Leveraging Tags within Gradescope for Improved Student Feedback.

Jenny Amos

Teaching Associate Professor

Bioengineering | University of Illinois Urbana-Champaign

Gradescope User Summit

2021

ILLINOIS

This presentation will share the approach taken by a group at the University of Illinois Urbana-Champaign to present assessment data to students using tags

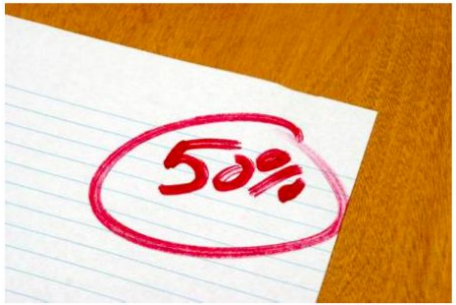
Background and motivation on assessment needs in engineering programs

gradescope by turnitin

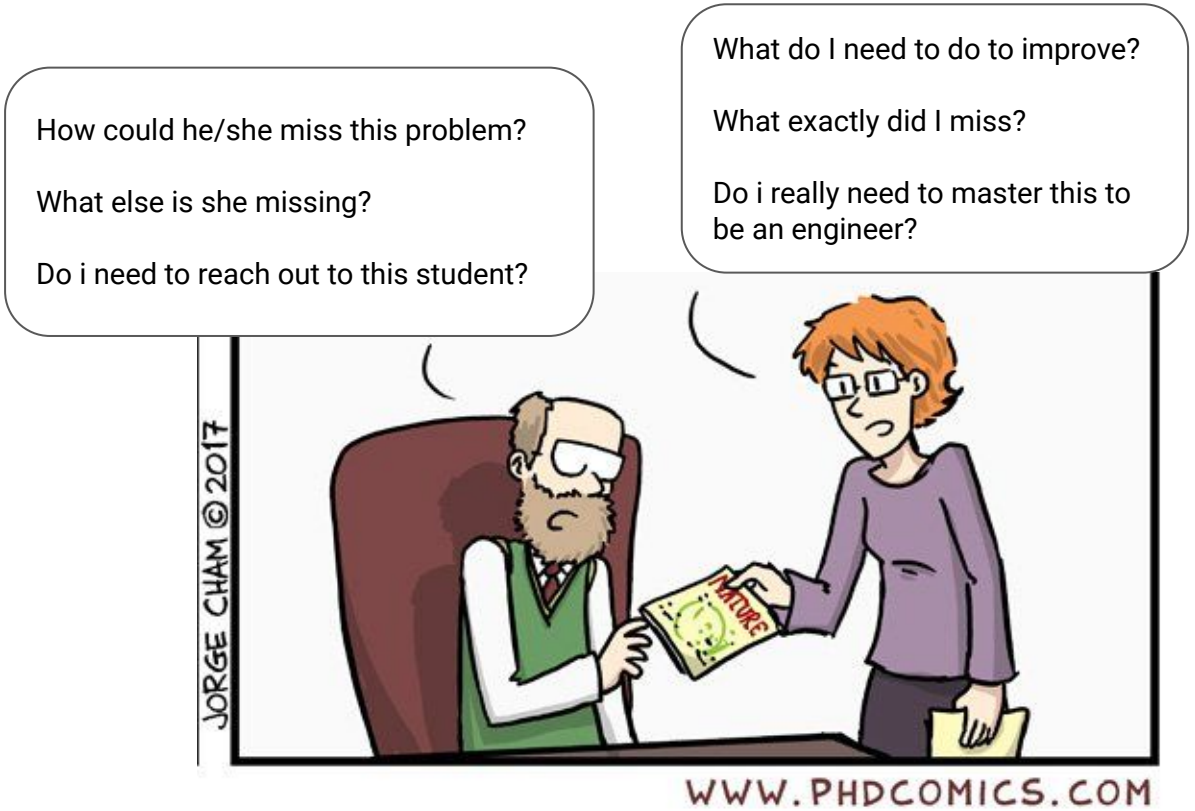
Capabilities of Gradescope and tagging protocol

Leveraging Gradescope data with tagging to increase student understanding of performance

Many engineering programs struggle with assessment on many levels



When grading assignments, we are comparing student performance to a ‘correct’ answer



We followed the NSF I-Corps program training and collected surveys and conducted focus groups from employers, faculty, students, alumni and peer institutions.

