

Supplemental Material

CBE—Life Sciences Education

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Supplemental Materials

Providing Experiential Business and Management Training for Biomedical Research Trainees

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Supplemental Materials Part A

2016 Project Topics

Project summary	Business area
<p>Many businesses need to determine whether a new service or equipment acquisition is a worthwhile investment. Often the decision stems from intuition. Core directors have similar difficulties deciding whether to establish a new core service. This project assessed the financial viability of establishing a new service for design and fabrication of biomedical research laboratory equipment using a 3D printer. In addressing this question, a generalized framework and supporting tools were created that can be used to guide a financially objective decision-making process for any new core service.</p>	Service Analysis
<p>Many organizations struggle to coordinate their tasks, employees, and resources, resulting in inefficient time management and progress tracking, under/over-budgeting, communication deficiencies or other issues. This core offers a suite of flexible and highly customizable services. Projects were monitored using an inefficient and sometimes confusing collection of electronic tools, including email, spreadsheets, electronic forms and more. The goal of this project was to analyze the project intake and management process and find opportunities for improved project oversight and more accurate budget and timeline estimates. The trainee team ultimately identified and beta-tested a centralized software tool which could be customized to integrate project monitoring, billable hours, and expenses into one common portal.</p>	Project Management
<p>Assessing performance by accepted metrics is core to all businesses and required for continued improvement, strategic planning, and ongoing evaluation. However, this remains a difficult, often ill-defined area for institutional cores. Most facilities are evaluated on a combination of financial performance and customer questionnaires of varying quality. The goal of this project was to define a performance measurement system that could be applied to any core facility. The team defined a data-driven paradigm based on publicly available recommendations from the NIH and core governing bodies like the CAN-CC. These were assembled into an e-dashboard of Key Performance Indicators in three major categories: scientific impact, finances and customer satisfaction. Each category is ultimately scored with a single numerical value generated by an algorithm consisting of quantitative related sub-factors.</p>	Performance Metrics
<p>Organizations can struggle to strategically deploy resources for marketing their services. The goal of this project was to evaluate marketing approaches available to cores and develop a marketing strategy that maximizes the core's most precious resource: time. A root-cause analysis was conducted with the "Five Why's" investigative method. From this assessment, marketing goals and a marketing plan were developed for the host facility and the approach was generalized to be useful to multiple cores.</p>	Marketing
<p>Strategic approaches to capital equipment procurement is a common issue for many businesses. A key problem is a lack of data-driven methods to evaluate large purchases that consider immediate and longer term factors. This project evaluated these factors with respect to a proposed large purchase by the core, and developed a generalized, Excel-compatible decision support tool to support a variety of capital purchases. The tool prompts users to acquire relevant data and consider the purchase using a seven-step investigative process.</p>	Procurement
<p>Human resource planning can be a challenge for core facilities that provide highly specialized and technically challenging services. This core performs difficult procedures that can take months or years of experience to master. The core's highly specialized and proficient technical staff have almost no cross-training, so loss of an employee would eliminate an entire service. The goal of this project was to evaluate current employee expertise, document time requirements for specialized training within each domain, and use this data to develop comprehensive, milestone-driven cross-training and succession plans to ensure orderly operation of the facility for the foreseeable future.</p>	Human Resources

