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A Student Seminar design:
Developing potential solutions to wicked problems

(Reading time:30 minutes)

A seminar design is outlined that provides teams of students the opportunity to research, critically analyse and develop creative, viable solutions to real, "wicked" problems facing industries and organisations. In order to maximize the quality of each "Presenting" team's solution, a "Mentoring" team of more senior students is assigned to provide them guidance. In addition, a second "Challenging" team of more senior students is specifically assigned to question, challenge and criticize the final presentation and proposed solution. Aspects of the design including: topic selection, team roles and responsibilities, schedule, marking scheme, presentation format, and research methods are outlined. The described student seminar design currently forms the core of a University of Toronto Mississauga (UTM), Master of Biotechnology (MBiotech) course.

Background:
This Student Seminar design forms the basis of the University of Toronto Missisauga's (UTMs) Master of Biotechnology programme (MBiotech) combined and concurrent BTC1600H (junior year) and BTC1610H (senior year) courses entitled Biopartnering series I & II respectively. These courses focus on issues facing biologic medicines manufactured and sold by biopharmaceutical companies. The basic design, including the three team design of Presenters, Mentors and Challengers, was originally developed by Drs. Revers and Parker, two UTM faculty members. The current rendition of this set of courses as well as the recommendations and guidelines for adapting and implementing a similar design for other subjects is based on the author's experience running this course in the Fall of 2019.

The objective of this Student Seminar Series is to have first/junior year student teams present viable solutions to "wicked" problems currently facing the biopharmaceutical industry. According to a Harvard Business review article, a "wicked" problem "has innumerable causes, is tough to describe, and doesn't have a right answer.[1]" Each "Presenting" team of five to seven students is assigned such a realistic and current problem by the course instructor. The team is then given seven weeks to research the problem, develop possible solutions and recommend a reasonable and viable one. Two scheduled meetings with the instructor and an assigned senior year "Mentoring" team are held during this period to provide guidance and direction as required. The seven week period culminates in a formal presentation to their whole combined first/junior and second/senior year classes. As part of this presentation, a different senior year team, the "Challenging" team, is assigned the lead responsibility for questioning, challenging and criticizing this final presentation and proposed solution. This "Challenging" team is frequently referred to as the "Dragons" in reference to the television program Dragon's Den in which a group of investors question, challenge and frequently criticize budding entrepreneurs.[2]

Topic Selection:
The first step involves identifying a number of the major issues facing the industry or firms of interest. The instructor is likely aware of some. Discussions with peers and senior industry employees is an additional source. Since most MBiotech alumni end up working in the biopharma industry, they have proven to be a valuable network. A good list can also be determined or supplemented by searching the internet for phrases like: "Challenges facing the biopharmaceutical (or other) industry", "Challenges facing CEOs in the biopharmaceutical industry", "The future of biopharmaceuticals", "Issues facing biopharmaceuticals" or "Trends in biologics." These types of searches will generally yield review articles as well as extensive industry reports done by major consulting firms, that outline the major issues and trends.

Having identified a set of major issues, the next step is to turn each of them into a specific problem by associating them with specific instances like individual products or companies. The goal is to generate a set of focused and challenging, so called wicked, problems. For example, the general issue might be the impact of the introduction of biosimilar medicines on sales of the originator's product. By doing some research into biologics about to be copied soon, the problem statement might become, "How should Roche defend their Lucentis® (ranibizumab) franchise against the imminent introduction of Biogen-Samsung

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[1] Camillus, J. C. (2008, May). Strategy as a Wicked Problem. *Harvard Business Review*. https://hbr.org/2008/05/strategy-as-a-wicked-problem

[2] *Dragons' Den* (Canadian TV series) (n.d.). In *Wikipedia*. Retrieved February 19, 2020, from https://en.wikipedia.org/wiki/Dragons%27_Den_(Canadian_TV_series)

Bioepis's biosimilar SB11 and two others?[3]" Another issue or wicked problem example involves the growth of the companion diagnostics market to pre-test the suitability of a given biologic in individual patients.[4] This issue could become the specific problem: "How should Novartis leverage companion or complementary diagnostics to best support their Kymriah (tisagenlecleucel) CAR-T cancer cell therapy franchise?" Developing such specific questions addresses the types of real life issues firms face and often adds an additional level of complexity and nuance which focuses the critical thinking and creativity needed to arrive at reasonable solutions. Although you may have some ideas as to possible solutions to these wicked problems, the design goal is to be as open-ended and future-focused as possible such that a particular solution does not currently exist. In some cases, it may be discovered that the actual problem is being addressed, but that approach should only be consider one of many by the students and not necessarily the only or best way forward. Occasionally, senior industry representatives have attended our final presentations as they were interested in hearing the alternate solutions and recommendations put forward by the students!

