

Efficient (And Easy) College Wide Processes for Outcomes Assessment

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Materials Science and Engineering and
College of Engineering
University of Michigan



Disclaimer

These are our views and not necessarily those of ABET, TMS, ACerS, or MRS

(but they should be)

This talk is about what we are doing at the University of Michigan. We do not want to preach but rather share. Just because we do what will be presented does NOT mean that it is what is best for your institution.

How To Inoculate Your Program From the Rapidly Mutating ABET Virus

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Why Develop an Electronic Tool for Outcomes Assessment?

- Simplicity and Sustainability
 - We have 13 accredited programs
 - We had 13 different assessment processes
- Now a uniform process across the college
- Much lower cost in time and dollars

Why do it now?

- The Outcomes have changed
- Google forms has evolved enough that it works easily

How to make it simple and drive faculty compliance

- Do it every term
- But, just a little every term
 - Step 1: build a matrix of outcomes and courses
 - Step 2: don't bother with first or second year courses
 - Step 3: make sure most courses only have 1 outcome to measure and no more than 3



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Mapping of MSE Courses to Student Outcomes

Course	Student Outcomes (Black-High, Grey-Low)						
	Apply math and science	Design	Communicate	Ethics	Teams	Experiments Analyze and interpret Data	Lifelong Learning
	1	2	3	4	5	6	7
MSE 220 Intro. to Materials	■	■	■	■	■	■	■
MSE 250 Intro. to Materials	■	■	■	■	■	■	■
MSE 242 Physics of Materials	■				■		■
MSE 330 Thermodynamics	■				■		■
MSE 335 Kinetics	■				■		■
MSE 350 Structure	■				■		■
MSE 360 UG Lab I	■	■	■	■	■	■	■
MSE 365 UG Lab II	■	■	■	■	■	■	■
MSE 400 Elec., Mag., Optical	■	■	■	■	■	■	■
MSE 410 Biomaterials	■	■	■	■	■	■	■
MSE 412 Polymers	■	■	■	■	■	■	■
MSE 420 Mechanical Properties	■	■	■	■	■	■	■
MSE 440 Ceramics	■	■	■	■	■	■	■
MSE 454 Computational Materials	■	■	■		■	■	■
MSE 465 Characterization	■		■		■	■	■
MSE 470 Metals	■	■	■	■	■	■	■
MSE 480 Processing Design	■	■	■	■	■	■	■
MSE 489 Design	■	■	■	■	■	■	■
MSE 514 Composites	■	■	■	■	■	■	■

Automated Outcomes Assessment: Google Form Created Each Term

- **Pre-filled**
- **The metric and the results can be uploaded as pdf or a spreadsheet**
- **Separate form for each outcome each course is measuring**
- **Edit after submission**

Automated Outcomes Assessment (Google form sent out once a term)

- We ask for only two things from each instructor:



1. The assessment metric used for each outcome (a pdf file)
2. A spreadsheet of the individual grade values of each student in the class for the metric

How to make it simple and drive faculty compliance

- It's all about muscle memory





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How to make your assessment strong



- The ABET Coordinator
- The Department Chair
- The College ABET Tsar
- The coordinator meetings and checklist

Council of ABET Coordinators

- Standing group that meets twice a year
- One from each program
- Coordinators are made aware of changes and issues that crop up with the ABET visits to ensure that we will perform well at our next visit in 2023
- Coordinators help continuously improve the process by working with faculty members in each department to:



1. Develop excellent assessment metrics
2. Keep excellent documentation of all aspects of ABET compliance
3. Analyze data and report to the faculty about the results of the outcomes assessment.



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What Every Department Chair Ought to Do for ABET Success



- Choose an excellent ABET coordinator and **support** them
- Send your ABET coordinator to ABET training that your society offers - even if they will not be an evaluator (MRS offers training that anyone from other societies can attend)
- Understand that you are the customer for your society's Accreditation Committee - Make them work for you.
- Read the Criteria so you are aware of the process. It is only 4-5 pages long.
- Recognize that ABET is a moving target and what happened at the last visit stays with the last visit. It is all about the evaluators and evaluators are easily swayed by other evaluators.

Future proofing your system and inoculating your program to the ABET virus

- **What exactly does “appropriate” mean?**
- **The meaning changes every time ABET visits**
- **Every change spreads to multiple teams by the evaluators every year**
- **So, how do you future proof your assessment process to make sure it is always “appropriate”?**

ABET Coordinator Checklist: Criterion 2 - Objectives

- Met with all constituencies and discuss their needs?**
- Record minutes and slides from these meetings and upload them to the college site.**
- Bylaws that dictate the makeup of your external advisory boards to ensure that all of your constituencies are consulted.**



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ABET Coordinator Checklist: Criterion 4 Continuous Improvement



- Develop rubrics for laundry list outcomes (2 and 4).
- Grade for the quality of consideration as a check list.

ABET Coordinator Checklist: Criterion 5 - Curriculum



- Do you have a **MAJOR** design experience that is really design (not just analysis)
- Does it incorporate appropriate engineering standards and multiple realistic constraints.

