

## Syllabus

### Implementing Process Improvement

OPNS-932

Northwestern University  
Kellogg School of Management

#### Contact Information

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#### Course Overview

Evaluating and improving operating processes is essential for the growth and health of any business. This course introduces a variety of frameworks for assessing performance as well as identifying and prioritizing improvement opportunities. It draws on the most frequently used tools from Six Sigma and Lean as well as project management techniques. The course also emphasizes organizational considerations in implementation. Students will have opportunities to apply these tools in visits to local firms as well as be expected to use them in a final project.

The emphasis of this course is on the practical application (vs. theory) of Six Sigma, Lean, and project management techniques as the best way to learn these techniques is to practice them. **So, in order for you to gain the most from this course, you are expected to identify an issue you want to analyze with these techniques, preferably a real problem encountered during your job.**

Please note that this is NOT a certification course, and completion of this course will not necessarily lead to certification. However, successful completion of your project can be used to demonstrate Six Sigma proficiency for any formal certification program, such as the one run by ASQ (American Society for Quality), the de facto industry standard for Six Sigma certification.

#### Approach

This class is grounded in the practical application of Six Sigma, Lean, Project Management, and Change Management. As such, there is typically at least one in-class exercise for each class.

There will be one mandatory opportunity to conduct observations. A second, optional, opportunity will also be offered.

The focus of the first half of the course is on some of the most frequently used tools in the Six Sigma toolset. While additional tools are introduced, the focus of the second half of the course is the practical application of the tools and in-depths reviews of the real-world problem you are attempting to solve. To help with the understanding of the material, there is an emphasis on student participation.

### Student Feedback

- Practical
  - One of the most useful classes I've taken.  
No text book, no calculator, just practical tools.
  - I used every single lecture in my work day.
  - It did not feel like a class. It felt like a guide to solve my work problems.
  - **Your class was instrumental in my job hunting process:** once I walked them through the DMAIC process and what I would do, they were sold (not a single DECS, Accounting, or Finance question!).
  - It felt like a capstone to my operations major and a combo of MORs & Analytics.
- Instructional
  - I have used many of your tools in order to guide novice project managers.
- Applicability
  - Looking at the variety of projects on which we have been able to use these tools, it is clear to me that they are **valuable even on 'non-process improvement' initiatives**, such as marketing and fundraising

### Prerequisites

- DECS 434
- OPNS 430

A working knowledge of Excel, PowerPoint, and Word, and Stata.

### Course Materials

There is no required textbook for this course.

All of the concepts and tools are industry-standard and multiple references can be found via a web search.

However, the Case Packet is required. Its contents are:

1. Excel Logistics Services
2. Samsung Electronics: Using Affinity Diagrams and Pareto Charts
3. Analyzing Low Patient Satisfaction at Herzog Memorial Hospital
4. Tipping Point Leadership

Also, there is required software – Stata (<http://stata.com/>). I have been told that all students have access to Stata and it is the analytical software used in DECS 434.

In the Six Sigma community, the primary statistical package is Minitab. We will use it starting Class 6.

Whenever Minitab is used to illustrate a tool, I will also show you what it looks like in Stata. *Since Minitab only has a 30-day trial version, please do NOT download it until you are instructed to do so.* <http://it.minitab.com/en-US/products/minitab/free-trial.aspx>

### Attendance

Students are expected to attend all classes. An attendance sheet may be circulated to check attendance. *Students who miss more than one class may lose a letter grade.*

### Grading

- 30% Homework
- 25% Class Participation & Attendance
- 20% Project Updates or Tools Demonstration
- 15% Exam
- 10% Mid-Term Case Study (Group Project)

### Homework

I will gauge / evaluate homework using the method outlined below.

- 0 = Not turned in.
- 0 = Turned in, but with numerous errors.
- 1 = Turned in, but with several errors.
- 2 = Turned in, but with a small number of errors.
- 3 = Turned in, with no errors.

At my discretion, I may award an additional ½ point if I consider your work to be a model for the other students. Under such circumstances, I may ask you to present your solution to the rest of the class.

Note – there may be homework assignments (i.e., case studies) that are worth more points. In those cases, the same scale will be used, but a multiplier used to determine the final score.

Observations are to be considered as homework.

Again, there will be two opportunities to conduct observations – both will be on a Saturday. Doing one is mandatory; it does not matter which one. To compensate for “having class” on a Saturday, there will be no class in Week 6.

Homework is due at the start of class. Points will be deducted on a sliding scale for late turn-ins.