Team Roles and Responsibilities:
Three teams are required to address each wicked problem: the "Presenting" team, the "Mentoring" team and the "Challenging" team. The "Presenting" team is at the core of the process. They are tasked over a seven week period with researching the assigned problem and proposing solutions and recommendations. With our seminar series involving both our first and second year cohorts, each first year "Presenting" team is assigned a second year "Mentoring" team and a second year "Challenging" team, the so called "Dragons." Each second year team serves as mentors for one first year "Presenting" team as well as challengers for another (see Table 1). The assigned first year teams graduate to form the second year teams[5].

Having developed a series of wicked questions, these are best tackled by a team of 5-7 students. This is enough students to ensure the every aspect of the problem and possible solutions are well researched as well as enough diversity to galvanise the range of critical thinking and creativity required. In addition, teams of this size remain manageable in terms of meetings, internal communications and task sharing.

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[3] Mehr, S (2020, January) Who Are the Key Lucentis Biosimilar Players to Watch? *Biosimilars Review & Report* Retreived March 7, 2020 from https://biosimilarsrr.com/2020/01/16/who-are-the-key-lucentis-biosimilar-players-to-watch/

[4] Latest Research On Companion Diagnostics Market 2020 – Global Size, Key Trends, Top Company Profiles, Business Opportunities and Challenges. In *Medgadget* Retrieved March 7, 2020 from https://www.medgadget.com/2020/01/latest-research-on-companion-diagnostics-market-2020-global-size-key-trends-top-company-profiles-business-opportunities-and-challenges.html

[5] All the teams seem to take great pleasure in becoming "Dragons" in their second year.

The second year "Mentoring" team, having been through the process previously, is tasked with assisting their assigned "Presenting" team, providing advice and constructive criticism during two scheduled meetings and occasional email enquiries (see Table 2). The second year "Challenging" team, sitting in the front of the classroom, is tasked with asking tough questions regarding the content of the presentation as well as preparing a 2-4 page written critique one week after the presentation. To help the "Challenging" team prepare, a 1-paragraph abstract/executive summary is provided by the "Presenting" team one week in advance (See Table 2).

Table 1: Team roles and responsibilities

Problem released	Presentation date	Presenting team	Mentoring team	Challenging team
	Week 1-7	Seven presentations by external speakers		
Week 1	Week 8	1	A	D
Week 2	Week 9	2	B	E
Week 3	Week 10	3	C	F
Week 4	Week 11	4	D	G
Week 5	Week 12	5	E	A
Week 6	Week 13	6	F	B
Week 7	Week 14	7	G	C

Schedule:
In order to allow each "Presenting" team seven weeks to prepare for their presentation, the course is fourteen weeks in length with the first seven weeks being allocated to talks by external speakers (see Table 1). The last seven weeks are then filled with sequential team presentations. Each class is scheduled for approximately two hours. Each team presentation is to be 40 minutes long, followed by 20 minutes of questioning by the "Challenging" team and then further questions by the instructor and the rest of the student audience.

Table 2: Schedule of "Presenting" team activities and due dates

Timeline	Activity	Notes
First week	Problem released.	Initial research into the problem: Issue, product, competitors etc.
Second/third weeks	Meeting 1 with "Mentoring" team.	Development of a range of solutions. Preparation of questions to research, ask the mentors, and ask external experts.
Third/fourth weeks	Meeting 1 to update the Instructor.	Refinement of the core problem and possible solutions. Continuing secondary research (reports and papers) and primary research (self-conducted - surveys, interviews).
Fifth/sixth weeks	Dress rehearsal with "Mentoring" team and instructor (Meeting 2's). Abstract due.	Further validation of the recommended solution(s). Preparation of draft slide deck and abstract.
Seventh week	Presentation. Slides to be posted.	Final refinements and recommendations.
Eighth week	"Presenting" team to complete mentor review. "Challenging" team to prepare written critique.	

