textbooks.

This is a particular problem in developing economies, which are opportunity-rich, but educated talent-poor. Textbooks are considered expensive in Europe and the US, but they are beyond the reach of many in developing economies. US publishers sell international editions of their textbooks for as much as half the price charged in the US.¹ Even so, while a \$150 textbook might sell for \$75 in Africa, the US gross national income per capita is \$44,710 while the figure for Uganda is \$300.² Clearly, the developed world's textbook model does not meet the needs of the developing world.

The Global Text Project,³ led by Professors Don McCubbrey of the University of Denver and Rick Watson of the University of Georgia, seeks to solve this problem with a new model that will create a free library of 1,000 electronic texts on the internet for university students in developing economies. Distribution will also be possible via paper, CD, DVD or eBook.

The approach of Global Text is to engage the collective intelligence of academics and practitioners in writing open content textbooks, under editorial control, and a Creative Commons license. Books can be tailored for the needs of individual countries. They will be continually updated by their creators and, importantly, by the community of academics and students that use them. In many cases, authors whose books are out of print but relatively current can obtain the copyright from the publisher, and students can refresh the book under the author's or some other expert's supervision.

Funding for the proof of concept phase, now complete, was received from the Jacobs Foundation.⁴ As the project scales, corporations and foundations will be approached to fund additional books, in partnership with universities.

The project is supported by a community of scholars, students and practitioners who share the vision of contributing to the

education of university students in developing economies so they can lift themselves and their countries out of poverty. More information on how to volunteer is available on the Global Text website at www.globaltext.org. A specific instance of a volunteer effort to create a textbook in bioentrepreneurship, led by Dr Arlen Meyers (ADM), is described in this paper.

A BIOENTREPRENEURSHIP TEXTBOOK FOR THE GLOBAL TEXT LIBRARY

One of the authors (ADM) has been teaching bioentrepreneurship at the University of Colorado for five years. The typical student is grounded in the life sciences or engineering and is either pursuing a graduate degree in business or taking some business electives in order to work with one of the emerging bioscience businesses in the Rocky Mountain region or is interested in starting a bioscience company. While most professors design their courses around a textbook, there are few standard textbooks of bioentrepreneurship. Consequently, we use a variety of custom materials as reading assignments. Some materials are available on the internet; others are obtained from scholarly journals available in digital form from the university library. We incorporate case studies from other business school libraries, invite regional bioentrepreneurs or develop our own cases to highlight local businesses.

Dr Meyers learned of the Global Text Project from a paper in the *Chronicle of Higher Education*.⁵ Realising that bioentrepreneurship is a global business requiring some familiarity with international standards and operating procedures, and knowing that the lack of a high-quality text would be an even more serious hindrance in classrooms in developing economies, he contacted the Global Text Projects co-leaders, Professors McCubbrey and Watson, to explore the possibility of leading the effort to develop a bioentrepreneurship text.

We developed the textbook using the following guidelines:

EDITORIAL CONTROL

Each book is assigned an editor in chief, whose responsibilities include the following:

- Develop the table of contents (TOC)
- Circulate the TOC for comments to other academics and the international advisory board
- Manage consistency between chapters
- Recruit chapter editors
- Assure complete coverage of the topic
- Identify links between chapters and manage consistency between chapters
- Manage relations with book sponsor (if any)
- Work with local adopters to support coverage for local and cultural issues
- Commission a reviewer's report and act upon it
- Report on monthly progress to the project co-leaders

Responsibilities of chapter editors are as follows:

- Develop the structure of the chapter, that is, topics and sub-topics
- Take a lead role in writing the chapter
- Recruit contributors to help with writing the chapter, developing exercises, support material and so forth
- Perform a quality assurance review of additions and deletions
- Recruit contributors to ensure a global perspective on key issues
- Create links where appropriate to other books in the series and relevant websites

Following these guidelines, Dr Meyers developed the synopsis and TOC.

SYNOPSIS AND TOC OF THE BIOENTREPRENEURSHIP TEXT

Synopsis

This textbook examines the process of technology transfer and new bioscience

venture creation in global settings. The focus of the textbook, from the discovery stage to building the business case and securing funding, will be on the process of identifying and addressing the technical, business, execution and intellectual property risks of the idea, determining whether the idea has commercial feasibility and securing resources at various stages of development.