ABET Coordinator Checklist: APPM

- Are your PEOs published on your website
- Do you have your current graduation data on your website
- Do you have the right ABET info stating that your program is accredited?
- Have you developed a resource room (it can be a box.com folder system)



Google forms and spreadsheet magic

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- Design of the form
- Limitations of google forms
- Behind the scenes
- Spreadsheets
- The Coordinator checklist
- Document repository
- Tableau® and reports



What technologies are we using?



Google Forms

A screenshot of the Google Apps Script editor interface. The browser address bar shows 'script.google.com'. The page title is 'Google Apps Script'. The main editor area contains a JavaScript function named 'onOpen' that creates an add-on menu item. The code is as follows:

```
function onOpen(e) {  
  SpreadsheetApp.getUi().createAddonMenu()  
    .addItem('Show', 'showSidebar')  
    .addToUi();  
}
```


Why?

- Easy to find people who can program App Scripts.
- Built-in functionality allows quick form creation and easy-to-share items.
- Can customize or change things on a per-program basis easily.
- Michigan says Google Drive is FERPA compliant!

Using Google Drive at U-M

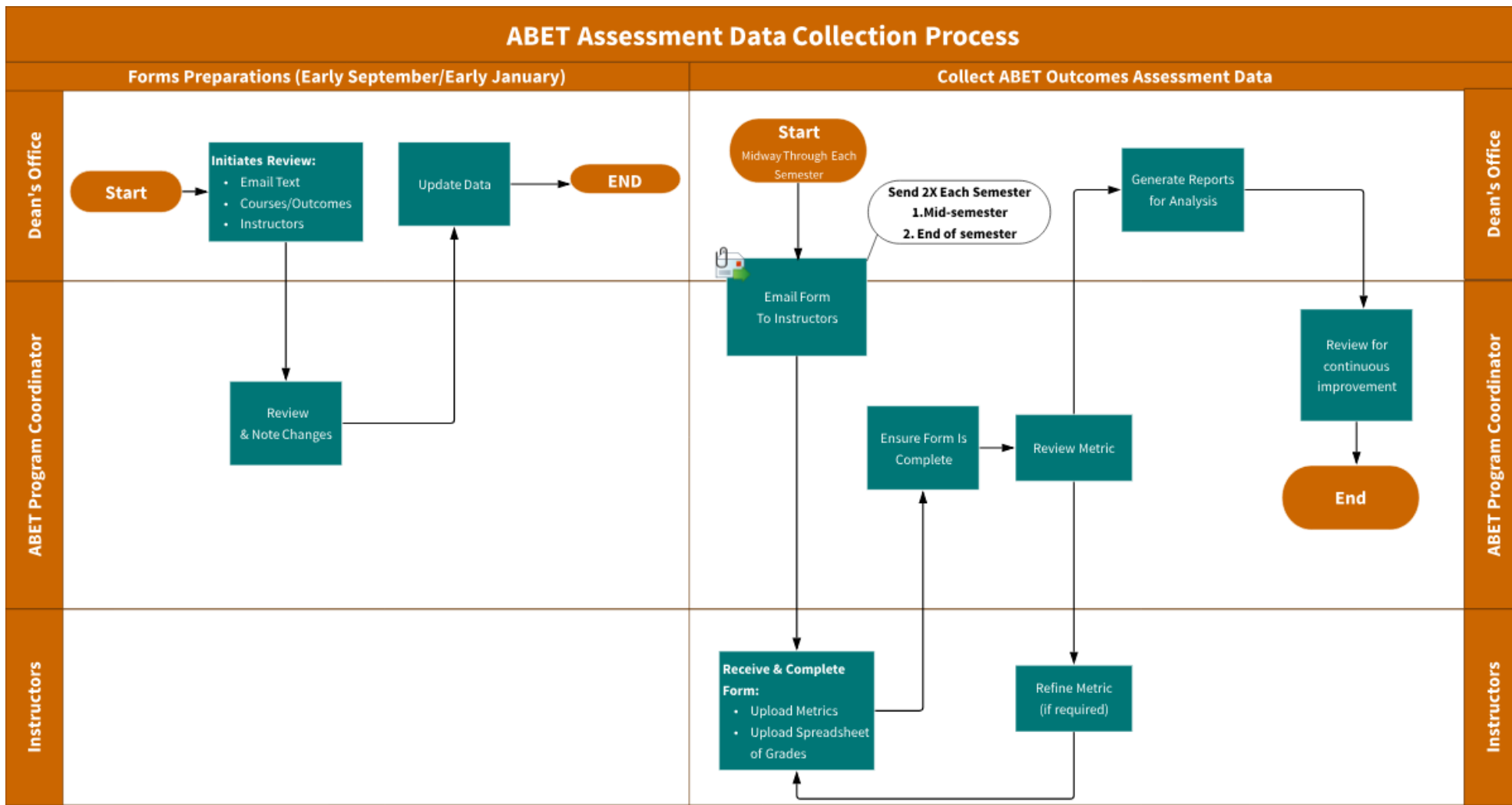
You are responsible for ensuring that your use of this service complies with applicable laws and regulations.