Marking Scheme:

As a result of the different activities, the marking scheme for the first year "Presenting" students and the second year students is different (see Table 3). There is also a mix of grades based on individual and group efforts: 30-70% for first years and 70-30% for second years. The main focus for the first year students is their presentation. As this is not the case for the second year students, they are tasked with writing an individual paper in which they are asked to forecast the impact, over the next 5 years, of a promising technology emerging today in the (biopharmaceutical) industry. This is an opportunity for these students to also demonstrate their creativity and critical thinking skills.

The grading of the presentation and the accompanying written report as well as the individual reports prepared by the second year students are all done using rubrics that mirror the recommendations given throughout this design. Generally 2/3rds of the grade is allocated to the combination of insights, value, depth and clarity whereas 1/3rd is allocated to format and flow. In the case of the oral presentation, the delivery is also evaluated shifting the allocation to 60-40%.

For each presentation, an initial impression of these different aspects is made in the moment. Input from other instructors who may be present, the written critiques of the "Challenging" teams and a second review of the videotaped presentation are also leveraged to come up with the final grade and a paragraph or so of comments both of which are provided to the student teams.

Table 3: Marking Scheme

First year students	Second year students	Grade
Individual participation in class/ pre-read quizzes/ post-presentation insights		20%
Individual efforts by Week 3/dress rehearsal		10%
Abstract/Copyright compliance		5%
Review of Mentors		5%
Presentation		45%
Handling of questions		15%
	Mentorship (graded by the presenting team)	15%
	Challenging questions and write-up	15%
	Individual disruptive technology in health paper	50%

Presentation Format:
As a guiding principle, each presentation is a simulated version of a presentation that a corporate team or department might make to the firm's CEO and senior management team. As a result, it must be insightful and valuable while at the same time clear and of high quality.

To be insightful, there needs to be a synthesis of an opinion or recommendation based on critical analysis and creative thinking about the problem and possible solutions. The value relates to the learnings and implications that arise from the process including those solutions that were disregarded. In support of the insights and value are the depth and clarity of the supporting research.[6]

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[6] Adapted from Duncan Jones' Oral-Written Rubric

The quality of the presentation encompasses the format of the slides (design, busyness, spelling and grammar), the flow (clear, orderly and to the point) as well as the delivery (passionate, good tone and natural i.e. not read from notes). Table 4 outlines a recommended structure to follow that outlines the problem, solutions and recommendation in a straightforward manner.

Table 4: Presentation Structure

Section	Notes
Problem	Introduce the problem statement that was given as well as any slight modifications or interpretations that you may have adopted. Upon researching the problem, it is not unusual to discover that it is not the core issue and may be more of a symptom. It is however important to clarify any modifications with the instructor before proceeding. If there are additional criteria or limitations, these should be outlined. Time is often a limitation based on patent expiration, regulatory changes, or competitive actions. Finances either internally or customer-related are another frequent limitation.
Solution	It is often good practice to make a brief referral to the solution early on, without going into the depth, so the audience can better follow the development of the recommendation.
Background	This section sets the stage for the audience. What is the current situation? Provide details, statistical support and references to support the situational analysis. Why does this problem exist? How long has it been apparent? What has been tried previously (and obviously was not a satisfactory solution).
Possible approaches/solutions	For this section, outline some of the possible solutions that either the team considered or that are currently being explored in the industry. Prepare a list of pros and cons for each one. This section is intended to showcase the teams creativity as well as critical thinking skills. As in any corporate setting, these alternatives may indeed be considered by senior management who perhaps bring different insights or weightings to the various pros and cons.
Recommended solution	Outline the team's chosen/recommended solution(s) as well as their pro's and con's.
Timeline and budget	Describe the implementation plan, any contingencies as well as the costs and timing of each activity. Where appropriate a return on investment (ROI) type calculation should be included. As with any proposal, it is recommended to not only outline the full project and costing but to also outline one or more initial experiments that can be done fairly quickly and cheaply. In the MBiotech programme, this has been described as FIND & FIX and involves making significant progress on the solution within a 2-year timeframe and a $200,000 budget.