Amos, Jennifer R., and Gabriella R. Dupont. "Board 3: Work in Progress: Are We on Track with Tracks?." *2018 ASEE Annual Conference & Exposition*. 2018.

Faculty and administrators prefer high-level overall performance on topic areas of their interest and help identifying learning gaps

Faculty want

- Norm-referenced and criterion-based data should clearly define the groups of students who need more intensive instruction and the groups of students who are at or above level.
- Information to help them effectively plan at a class level and manage instructional time for whole-class and small group instruction,

Administrators want

- Information to better assign resources across cohorts.
- Information that highlights learning gaps in a course and across the curriculum

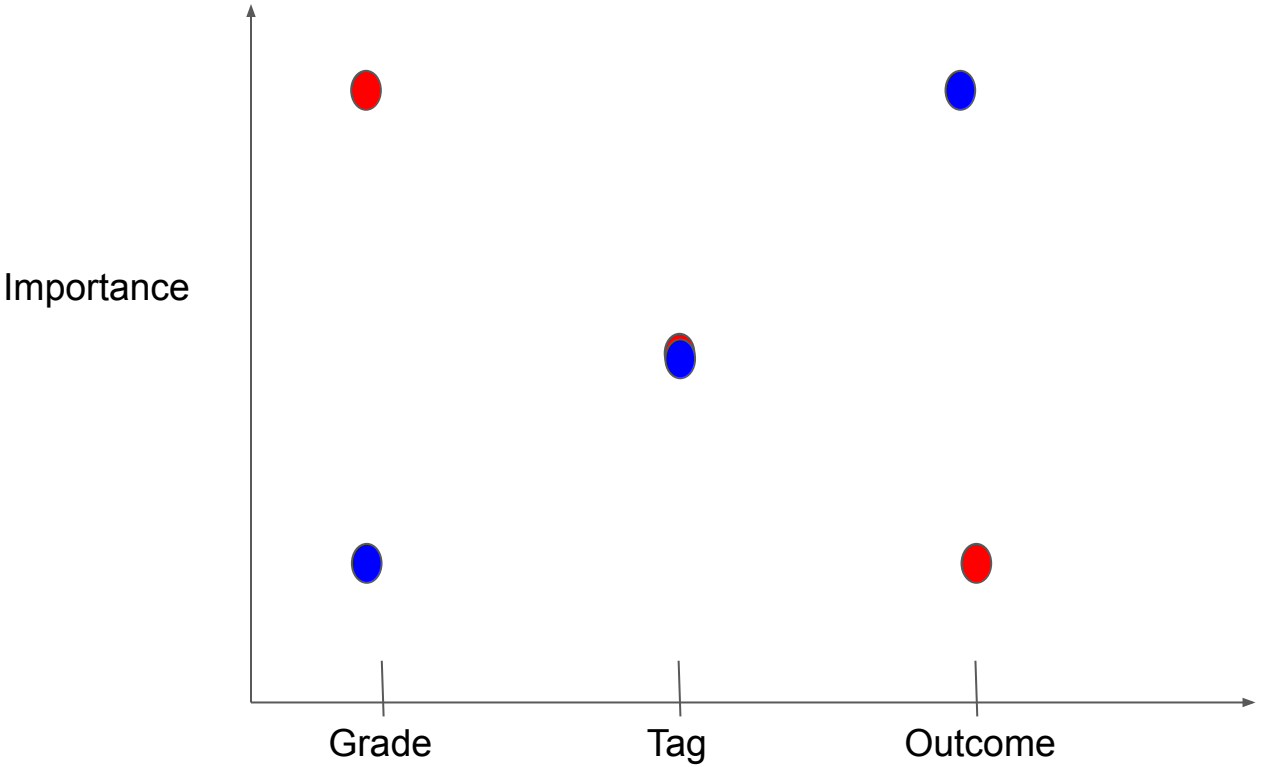
Focusing on the cohort level can help a program make decisions on

- Curriculum changes
- Outcomes attainment (ABET)
- Effectiveness of different teaching methods
- Effect of changes
- Etc.