TOC

Bioentrepreneurship requires an extensive repertoire of knowledge, skills and attitudes. For those who have read this book and completed the exercises, the learning objectives are:

Section 1: Understanding the Context of Global Bioentrepreneurship

Chapter 1: Global Bioclusters

What are bioclusters? What factors contribute to their development and success? How do bioclusters differ throughout the world?

Chapter 2: Leading Bioscience Ventures

What knowledge, skills and talents are required to start and run bioscience companies? How is leading a bioscience company different from leading other kinds of companies? How do you lead knowledge workers like scientists and physicians?

Chapter 3: International Bioentrepreneurship Collaboration and Strategic Partnerships

How do you create foreign alliances to develop and market your products? When is it advisable to do so?

Section 2: Determining the Commercial Feasibility of Your Idea

Chapter 4: Global technology transfer models

How does technology transfer happen from academia to industry and from industry to industry in different parts of the world?

Chapter 5: Legal environment of bioscience commercialisation

The basics of intellectual property law. How do you protect your idea in different countries? How do you license your ideas?

Chapter 6: Marketing and sales of drugs, devices, diagnostics and healthcare software products

Who is your competitor? How do you determine whether there is a market for your idea? How will you determine product benefits? How will you price your product? How will you sell and distribute your product? How will you promote your product?

Chapter 7: Regulatory and reimbursement environment

What is the regulatory approval process in your country and those countries where you want to sell your product? How will you get paid for your product?

Chapter 8: New Product Development

How will you develop new products?

Chapter 9: Prototyping and Design for Manufacturing

How do you design and build products beyond the prototype? How do you mass manufacture products that adhere to regulatory requirements?

Chapter 10: Clinical Trials and Clinical Validation

How do you conduct clinical trials throughout the world? What are the human subjects and ethical issues?

Section 3: The Commercialisation Development Plan

Chapter 11: Business Development and Planning

How to write a bioscience venture business plan?

Chapter 12: Building the Team

How do you create a high performance leadership team that can execute your plan?

Chapter 13: Financing the New Venture

How, where and when do you secure capital in the various stages of new bioscience venture creation?

Section 4: Telling Your Story

Chapter 14: Networking

How to make connections to the value chain?

Chapter 15: Making the Pitch

How to tell your story to stakeholders and the financial community?

DISCUSSION

In a previous paper, we reviewed bioentrepreneurship programmes in the US and made several suggestions about standardising curricula and including international topics.⁶

Biotechnology and life science commercialisation is an international endeavour. Like other industries, globalisation has affected how life science discoveries and inventions are created, developed and commercialised. Talent, technology and money flow freely across continents. Reflecting that reality, bioentrepreneurship education programmes should incorporate principles and practices of international business and entrepreneurship by adding international business courses, using international case studies, inviting faculty or guest speakers with international biotechnology experience and drawing on the experiences of foreign students.

In addition, bioentrepreneurs need to understand how to make their technologies available in underdeveloped economies. Conventional funding and business models usually do not work in markets where there is limited infrastructure, literacy and poverty. Despite this, the market potential for life science products in third-world environments is huge and profitable. Bioscience entrepreneurs should understand new funding models and how to tap into innovative foundation initiatives, partners and distribution arrangements.

Finally, the process of commercialising innovation and the structure of healthcare systems vary considerably around the world. There are significant differences in how knowledge flows, academic–industry collaborative models, funding mechanisms, management structures and diverse legal and regulatory environments. While the US is the single largest bioscience products market in the world, how things are done in the US does not always apply to a given bioentrepreneur trying to commercialise a product in another country or sell it in a non-US market. Students need to understand these differences and know how to take advantage of them.

The Global Text Project textbook of bioentrepreneurship is designed to satisfy some of these objectives. The editors intend to recruit a roster of international authors representing both developed and emerging economies providing a comprehensive, international perspective.

CONCLUSION

While the proposed bioentrepreneurship book addresses a pressing need in developing economies, it can be used anywhere. Bioentrepreneurship education programmes are emerging but are not standardised and as yet have not demonstrated their value. Because books in the Global Text library are

continuously updated by their community of users (in the fashion of Wikipedia, but with editorial control), it will help set a worldwide standard.

Some observers believe that there is a risk of the US losing its leadership position in bioscience entrepreneurship and that, because of this, there is an inherent threat if we educate future competitors. While there is some truth to this point of view, another perspective is that efforts such as this will help educate future partners for collaborative ventures. It could be said that they will think of the US first when seeking partners because of the leadership role it has played in bioentrepreneurship education.

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