Permitted

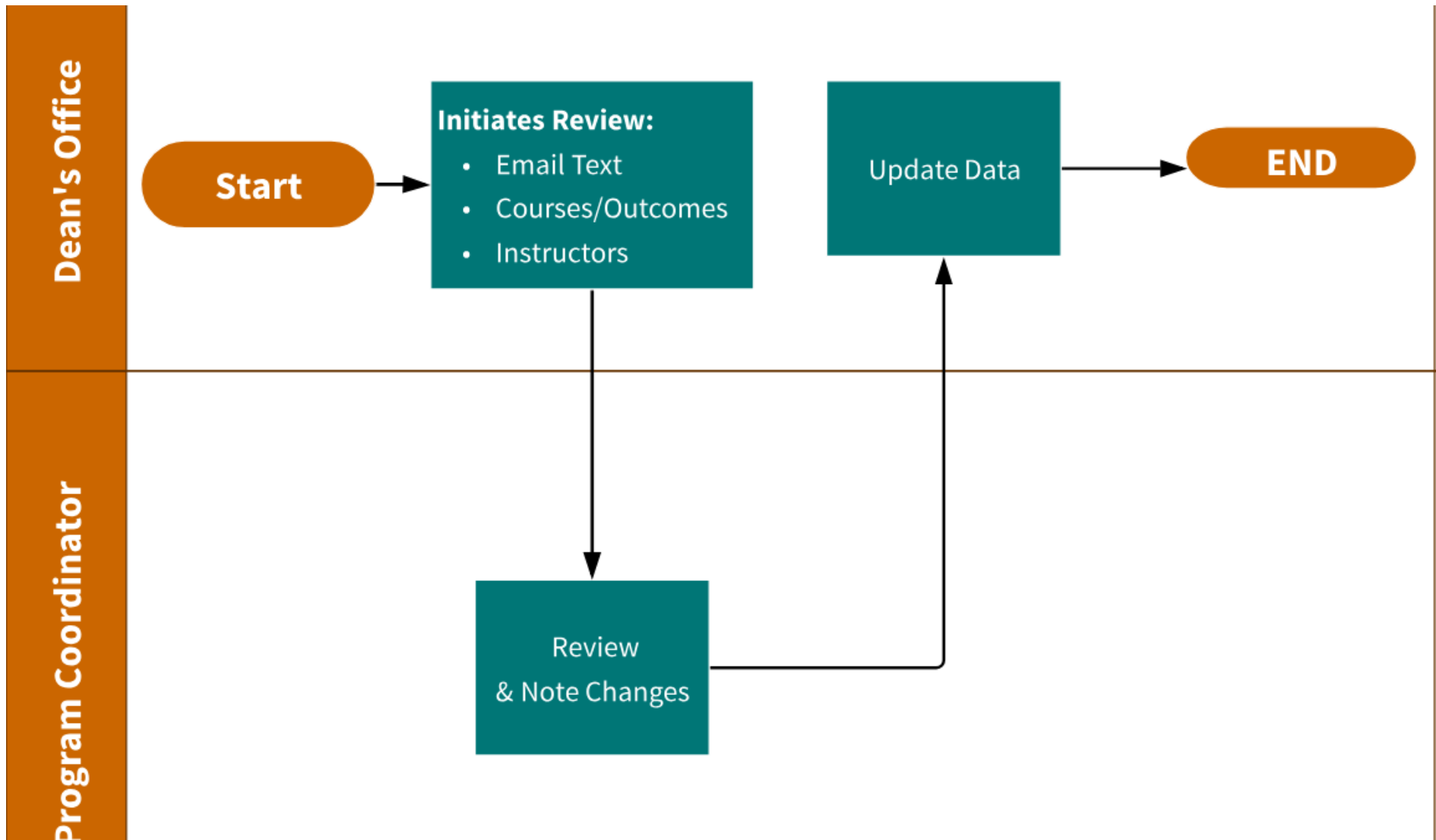
- ✓ [Attorney - Client Privileged Information](#)
- ✓ [IT Security Information](#)
- ✓ [Other Sensitive Institutional Data](#)
- ✓ [Personally Identifiable Information \(PII\)](#)
- ✓ [Sensitive Identifiable Human Subject Research](#)
- ✓ [Student Education Records \(FERPA\)](#)