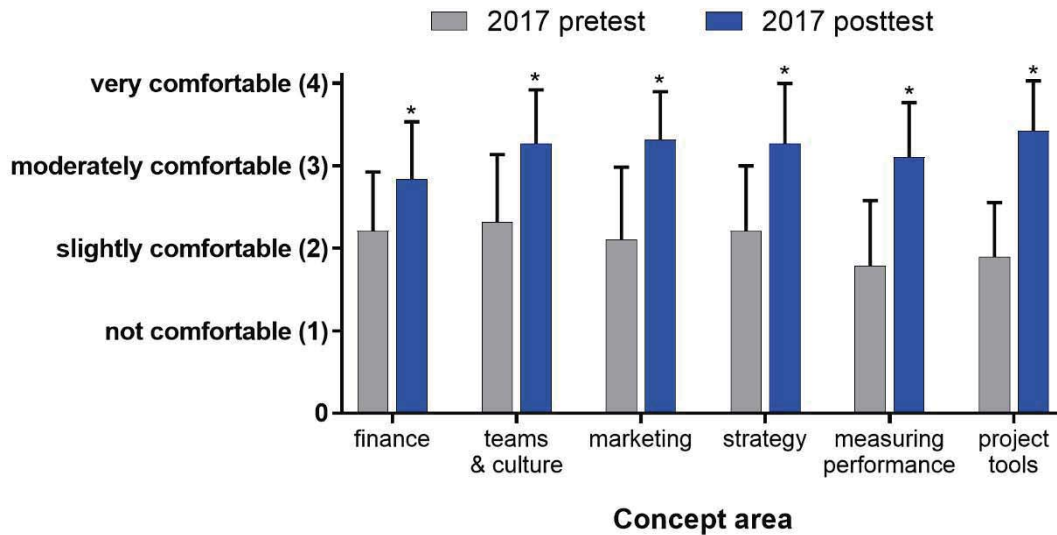
Supplemental Materials Part B

2017 Project topics

Project summary	Business area
<p>Lack of communication between doctors who have patients/patient samples, core facilities who have technical resources, and PIs who have relevant grants can lead to unrealized opportunities. Currently, this core uses “completely manual” efforts to connect these parties. The project team’s goal was to develop a strategy for building a platform that connects physicians, cores, and PIs. The team proposed a framework of strategic marketing during onboarding for all incoming researchers (staff, students, postdocs, faculty), and ongoing marketing. This framework strives to build and improve research partnerships and provide a template to standardize the workflow for cores.</p>	Marketing
<p>Frequent use of the highly sensitive tools used in analytical cores can be detrimental to instrument components. To maintain user confidence in core facility services, cores employ quality assurance measures to manage “wear and tear” and insure that analysis remains consistent across experimental trials. Sophisticated software from instrument manufacturers helps track quality control and calibration over time and assists in early identification component failures. However, due to the complexity and sensitivity of these instruments, certain failures may not be efficiently identified, and small inconsistencies result in difficulty analyzing results and can contribute to user attrition. Here, we outline a best practice mechanism that engages users and technical staff to ensure that the core continuously improves quality assurance processes.</p>	Quality Assurance
<p>Cores have inventory. Some inventory is part of the lab’s overhead and some is consumable supplies used by core customers so costs should be recouped. Despite the complexity, most core inventory is managed in the minds of a few key people. Reconciling what is spent, recouping costs, and determining if the core is on budget is a tedious task. The team worked with staff to observe current processes, categorize current inventory, and build tools to help manage inventory efficiently.</p>	Inventory
<p>Many organizations struggle with effective project management. We assessed current project management processes in place at the core to improve their systems and efficiency. Currently, the Lab Manager completes and troubleshoots experimental assays, in addition to drafting standard operating procedures (SOPs) and protocols (with input and assistance from the Director) and handling tracking of time and expenses versus budget for each of the core’s projects. Assigning clear roles and duties to the core staff in addition to hiring a dedicated lab technician should improve allocation of human resources. Using shared calendars and task lists in Outlook should allow more effective and efficient communication of tasks and progress of projects.</p>	Project Management
<p>The core tracks billable hours spent on projects. In order to properly account for staff time and properly bill clients for completed work, accurate time records and activities are needed. The project team observed staff activity, completed time/motion studies, worked with the core to define and document workflows and systems, and developed a functional specification for a time and activity tracking system. A daily time tracking Google Form was implemented by the core and has made an immediate impact on user compliance and satisfaction, and revealed a need to clarify and standardize billing categories.</p>	Time Tracking
<p>Publically sharing scientific knowledge helps with community engagement and adoption of new techniques. Creating a central repository for this knowledge is the easy part. The hard part is sustaining this repository by making people aware of this repository and keeping knowledge current. The project team worked with the core to increase awareness of and participation in a knowledgebase of clinical decision support. The team interviewed many of the primary faculty and staff involved with the repository and developed two low-cost social media strategies to target and engage users and developers.</p>	Marketing

Supplemental Materials Part C

Comfort levels of the 2017 cohort with module concept areas at pre-test and post-test



2017 participants indicated their comfort level with six different course concept areas using a Likert-scale. Text comfort levels were converted to numerical rankings (very comfortable=4, moderately comfortable=3, slightly comfortable=2, not comfortable=1). Bars represent mean comfort level \pm SD in each concept area at pre-test (gray bar) and post-test (blue bar). For each concept area, a Wilcoxon matched pairs test was used to detect differences in comfort levels between individuals' pre-test and post-test scores. * $p \leq .0001$ compared to pre-test. $n=19$

Supplemental Materials Part C
Post-test qualitative survey questions

(see following 13 pages)

Management and Business Principles Module Final Evaluation: Spring, 2017

Background Information:

Thank you for participating in the Business and Entrepreneurship Module. Your feedback is important to us as we plan future programming. Please take a few minutes to complete this anonymous survey letting us know (1) what you think about the module and (2) your current knowledge of topics that will be covered in this module.