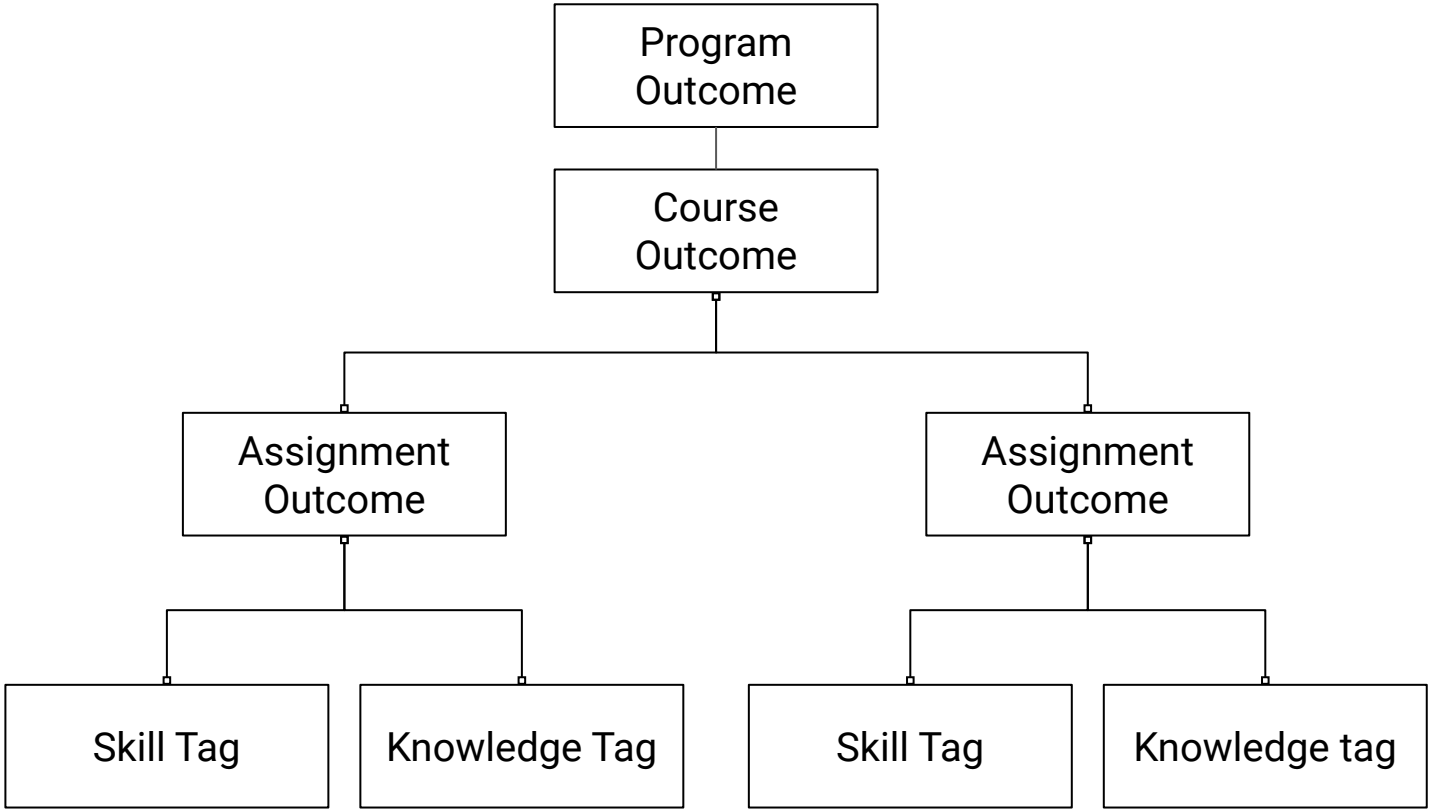
Students crave actionable and timely feedback above all else learners are mostly focused on action related to course level performance

- Information that highlights learning gaps needed to pass courses (worried about GPA)
- Feedback that helps them direct their own learning
- Timely feedback so that they can correct gaps before they affect performance
- Benchmarks to situate their learning amongst peers