### **Class Participation**

Class participation / discussion is a very important part of the learning process in this course. That said, grading class participation is necessarily subjective. You are evaluated on the quality of the contributions that you make to class discussion and not on the amount of "air time" you take up.

Please note that you will not be evaluated on questions that you ask to clarify lecture or course material. If you have a question, chances are that the same question is on the minds of some of your classmates as well. Thus, you are doing the class a favor by asking it.

Again, I am assuming that this material is new to most of you. So, please, ask questions. And yes, cold-calling is a possibility.

I will gauge / evaluate participation by class using the method outlined below.

- 0 = Not in attendance.
- 1 = In attendance, but little-to-no participation in the discussion.
- 2 = In attendance and moderate participation in the discussion.
- 3 = In attendance and active participation in the discussion.

Again, I understand that this scale is subjective.

A score of 2 is NOT bad. Your final grade is on a relative scale, not an absolute one.

- For example, if you receive a 2, that is “good” if the average class participation score for that class is a 1.625.
- Alternatively, if you receive a 2, that is “OK” if the average class participation score for that class is a 2.125.

At the start of class, everyone starts with a 2 – as I expect everyone to participate in some manner. If I deem your participation to be “active”, you will likely be awarded a 3. Expect points to be deducted for:

- Arriving Late
- Nodding Off (or worse, sleeping) – if tired, I would prefer that you stand in the back of the room
- Smartphone use (e.g., texting or surfing the web)
- Use of your laptops / notebooks for non-class reasons (e.g., e-mail or surfing the web)
- Disruptive Behavior
- Behavior not consistent with the Kellogg Code of Classroom Etiquette

**Project Updates (Application of Tools on a Real-World Improvement Opportunity)**

Similar to the Homework scale:

- 0 = Not turned in.
- 0 = No update from the previous turn-in.
- 1 = Turned in, but with numerous errors and/or omissions, or a just a nominal (i.e., insignificantly small; trifling) update from the previous turn-in.
- 2 = Turned in with minor updates from the previous turn-in (such as evidence that you are moving the project forward, providing new analysis, and/or use of new tools).
- 3 = Turned in with a major updates from the previous turn-in (such as evidence that you are moving the project forward, providing new analysis, and/or use of new tools).

Again, at my discretion, I may award an additional ½ point if you used a tool in a manner that I would consider it to be a model for the other students. Under such circumstances, I may ask you to present your solution to the rest of the class.

Project Updates are due Weeks 2, 3, 4, 6, 8, & 10.

**Project Updates are due two days before class.**

In other words, if class is on Thursday, homework is due Tuesday at 6:00 PM.

This will enable me to provide you with more immediate (“real-time”) feedback.

**Tools Demonstration**

As an alternative to the Project Updates, you may select to write-up a “Tools Demonstrated” paper for Weeks 4, 6, 8, 9, & 10.

You will still be required to turn-in a Project Update for Week 2.

You may decide to elect this option if:

- You are having troubling selecting a suitable (single) project
- You are working multiple projects and you have a “real-time” opportunity to use the tools

You may write-up the same tool up to two times (albeit, the circumstances for their application must be different). You may not repeat work previously turned in as homework.

These papers will be graded on the same 3-point scale as the Homework and Project Updates, but will be **evaluated upon their breadth and depth**.

**As with the Project Updates, Tools Demonstrations are due two days before class.**

**Late Submissions – Homework and Tools Demonstration**

Points are deducted on a sliding scale for late submissions.

Submissions that are more than 48 hours late will receive a zero (0).

### **Exam**

The in-class exam (Class 10) will be closed book, closed notes.

However, you will be allowed to use notes on both sides of one sheet of paper during the exam.

This one sheet of paper will be turned in along with your exam. Since the exam is an individual effort, it is expected that the creation of this one sheet will be an individual effort, too.

The in-class exam will cover the concepts discussed in class to-date. It will be a mix of:

- Fill-in-the Blank
- Multiple Choice

### **Mid-Term Exam Case Study**

A take-home Case Study – to be worked on as a group; due by the start of Class 5 at 6:00 PM (CT).

### **Week 11**

There is no final exam. Class 11 is optional and will only be held if there are special topics submitted by the students.

### **Classroom Etiquette**

Students will abide by the Kellogg Code of Classroom Etiquette in interaction with their fellow students and with the instructor.

Laptops – please leave them off unless we are using them in an exercise.

**Cell phones – please turn them off or on vibrate.  
And no texting, please.**

Nameplates – please bring & display them (thank you).

“Vegas Rules” – class discussion stays in class, please.

### **Honor Code**

The student experience at the Kellogg School is unique because, among other reasons, students trust that their classmates will behave with honesty, integrity, and respect in all academic, professional, and social matters.