Not Permitted

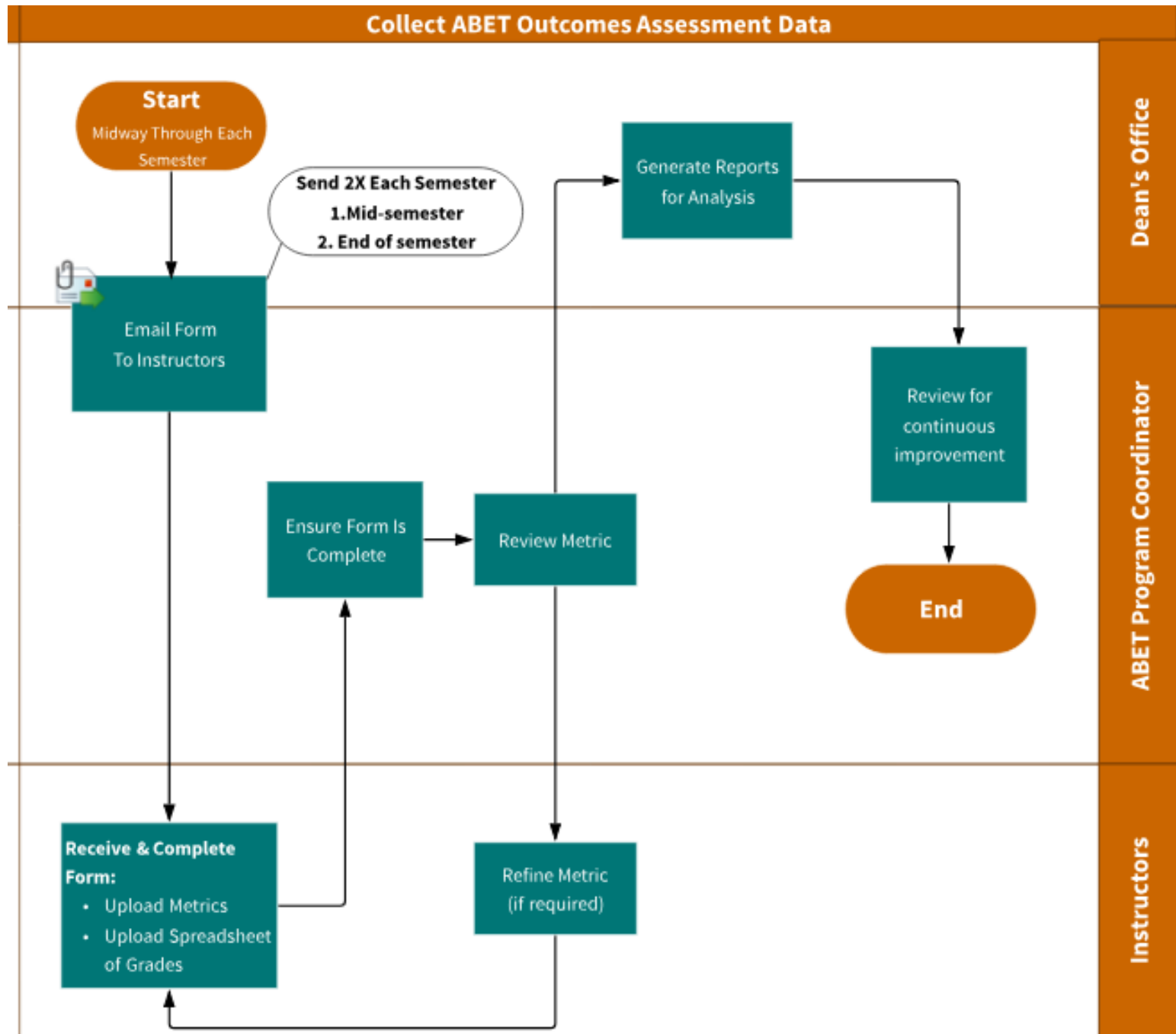
What does the process look like in the long-term?



Form Preparation (Early Sept/Early January)



Collect ABET Outcomes Assessment Data



Let's Try It!

MSE Student Outcome Evaluation (Responses) ☆

File Edit View Insert Format Data Tools Form Add-ons Help Pre-Fill Forms Send Emails [All changes saved in Drive](#)

100% \$ % .0 .00 123 Arial 10 B I S A

2019	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
	ABET Accredited Program	Course	RO Home	Semester	Year	Assessment Measure	Question or Metric PDF	Spreadsheet for Student Scores	Instructor Report PDF	Faculty Uniqname	Name	Reserved for Future Use	Response Key	Pre-filled Form URL	Edit Form
25	Materials Scienc	MATSCIE 365	MATSCIE	Winter	2019	3				timchamb	Timothy Chambe		RKEYb0I9vBmIS	http://bit.ly/2RNq	
26	Materials Scienc	MATSCIE 365	MATSCIE	Winter	2019	4				timchamb	Timothy Chambe		RKEYb0S6jrpug	http://bit.ly/2RJv	
27	Materials Scienc	MATSCIE 365	MATSCIE	Winter	2019	6				timchamb	Timothy Chambe		RKEYb0ih28TCE	http://bit.ly/2DbO	
28	Materials Scienc	MATSCIE 440	MATSCIE	Winter	2019	7				ppoudeup	Pierre Ferdinand		RKEYb0fLNd2yA	http://bit.ly/2Dac	
29	Materials Scienc	MATSCIE 470	MATSCIE	Winter	2019	7				johna	John Edmond All		RKEYb0bFC4YII	http://bit.ly/2RtUz	
30	Materials Scienc	MATSCIE 480	MATSCIE	Winter	2019	2				alantaub	Alan Taub		RKEYb09HJSI67	http://bit.ly/2Dbi8	
31	Materials Scienc	MATSCIE 480	MATSCIE	Winter	2019	3				alantaub	Alan Taub		RKEYb00VPjA9t	http://bit.ly/2RqO	
32	Materials Scienc	MATSCIE 480	MATSCIE	Winter	2019	4				alantaub	Alan Taub		RKEYb0H956K2	http://bit.ly/2Db4	
33	Materials Scienc	MATSCIE 514	MATSCIE	Winter	2019	7				ksevener	Kathleen Sevener		RKEYb0lozVaqe	http://bit.ly/2RNq	
34	Materials Scienc	MATSCIE 770	MATSCIE	Winter	2019	7				nlroth	Nicole Heffernan		RKEYb0XBSebjf	http://bit.ly/2T5ol	
35															
36															
37															
38															

<https://docs.google.com/spreadsheets/d/1URD0ijt3zgtqKTnrRMN24-YnycvV5DzRMuOBNWXdOk/edit#gid=730474636>