Where the faculty, administrators, and students all meet are not in grades but in outcome-level feedback



We have worked with faculty to create tag lists in their courses that provide meaningful feedback to both instructor and student



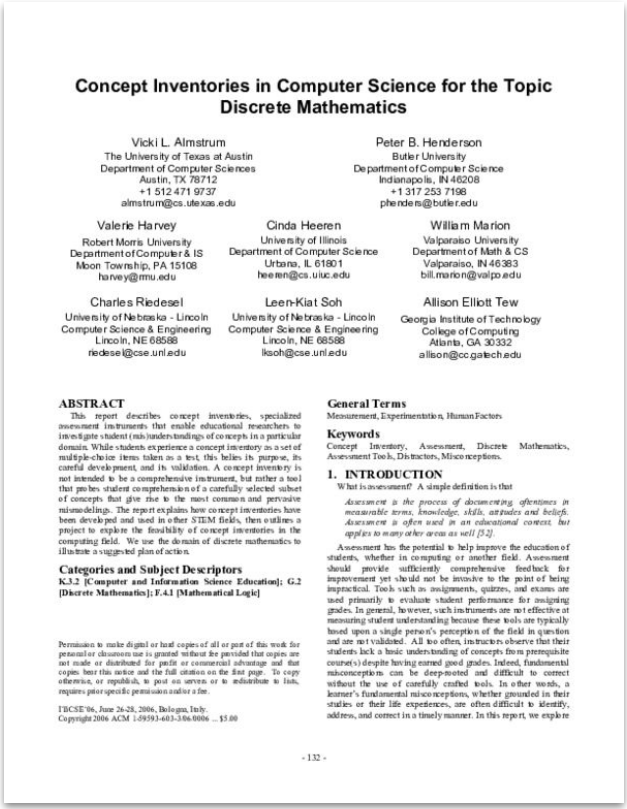
Try to focus outcomes on key concepts and skills used in the course, focusing on ones that you want to track long-term

1. Analyze a complex computing problem and to apply principles of computing and other relevant disciplines to identify solutions.
    a. Identify key components and algorithms necessary for a solution.
    b. Produce a solution within specifications.
    c. Analyze at least two possible solutions to a given problem and select the best solution for the given problem.
    d. Use discrete mathematics techniques and algorithms.

Types of algorithms
Graph search
Binary trees
Tree traversal
Data mining

You don’t have to reinvent the wheel, you can find lists for outcomes and tags to use as a starting point

Textbooks



Concept Inventories in Computer Science for the Topic Discrete Mathematics

Vicki L. Almstrum
The University of Texas at Austin
Department of Computer Sciences
Austin, TX 78712
+1 512 471 9737
almstrum@cs.utexas.edu

Peter B. Henderson
Butler University
Department of Computer Science
Indianapolis, IN 46208
+1 317 253 7198
phenders@butler.edu

Valerie Harvey
Robert Morris University
Department of Computer & IS
Moon Township, PA 15108
harvey@rmu.edu

Cinda Heeren
University of Illinois
Department of Computer Science
Urbana, IL 61801
heeren@cs.uiuc.edu

William Marion
Valparaiso University
Department of Math & CS
Valparaiso, IN 46383
bill.marion@valpo.edu

Charles Riedesel
University of Nebraska - Lincoln
Computer Science & Engineering
Lincoln, NE 68588
riedesel@cse.unl.edu

Leen-Kiat Soh
University of Nebraska - Lincoln
Computer Science & Engineering
Lincoln, NE 68588
lksoh@cse.unl.edu

Allison Elliott Tew
Georgia Institute of Technology
College of Computing
Atlanta, GA 30332
allison@cc.gatech.edu

ABSTRACT

This report describes concept inventories, specialized assessment instruments that enable educational researchers to investigate student (mis)understandings of concepts in a particular domain. While students experience a concept inventory as a set of multiple-choice items taken as a test, this belies its purpose, its careful development, and its validation. A concept inventory is not intended to be a comprehensive instrument, but rather a tool that probes student comprehension of a carefully selected subset of concepts that give rise to the most common and pervasive misunderstandings. The report explains how concept inventories have been developed and used in other STEM fields, then outlines a project to explore the feasibility of concept inventories in the computing field. We use the domain of discrete mathematics to illustrate a suggested plan of action.