Kellogg's Honor Code plays a critical role in engendering this trust. The Honor Code requires that a student not to seek an unfair advantage over other students, including but not limited to giving or receiving unauthorized aid during completion of academic requirements; to truthfully represent fact and self at all times; and to respect the property and personal rights of all members of the Kellogg community.

Students' willingness to abide by this Code serves as the lubricant that allows faculty and students at the Kellogg School to interact with a minimum of rules, regulations, and bureaucracy,

which in turn allows all of us to focus on creating an engaging and challenging academic environment.

For each formal course requirement, I will attempt to be clear about my expectations and standards. If you have questions about whether behavior is within the bounds of honorable behavior, please ask. Your mantra should be: when in doubt, ask!

One final word / request – students will not disseminate course materials or their course notes beyond other members of the course.

### Sanity Check

This course is grounded in published “best practices”.

Please be wary of anyone pushing (selling) proprietary approaches to improvement.

Creating a culture of engaged problem solvers in your business is not nearly as difficult as it may sound. So, don’t leave the tools of process improvement only in the hands of a few “experts”. Become familiar with the basics, as they will help you become part of the solution to any business problem.

Course Outline

A detailed week-by-week agenda is below.

Class	Topic	In-Class Exercises	Tools Introduced	Homework Due
0	black font = lecture			
	green font = student participation/exercise			
1	Introductions		Project Risk Assessment	Identify an Improvement Opportunity
	Survey Results - Expectations		A4	Survey
	Syllabus Review		Pareto	
	Icebreaker & "Quick Wins"		5 Whys	
	Course Overview		Voice of the Customer (VoC)	
	Break		Process Maps (overview) Gemba Walks	
	A Basic Problem Solving Framework	Pareto	Spaghetti Diagrams	
	DMAIC --> DEFINE		Stakeholder Analysis	
	Homework Assignment		Consensus / Voting	
			Action Item Tracking	
2	Icebreaker & "Quick Wins"		Histograms	Project Update - Quadrant 1 of A4 --> DEFINE
	Review of Case Study Pareto		Box Plots	Case Study - Excel Logistics Services (Pareto Diagram)
	Review of "Real World" Pareto (2-3 students)		Scatter Diagrams	Create "Real World" Pareto
	Review of Gemba Walk		Run Charts	Gemba Walks
	Review of Stakeholder Analysis (2-3 students)		Control Charts	Conduct Stakeholder Analysis
	Review of Quadrant 1 of A4 --> DEFINE (2-3 students)			Start Daily Tracking of your (a) Commute Time or (b) Weight
	Tollgate Review - Define			Form 3-4 member groups



Class	Topic	In-Class Exercises	Tools Introduced	Homework Due
	Break	Card Drop Game		
	DMAIC --> MEASURE - Card Drop Game	Demining Funnel Experiment (Variation)		
	- Deming Funnel Experiment			
	Homework Assignment			
	Review of Quadrant 1 of A4 --> DEFINE (1-2 students)			
3	Icebreaker & "Quick Wins"		Process Mapping	Project Update - Quadrant 2 of A4 --> MEASURE
	Review of Deming's Red Bead Experiment		Affinity Diagram	- Quadrant 4 of A4 --> Project Mgt
	DMAIC --> MEASURE (continued)		Fishbone (Cause & Effect)	<a href="#">Watch Video of Deming's Red Bead Experiment</a>
	Tollgate Review - Measure		ANOVA (overview)	<a href="#">Read AT&amp;T Wireless Complaints</a>
	DMAIC --> ANALYZE - Qualitative Data			REMINDER - Continue Daily Tracking
	- Process Mapping	Process Mapping (2)		
	- Affinity Diagram - Class Example - "Thanksgiving" (Entire Class)	Affinity Diagram (2)		
	Break			
	- Fishbone Diagram - Quantitative Data			
	- Affinity Diagram - Class Example - AT&T Wireless Complaints (Group)			
	Homework Assignment Case Study Intro			
	A4 Review (2-4 students)			
4	Icebreaker & "Quick Wins"		Multi-Voting	Project Update - Quadrants 2 & 3 of A4 --> ANALYZE
	Review Process Maps (1-2 students)		Criteria Selection Matrix	- Other A4 Quadrants (as needed)