Google Magic

ons Help Pre-Fill Forms Send Emails All changes saved in Drive

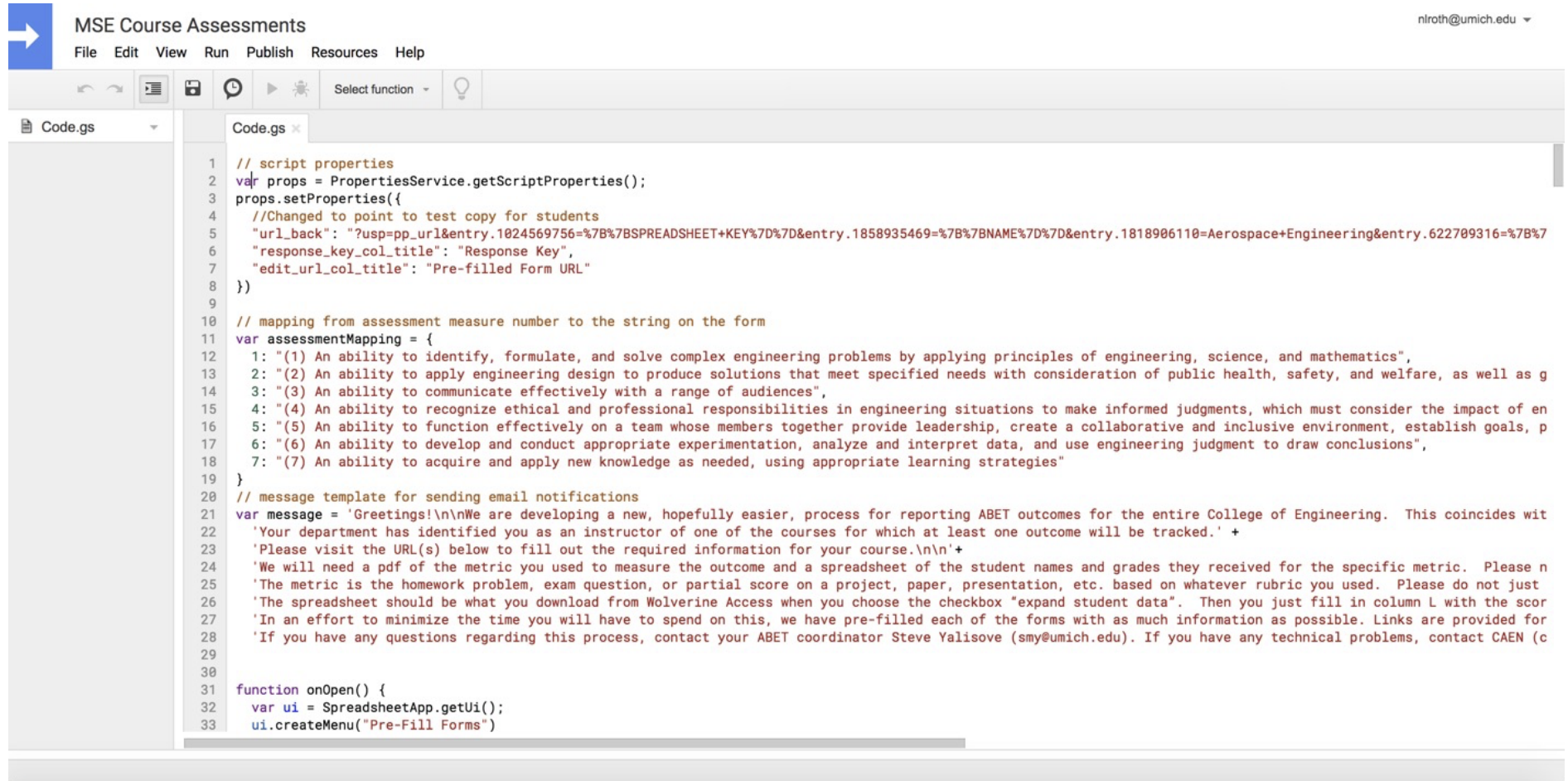
10

Generate Response Keys

Create URLs

	Question or Metric PDF	Spreadsheet for Student Scores	Instructor Report PDF	Faculty Uniqname	Name
3				timchamb	Timothy C
4				timchamb	Timothy C
6				timchamb	Timothv C