* 1. What is your current status at Vanderbilt?

- Student
- Postdoctoral Fellow
- Core Director / Staff

2. Did you attend all didactic sessions of the module?

- Yes.
- No, I missed 1-2 sessions.
- No, I missed 3 or more sessions.

Management and Business Principles Module Final Evaluation: Spring, 2017

Career Interests

Below is a list of career paths commonly followed by Ph.D.-level scientists. Please review the list carefully before you answer the next question.

* 3. Based on the list of career paths, to what extent are you currently considering the following?

	Will definitely pursue	Strongly considering	Moderately considering	Slightly / Not at all considering	Not familiar enough to decide
a. Principal investigator in a research-intensive institution	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
b. Research in industry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
c. Research staff in a research-intensive institution	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
d. Combined research and teaching careers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
e. Teaching-intensive careers in academia	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
f. Science education for K-12 schools	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
g. Science education for non-scientists	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
h. Clinical practice	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
i. Public health related careers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
j. Scientific/medical testing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
k. Science writing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
l. Research administration	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
m. Science policy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
n. Intellectual property	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	Will definitely pursue	Strongly considering	Moderately considering	Slightly / Not at all considering	Not familiar enough to decide
o. Business of science	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
p. Entrepreneurship	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
q. Sales and marketing of science-related products	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
r. Support of science-related products	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
s. Drug/device approval and production	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
t. Clinical research management	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
u. Career not related to science (please specify in box below):	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

v. Other (please specify in box below):

Management and Business Principles Module Final Evaluation: Spring, 2017

Reasons for participating in the module

* 4. Please rate the following statements as they pertain to your career:

	Strongly Agree	Agree	Disagree	Strongly Disagree
This module helped to solidify my career interests.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
This module helped me to identify next steps in my career planning.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
This module provided me with knowledge that will help guide my career decisions in the future.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Feel free to add additional comments here

Research advisor awareness

* 5. Please select the statement that best describes your experience:

- My research advisor was aware that I was participating in this module
- My research advisor did not know that I was participating in this module
- I don't know if my research advisor knew about my participation in this module

Aware of participation

6. How supportive was your research advisor of your participation in this module ?

- Supportive
- Neutral
- Not supportive

Please feel free to add any additional comments here:

Not aware of participation

7. If you chose not to tell your advisor of your participation in this module, please explain why.

Management and Business Principles Module Final Evaluation: Spring, 2017

Module content

* 8. Please rate the following statements as they pertain to the module.

	Strongly Agree	Agree	Disagree	Strongly Disagree
The module was a valuable use of my time	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The in-class didactic learning was appropriate	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Working on a project helped drive home concepts taught in class	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Feel free to add any additional comments in the box below

9. Were there any topics covered that should be expanded upon or covered in less detail? Please explain.

10. On average during the didactic portion of the module how many hours/week did you spend outside of class to complete readings and prepare for class?

- 0-1 hours
- 1-2 hours
- 2-3 hours
- 3-4 hours
- Other (please specify)

11. On average during the *project* portion of the module, how many hours/week did you spend outside of class to complete readings and prepare for class?

- 0-1 hours
- 1-2 hours
- 2-3 hours
- 3-4 hours
- Other (please specify)

Management and Business Principles Module Final Evaluation: Spring, 2017

Instructor evaluation

* 12. Rate your instructor in the following categories: (Scale: 1=Excellent...5=Poor)

	1 (Excellent)	2	3	4	5 (Poor)
Communication Effectiveness	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Outside Class Helpfulness	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Enthusiasm for Teaching	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Stimulating Interest	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Overall Instructor Rating	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Feel free to add any additional comments in the box below

Management and Business Principles Module Final Evaluation: Spring, 2017

Course Objectives

* 13. Rate your comfort level with the following:

	Very comfortable	Moderately Comfortable	Slightly Comfortable	Not Comfortable
Using fundamental financial tools and concepts to make financial decisions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Using strategies to build effective teams and develop an effective culture to improve performance.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Understanding the need for internal and external marketing and communication.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Using the unique strengths of a product or service to gain strategic advantage in the marketplace.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How to use performance measurements to improve results.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A basic understanding of techniques and tools used by businesses for problem-solving, project management, and decision making.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

14. What was the most valuable aspect of the module?

Final feedback - p.2

* 15. Would you recommend this module in its current format to a colleague interested in learning more about management and business principles for scientists?

Yes

No

Why or why not?

* 16. Please rate the overall quality of this module.

Excellent

Good

Fair

Poor

Other comments?

17. What suggestions do you have to improve or enhance this module in the future?