Section	Notes
Copyright compliance and references	This presentation is a simulation of a private sector or "business" presentation that might be shown publicly. As a result, it is important that it be copyright compliant. What this means is that images from the internet or papers cannot just be "clipped" and used. Permission to use each image must be obtained in advance from the author, or figures, diagrams, graphs and other representations must be recreated. Beware! It takes time to email or contact the author to obtain permission so planning is required. In addition, such permission may not be granted.
Backup slides	A series of backup slides should also be prepared. These generally provide more detail on specific items, especially technical but also covering market research and financial calculations. In addition to including slides that didn't make the final presentation, a way to develop them is to ask yourselves/ list as many questions as possible that an audience might ask.

It is expected that each member of the "Presenting" team speak to a section of the presentation as well as contribute to the question and answer session that follows. Given that the presentation is scheduled for 40 minutes, that is approximately 6-8 minutes each. Aside from the overall structure of the presentation, Table 5 outlines some additional points and items that should be considered for incorporation into the final presentation.

Research Methods:
To understand the details and nuances of the problem and to critically appraise the proposed solutions, extensive research needs to be carried out by the "Presenting" team. This research takes two forms: Secondary research involves finding published information including news articles, scientific reports and government publications. Primary research involves collecting information directly from individuals through interviews and surveys. The sources for primary research could include current and potential customers (including patients and doctors for medical questions), suppliers, regulators, experts/key opinion leaders, or analysts. It is important when carrying out primary research that you do not misrepresent yourself nor take any action that may get the interviewee in trouble for disclosing confidential information.[7] Table 6 provides additional details on accessing the major research sources.

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[7] Society of Competitive Intelligence (SCIP) Code of Ethics https://www.scip.org/page/Ethical-Intelligence

Table 5: Key points to consider

Item	Notes
Timing	Stick to the required time (40 minutes). At approximately 1 minute/slide, that is approximately 40 slides, certainly no more. Rehearsal is key for timing and team member roles.
Graphs/ data	Remove all extraneous information from graphs and figures. If an item is not going to be addressed then don't include it. Be sure to clearly label the axis of graphs and the columns and rows of tables.
Slides	Make sure that the slides are not too busy. Avoid small fonts i.e. < 30 point. Number the slides for later referral.
Copyright and references	Place the permissions and full references at bottom of each slide.
Team slide	Include a slide with the names and pictures of all the team members. You may also wish to acknowledge those who provided assistance i.e. "Mentoring" team, external contacts etc.
Index slide	An index slide with hot links to all the other slides in the talk as well as the backup slides is very valuable for quick navigation during questioning.
Quality of insights, not data dump	The most important part of any presentation are the insights, implications, calls to action and/or recommendations. It is both the critical and creative thinking that are of interest to the audience, The data serves to support this thinking. A dump of lots of data, often data that the audience could find themselves, is of little or no value on its own.
Presentation flow/ transition	The presentation and the sequencing of the team presenters should be well structured making it easy to follow for the audience. A series of headings and subheadings can help here. Introducing at the start how the presentation will unfold is also valuable.
Notes/reading	It is imperative that notes or the slides themselves are not just read directly. It is highly recommended that notes in general are kept to a minimum. Through rehearsal a few times both alone, to your team and to the mentors, the need for notes can be eliminated.

Optional components:
Of course the process that has been described is open to modification. What has been described is what actually is done in the MBiotech programme and found to work. Table 7 describes some of the additional features that are also incorporated into the MBiotech programme, aside from the single year class.