Class	Topic	In-Class Exercises	Tools Introduced	Homework Due
	Review of Samsung Case Study		DOE (overview)	Tool Demonstrated
	A4 Review (2-3 students)		Lessons Learned	Process Map
	Tollgate Review - Analyze			Case Study - Samsung Electronics: Using Affinity and Pareto Diagrams
	Break			REMINDER - Continue Daily Tracking
	DMAIC --> IMPROVE			Assign Herzog - Class 4
	- Multi-Voting	Multi-Voting		
	DMAIC --> IMPROVE (continued)			
	Tollgate Review - Improve			
	DMAIC --> CONTROL			
	Tollgate Review - Control			
	Exam Expectations			
	Homework Assignment Case Study Intro			
	Expectations for Observations			
	A4 Review (1-2 students)			
4a	REAL-LIFE Observation #1 (will take place on a Saturday either before Class 4 or Class 5)			
5	Icebreaker & "Quick Wins"		VSA	Write-Up Observations
	Review of Observation #1			Case Study - Analyzing Low Patient Satisfaction at Herzog Memorial Hospital
	Review of Herzog Hospital Case Study			REMINDER - Continue Daily Tracking
	Tools Demonstration Review			
	Break			
	Plan / Expectations for Observation #2			
	Lean Revisited			
	Lean Simulation - 5S Game	Lean - 5S		
	Lean Revisited (continued)			
	Lean Simulation - Dot Game	Lean - Dot		

Class	Topic	In-Class Exercises	Tools Introduced	Homework Due
	Homework Assignment			
	A4 Review (4-5 students)			
6	REAL-LIFE Observation #2 (no class - as observation will take place on a Saturday)			Update A4
				Tool Demonstrated
				<a href="#">Applying Lean</a>
				REMINDER - Continue Daily Tracking
7	Icebreaker & "Quick Wins"		Minitab	<a href="#">Write-Up Observations</a>
	Review of Applying Lean			<a href="#">Download &amp; Install Trial Version of Minitab (and prep data file)</a>
	Review of Observation #2			
	Minitab Overview	Minitab		
	Break			
	Control Charts Revisited			
	Weight Control Chart Exercise	Weight Control Chart		
	Change Management Revisited			
	Homework Assignment			
	A4 Review (1-2 students)			
8	Icebreaker & "Quick Wins"			Update A4
	Review Control Charts Homework			Tool Demonstrated
	MSA Exercise #1	MSA		<a href="#">Control Charts - Excel Logistics Case Study</a>
	Measurement Systems Analysis (MSA)			<a href="#">Submit Special Topics for Class 11</a>
	MSA Exercise #2	MSA		
	Break			
	Project Management – Process to Develop a Workplan			

Class	Topic	In-Class Exercises	Tools Introduced	Homework Due
	Class Critique Prep			
	Homework Assignment			
	A4 Review (6-8 students)			
9	Icebreaker & "Quick Wins"			Tool Demonstrated
	Guest Speaker			Update Stakeholder Analysis
	Break			Create Communication Plan
	De-Brief - Guest Speaker			Prepare for Class 9 Lessons Learned Discussion
	Review Communication Plan			
	Review Stakeholder Analysis			
	Lessons Learned - Review of Expectations from Class 1			
	VOC - Survey Methods			
	A4 Review (2-3 students)			
	Homework Assignment			
10	Kellogg Class Critique (by Students)			Update A4
	Icebreaker & "Quick Wins"			Tool Demonstrated
	Process Improvement Resources			
	Tools Demonstration Option			
	A4 Review (3-4 students)			
	Break			
	Exam			

### Homework Summary

		Total	57	18	18
Due		Possible Points			
Class	Item	Homework	Project Updates	Tools Demonstrated	
2	A4 Update		3	3	
2	Case Study - Excel Logistics Services (Pareto Diagram)	3			
	Create "Real World" Pareto	3			
	Gemba Walks	3			
	Conduct Stakeholder Analysis	3			
3	A4 Update		3		
4	A4 Update		3		
4	Tool Demonstrated			3	
4	Process Map	3			
	Case Study - Samsung Electronics: Using Affinity and Pareto Diagrams	15			
5 / 7	Observation #1 - due class 5 Observation #2 - due class 7	15			
5	Case Study - Analyzing Low Patient Satisfaction at Herzog Memorial Hospital				
6	A4 Update		3		
6	Tool Demonstrated			3	
6	Appplying Lean	3			
5 / 7	Observation #1 - due class 5 Observation #2 - due class 7				
8	A4 Update		3		
8	Tool Demonstrated			3	
8	Case Study - Excel Logistics Services (Control Chart)	3			
9	Tool Demonstrated			3	
9	Update Stakeholder Analysis	3			
	Create Communication Plan	3			
10	A4 Update		3		
10	Tool Demonstrated			3	