Proof Email



The screenshot shows a web-based code editor interface. At the top, there is a header with the text "MSE Course Assessments" and a user email "nroth@umich.edu". Below the header is a menu bar with options: "File", "Edit", "View", "Run", "Publish", "Resources", and "Help". A toolbar contains icons for undo, redo, save, and a "Select function" dropdown. The main area is a code editor with a file named "Code.gs" open. The code is as follows:

```
1 // script properties
2 var props = PropertiesService.getScriptProperties();
3 props.setProperties({
4   //Changed to point to test copy for students
5   "url_back": "?usp=pp_url&entry.1024569756=%7B%7BSPREADSHEET+KEY%7D%7D&entry.1858935469=%7B%7BNAME%7D%7D&entry.1818906110=Aerospace+Engineering&entry.622709316=%7B%7B
6   "response_key_col_title": "Response Key",
7   "edit_url_col_title": "Pre-filled Form URL "
8 })
9
10 // mapping from assessment measure number to the string on the form
11 var assessmentMapping = {
12   1: "(1) An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics",
13   2: "(2) An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as g
14   3: "(3) An ability to communicate effectively with a range of audiences",
15   4: "(4) An ability to recognize ethical and professional responsibilities in engineering situations to make informed judgments, which must consider the impact of en
16   5: "(5) An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, p
17   6: "(6) An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions",
18   7: "(7) An ability to acquire and apply new knowledge as needed, using appropriate learning strategies"
19 }
20 // message template for sending email notifications
21 var message = 'Greetings!\n\nWe are developing a new, hopefully easier, process for reporting ABET outcomes for the entire College of Engineering. This coincides wit
22 'Your department has identified you as an instructor of one of the courses for which at least one outcome will be tracked.' +
23 'Please visit the URL(s) below to fill out the required information for your course.\n\n'+
24 'We will need a pdf of the metric you used to measure the outcome and a spreadsheet of the student names and grades they received for the specific metric. Please n
25 'The metric is the homework problem, exam question, or partial score on a project, paper, presentation, etc. based on whatever rubric you used. Please do not just
26 'The spreadsheet should be what you download from Wolverine Access when you choose the checkbox "expand student data". Then you just fill in column L with the scor
27 'In an effort to minimize the time you will have to spend on this, we have pre-filled each of the forms with as much information as possible. Links are provided for
28 'If you have any questions regarding this process, contact your ABET coordinator Steve Yalisove (smy@umich.edu). If you have any technical problems, contact CAEN (c
29
30
31 function onOpen() {
32   var ui = SpreadsheetApp.getUi();
33   ui.createMenu("Pre-Fill Forms")
```


Send Email

Fill Forms **Send Emails** All changes saved in Drive



Send Notification Emails



	H	I	J	K	
r	Spreadsheet for Student Scores	Instructor Report PDF	Faculty Uniqname		

	Metric PDF	Scores	Report PDF	Uniqname
3				
4				
6				
7				
7				
2				
3				
4				
7				
7				

×

Select Rows to Send email to
Input can be:

- 1) A range of rows, both numbers inclusive eg.2-5
- 2) individual rows separated by spaces, eg.2 6 8:

Ok

What does a faculty member see?

Greetings!

We are developing a new, hopefully easier, process for reporting ABET outcomes for the entire COE. This coincides with the new ABET outcomes that we will be required to assess for our next ABET visit in 2023.

Your department has identified you as an instructor of one of the courses for which at least one outcome will be tracked. Please visit the URL(s) below to fill out the required information for your course.

We will need a pdf of the metric you used to measure the outcome and a spreadsheet of the student names and grades they received for the specific metric. Please normalize the scores to 100%.

The metric is the homework problem, exam question, or partial score on a project, paper, presentation, etc. based on whatever rubric you used. Please do not just write, exam 1 question 2. We need to see exactly what was used to assess each outcome.

The spreadsheet should be what you download from Wolverine Access when you choose the checkbox "expand student data". Then you just fill in column L with the scores (normalized to 100%) and upload it to the google form that is linked here.

In an effort to minimize the time you will have to spend on this, we have pre-filled each of the forms with as much information as possible. Links are provided for each assessment for each course, so if you are teaching two courses with two assessments each, four links will be listed.

If you have any questions regarding this, contact your ABET coordinator Steve Yalisove (smy@umich.edu). If you have any technical problems, contact CAEN (caen@umich.edu).

Links:

MATSCIE 360 - Assessment 3 - <http://bit.ly/2B7GF9O>

MATSCIE 360 - Assessment 5 - <http://bit.ly/2PxT5AZ>

MATSCIE 360 - Assessment 6 - <http://bit.ly/2B8Uncl>

Click on a Link!



<http://bit.ly/2T5olcl>

RESPONSE KEY

Do not change this value (even if blank). It is used to correlate responses. Sadly, Google will not let us hide this, but if you change it, your name will be announced in the faculty meeting as a delinquent faculty member.

RKEYb0XBSebj6wcEJm1aydap96QBzle'

Name *

Nicole Heffernan

ABET Accredited Program *

Materials Science Engineering ▾

Course *

MATSCIE 770

Which term is this for? *

Semester:

Winter ▾

Academic Year *

2019 ▾

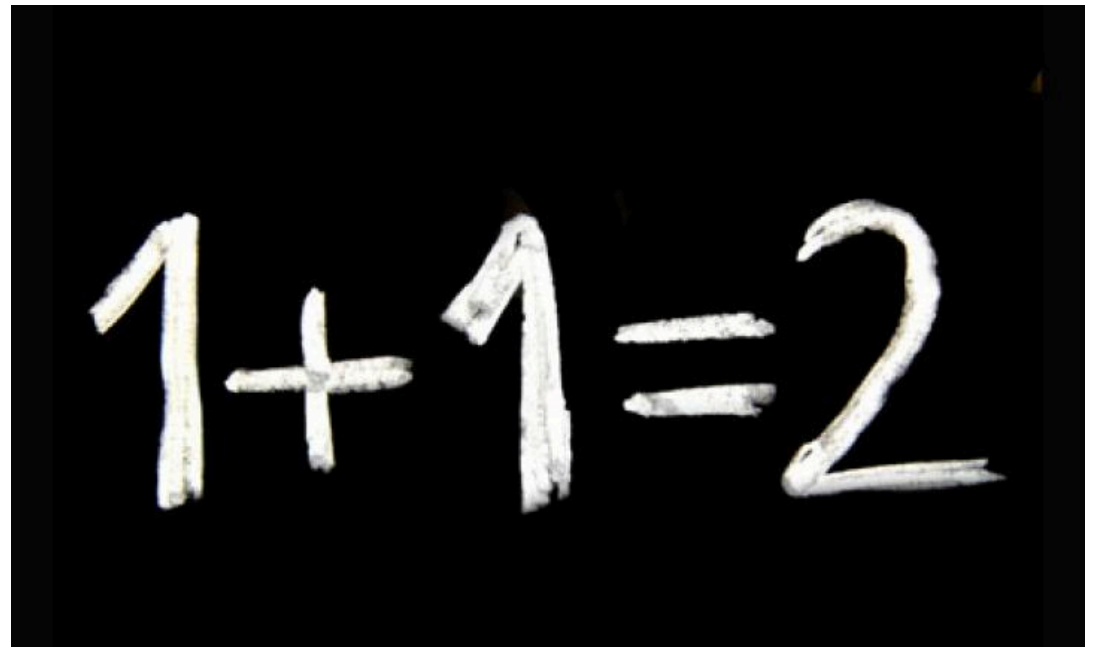
Your course is responsible for assessing the following outcome(s) *

Please do not change this - we will find you.

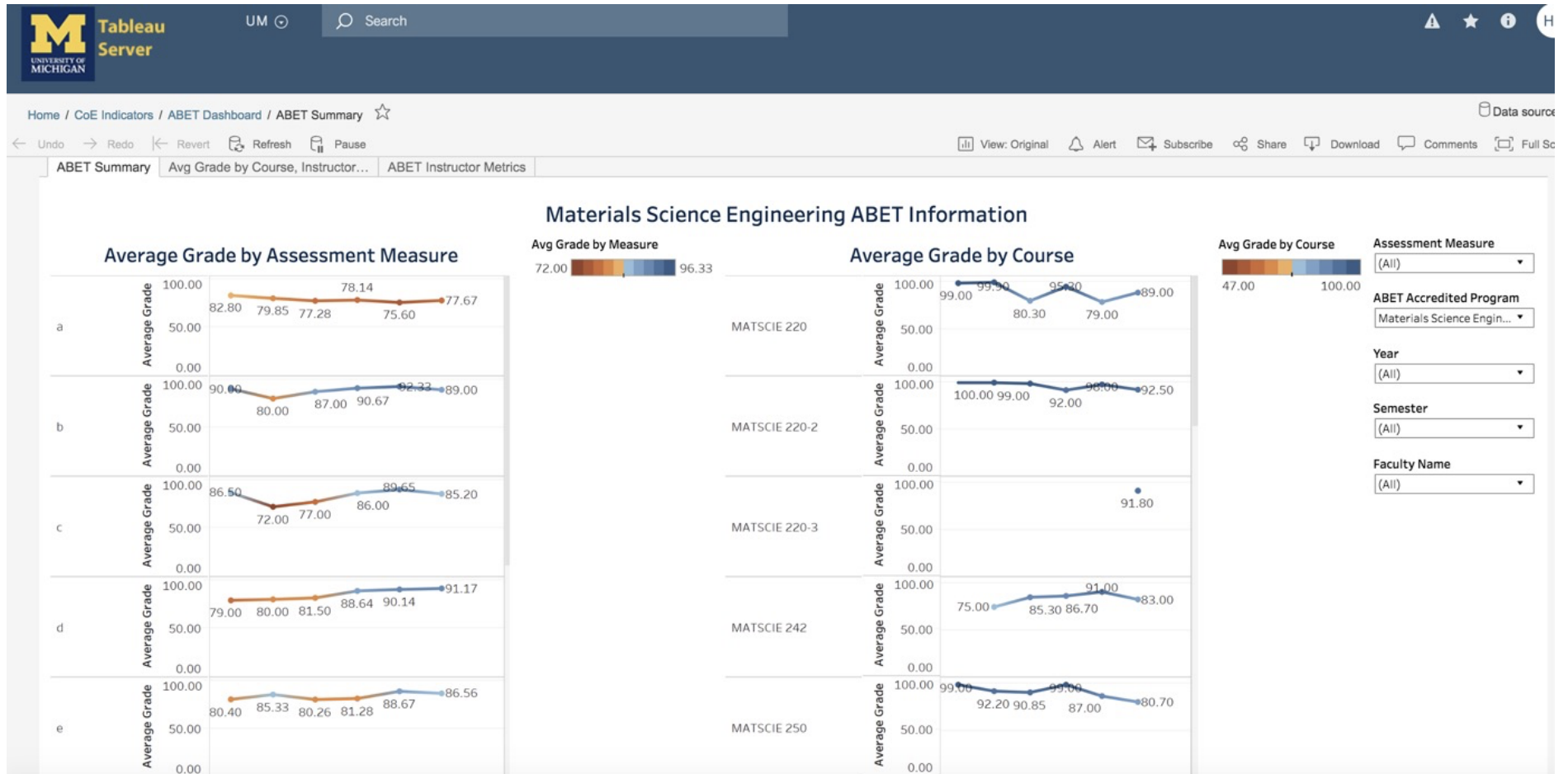
(7) An ability to acquire and apply new knowledge as needed, using appropriate learning strategies

What is next?