Categories and Subject Descriptors

K.3.2 [Computer and Information Science Education]: G.2 [Discrete Mathematics]: F.4.1 [Mathematical Logic]

General Terms

Measurement, Experimentation, Human Factors

Keywords

Concept Inventory, Assessment, Discrete Mathematics, Assessment Tools, Distractors, Misconceptions.

ITiCSE'06, June 26-28, 2006, Bologna, Italy.

1. INTRODUCTION

What is assessment? A simple definition is that

Assessment is the process of documenting, often times in measurable terms, knowledge, skills, attitudes and beliefs. Assessment is often used in an educational context, but applies to many other areas as well [3,2].

Assessment has the potential to help improve the education of students, whether in computing or another field. Assessment should provide sufficiently comprehensive feedback for improvement yet should not be invasive to the point of being impractical. Tools such as assignments, quizzes, and exams are used primarily to evaluate student performance for assigning grades. In general, however, such instruments are not effective at measuring student understanding because these tools are typically based upon a single person's perception of the field in question and are not validated. All too often, instructors observe that their students lack a basic understanding of concepts from prerequisite course(s) despite having earned good grades. Indeed, fundamental misconceptions can be deep-rooted and difficult to correct without the use of carefully crafted tools. In other words, a learner's fundamental misconceptions, whether grounded in their studies or their life experiences, are often difficult to identify, address, and correct in a timely manner. In this report, we explore

Concept Inventory

Here is an example from a controls course that we worked with last year

Linear time invariant systems

Solution in the time domain (ordinary differential equations – ODEs)

Solution in the Laplace domain (transfer function – TF)
- Poles and zeros; their physical meaning
- Stability: stay on the left-hand plane

1st order systems
- Impulse, step, and other responses
- Time constant
- Steady state

2nd order systems
- Impulse, step, and other responses
- Dominant pole (slow/fast poles)
- Over-/critically/under-damped response
- Damping ratio, natural frequency, damped oscillation frequency
- Rise time, settling time, peak time, overshoot
- Steady state

State space: formulation only
- Eigenvalues of system matrix ⇔ system poles

Certain physical implementations
- Flywheel
- DC motor with flywheel load and with/without inductance
- Simple RC / RL / RLC circuits, impedance and voltage divider
- More generally: physical model => ODE => system behavior

Week #	Lecture	Assessment
1	Topic 1	Quiz
2	Topic 2	HW
3	Topic 3	Quiz
4	Topic 4	HW
5	Topic 5	Quiz
6	Topic 6	HW

	A	B	C	F	G	H	I	J
1	Assignment Submission ID	Question Submission ID	Name	Score	Submission Time	Correct	Grader	Tags
2	8911144	75074653	Kristin S	4	9/10/18 13:16	FALSE	Edward Chen	Impulse, step
3	8916377	75109313	Bailey Z	4	9/10/18 15:50	FALSE	Edward Chen	Impulse, step
4	8944544	75343746	Zhihuai	6	9/11/18 13:13	TRUE	Edward Chen	Impulse, step
5	8957326	75439976	Claire P	6	9/11/18 19:10	TRUE	Edward Chen	Impulse, step
6	8959458	75451200	Lauren L	6	9/11/18 20:03	TRUE	Edward Chen	Impulse, step
7	8962292	75466652	Anna Ul	4	9/11/18 21:22	FALSE	Edward Chen	Impulse, step
8	8962669	75468993	Brendan	4.5	9/11/18 21:35	FALSE	Edward Chen	Impulse, step
9	8963681	75475251	Nina Ch	4	9/11/18 22:15	FALSE	Edward Chen	Impulse, step
10	8975473	75614566	Courtney	4	9/12/18 12:00	FALSE	Edward Chen	Impulse, step
11	8977364	75625753	Sofie Sc	6	9/12/18 13:06	TRUE	Edward Chen	Impulse, step
12	8977646	75627834	Preston	4	9/12/18 13:16	FALSE	Edward Chen	Impulse, step
13	8979472	75642616	Isabel M	6	9/12/18 14:10	TRUE	Edward Chen	Impulse, step