Table 6: Research methods

Method	Notes
News/ press releases	These can be found by simply "googling". Alternately, searching financial sites like https://ca.finance.yahoo.com/, financial news sites like https://www.cnn.com/, https://www.cnbc.com/, https://www.bnnbloomberg.ca/ or more general news sites like https://www.reuters.com/, https://www.cbc.ca/news and https://www.ctvnews.ca/ is recommended.
Web sites	Company and association websites are another good source initial secondary research. Often company websites have internal links to their own press releases as well as news and financial information.
Financial information	All publicly-traded companies must publish their financial information quarterly and an annual report, In addition, any material changes including major deals with other companies must be disclosed. In Canada this information is available at www.sedar.com. In the US this information is available at https://www.sec.gov/edgar/ (10-K and 10-Q are the most important).
Scientific literature	Significant information is available in the scientific literature. This can be accessed by simply googling as much of it is publicly available. Google searches may also reveal abstracts that need to be accessed through paid providers like Scopus and Web of Science which Universities have access to.
Patent literature	The patent literature is another excellent source as valid patents require full disclosure of how to carry out the invention. An excellent source is https://patents.google.com/. Additionally you can search https://www.ic.gc.ca/eic/site/cipointernet-internetopic.nsf/eng/home, https://www.uspto.gov/ and https://www.epo.org/,
Government sites	All governments host a number of websites outline laws, regulations and guidelines. Some examples are https://www.canada.ca/, https://gov.ecfr.io/ and https://www.fda.gov/
Email	The best way to contact an individual is by email. Sending a clear and concise note as to who you are, what you want and why you want this information will result in the highest response rate. However don't be surprised if it is less than 10%. As a result, you may need to contact a number of different individuals. To obtain email addresses, search company websites under contacts or search https://www.linkedin.com/.
Telephone/Skype/meet	Speaking directly with individuals usually follows an email introduction. In order to maximize the exchange and learn the valuable nuances of a particular situation, it is important to do as much background, secondary research as possible and prepare a detailed set of key questions. This way you can garner the most information in the shortest period of time. Confidentiality is another issue that must be discussed.

Method	Notes
Survey	Online surveys using tools like https://www.surveymonkey.com/ can be valuable, although the response rate is often quite low. Like emails, it is important to outline the who, what and why of your survey. Like speaking directly, it is also important to respect the time of the individual by not asking too many questions. You need to also inform all participants how you will use the data and whether it will be kept confidential.

Table 7: Additional/alternate approaches

Approach	Notes
Single year class	Do away with the "Mentoring" team which will require the instructor and possibly Teaching Assistants to provide more guidance. Have each team serve as a "Presenting" team and a "Challenging" team.
Video tape	We video tape and post all the presentations so students can reflect on their work. The presentations also serve as exemplars for future classes.
Pre-read quizes	Before each external speaker's presentation, a relevant pre-read paper is posted along with a brief 5-6 question quiz. This allows the speakers to address the topic at a more sophisticated and nuanced level.
Post-presentation insights	After each external speaker and student team presentation, each student is required to reflect, draft and post a short paragraph on a few insights that they gleaned. This is not to be summary notes of the presentation. This exercise helps reinforce the learning. Of course, this does not apply to the "Presenting" or "Challenging" team in any given week.
Guests	Within the MBiotech programme, these presentations are open to everyone and are advertised around campus. Nevertheless, few external students and staff attend. However on occasion company representatives relevant to the problem at hand, especially those with whom the students have consulted, do attend and are generally impressed with the recommended solutions.
Formal attire	Within the MBiotech programme, student presentations to large groups even their peers, has taken on a formal nature to mirror the simulation of a serious corporate simulation.
Debriefing	Having the instructor and "Presenting" team hold a quick debrief immediately following the presentation provides yet another learning opportunity.

Conclusion:

A seminar design that is used in the University of Toronto's Master of Biotechnology programme has been described. It involves teams of students researching, critically analyzing and developing creative, viable solutions to real, "wicked" problems facing industries and organisations. A number of key steps are taken In an effort to simulate a "real world" experience. First, the problems are designed to mirror current, challenging and unresolved issues faced by the industry. Second, each assigned problem is made very product and company specific to mirror what actually may be taking place in corporate boardrooms. Indeed, feedback from various company representatives supports this. And finally, a formal presentation of the considered solution and final recommendation is made to a discerning panel of peers.

According to the official course evaluation survey completed by one-third of the first year "Presenting" class, this course was both challenging and hard work. However, the majority of these same students found the experience and learnings to be valuable for their careers.

The design that has been outlined represents the evolution of the course at UTM. It is meant to be descriptive as opposed to prescriptive as there are are a number of modifications that may be necessary to fit with the timing or numbers in a particular course, as well as the subject matter. In addition, there are no doubt amendments that would further improve the overall design.