- Augment data with Programs (if not available)
- Calculate mean score out of 100



We have data, now what?



<https://tableau.dsc.umich.edu/#/site/UM/views/ABETDashboard/ABETSummary?iid=1>

Challenges

- No Response
- Format
- Identifying Individuals

Opportunities

- Continuous improvement
- Ability to evolve process
- Wait till the end of the talk... We have reserved one more thing.

Checklist



ABET Checklist

The name, username and photo associated with your Google account will be recorded when you upload files and submit this form. Not nlroth@umich.edu? [Switch account](#)

Program

Choose

Objectives

- Did you meet with all of your constituencies and discuss how the needs of the constituencies are consistent with the objectives?
- Did you record the minutes and slides from these meetings?
- Did you have bylaws that dictate the makeup of your external advisory boards to ensure that all of your constituencies are consulted?

Objectives: Minutes and Slides

[ADD FILE](#)

Objectives: Bylaws

[ADD FILE](#)

Continuous Improvement

- Do you have an appropriate (direct and indirect measures), systematically utilized, regular outcomes assessment process to measure the extent to which your graduates have achieved the outcomes by the time they graduate?
- Utilizing rubrics can be great ways to ensure that you are separating specific parts of student work related to outcomes. For example, those outcomes that require that students have the ability to design something with "consideration of" x, y, z, ... can be handled by giving a part of the grade to the quality of that consideration as a check list.
- Do you have minutes of faculty meetings or retreats where you explicitly discuss the results of the outcomes assessment process as input to the continuous improvement of your program?

Continuous Improvement: Minutes Discussing Results of Outcome Assessments






[ADD FILE](#)

Curriculum

- Do you have a MAJOR capstone design experience that is really design (not just analysis)?
- Does your capstone design course incorporate appropriate engineering

Magic

- Each program has their own “copy” of assets.
- A central repository exists with all files.

Name
 Continuous Improvement
 Bylaws
 Minutes
 ABET responses 



How can we continue to improve?

- History
- Documents
- Dashboard Analytics
- Transcript Analysis
- Repeat, Iterate, and Improve



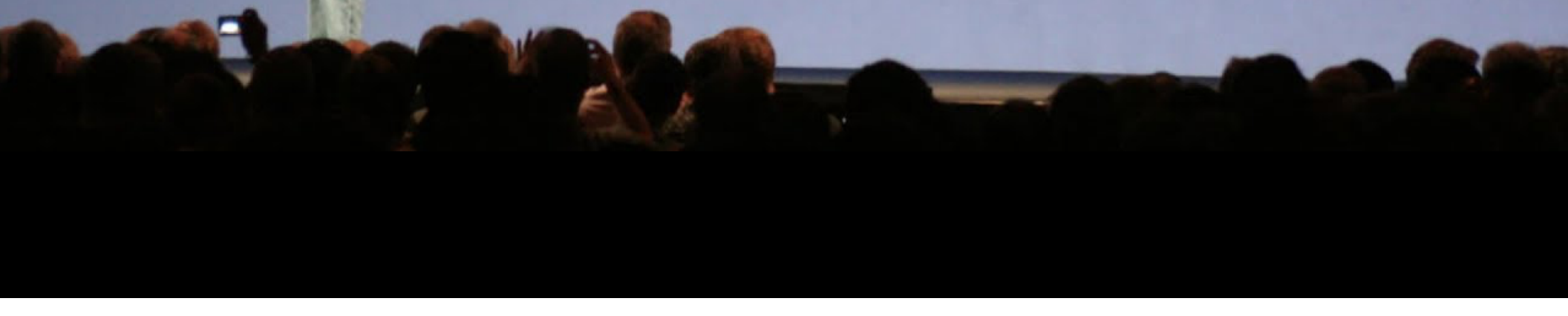
Other things to make sure we are ready for our next visit

- **Automated transcript analysis**
- **Box.com resource room**
- **Repository of critical minutes**



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One more thing...



An Unexpected Bonus



- Data has student identifier attached
- Opportunity for longitudinal studies
- Education researchers can apply for IRB approval for access
- What about sharing with other institutions?
- Non-accredited programs have asked to be included.

Summary

- **Do it often - Do it simply**
- **Build a strong team**
- **Support your team**
- **Use your team to continuously improve the assessment process**

Resources

- **We are building a website with this talk, Google Form templates, scripts, and a short demonstration video of how we put it together.**
- **We will post our checklist for the community and have a discussion board to have the community help us**

<http://abet-process.engin.umich.edu>

Transcript Analysis

Process

- Export transcripts from SIS in CSV
- Collect Math/Science and Engineering breakdowns for each program
- Copy data into smart spreadsheet
 - Creates links to our Course bulletin
 - Auto calculates totals based on values
- By-hand categorization of everything

Why by hand?

- By hand cost < Making it automatic
- Allow us to find and resolve issues quickly
- The calculation - which is the most difficult - is done automatically



New Student Outcomes

- (1) an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics**
- (2) an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors**
- (3) an ability to communicate effectively with a range of audiences**
- (4) an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts**
- (5) an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives**
- (6) an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions**
- (7) an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.**