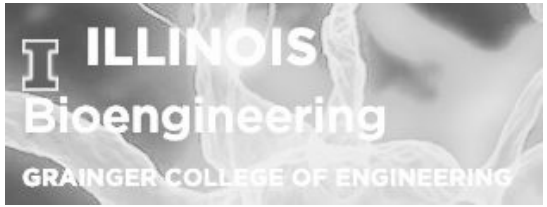
Turn Grading into Learning

Grading should provide **actionable feedback** to both students and instructors

- Help **students** learn
- Help **instructors** pace and direct instruction
- Help **instructors** compose assessment

Gradescope helps by decreasing grading time, increasing consistency, and providing insights into student learning and assessment quality.

This presentation will share the outcomes of a Gradescope and University of Illinois Partnership to improve assessment and student learning in a curriculum



Motivation and assessment needs in engineering programs

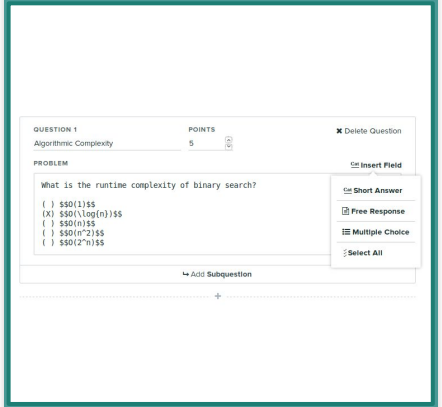
gradescope by turnitin

History and capabilities of Gradescope

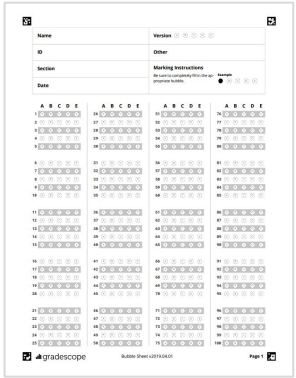
Leveraging Gradescope to improve student learning across courses

Any of the assignment formats can be used for this approach

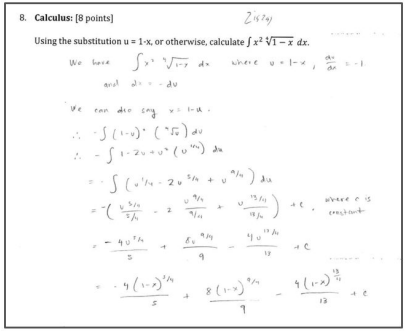
Online



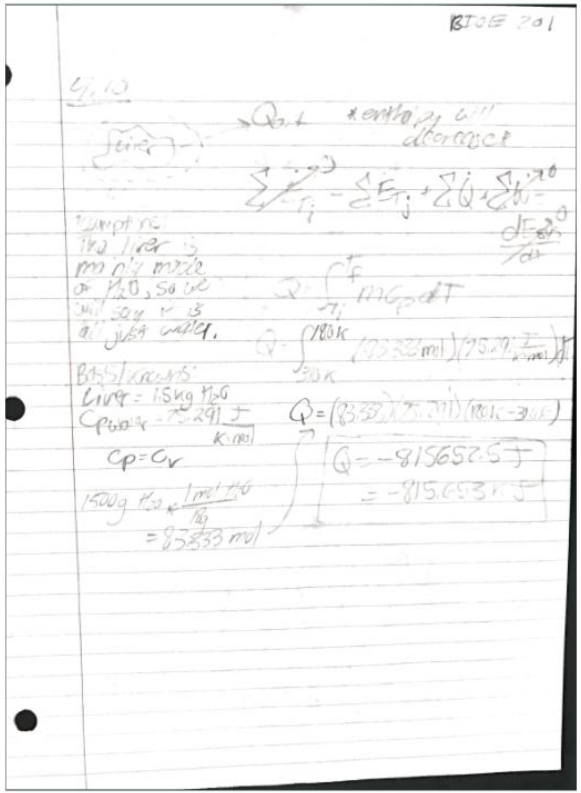
Multiple Choice



Constructed Response



By simply grading assignments as I usually would with a rubric, I am also collecting the tagged data scores



All Images

Hw#3 ● GRADED

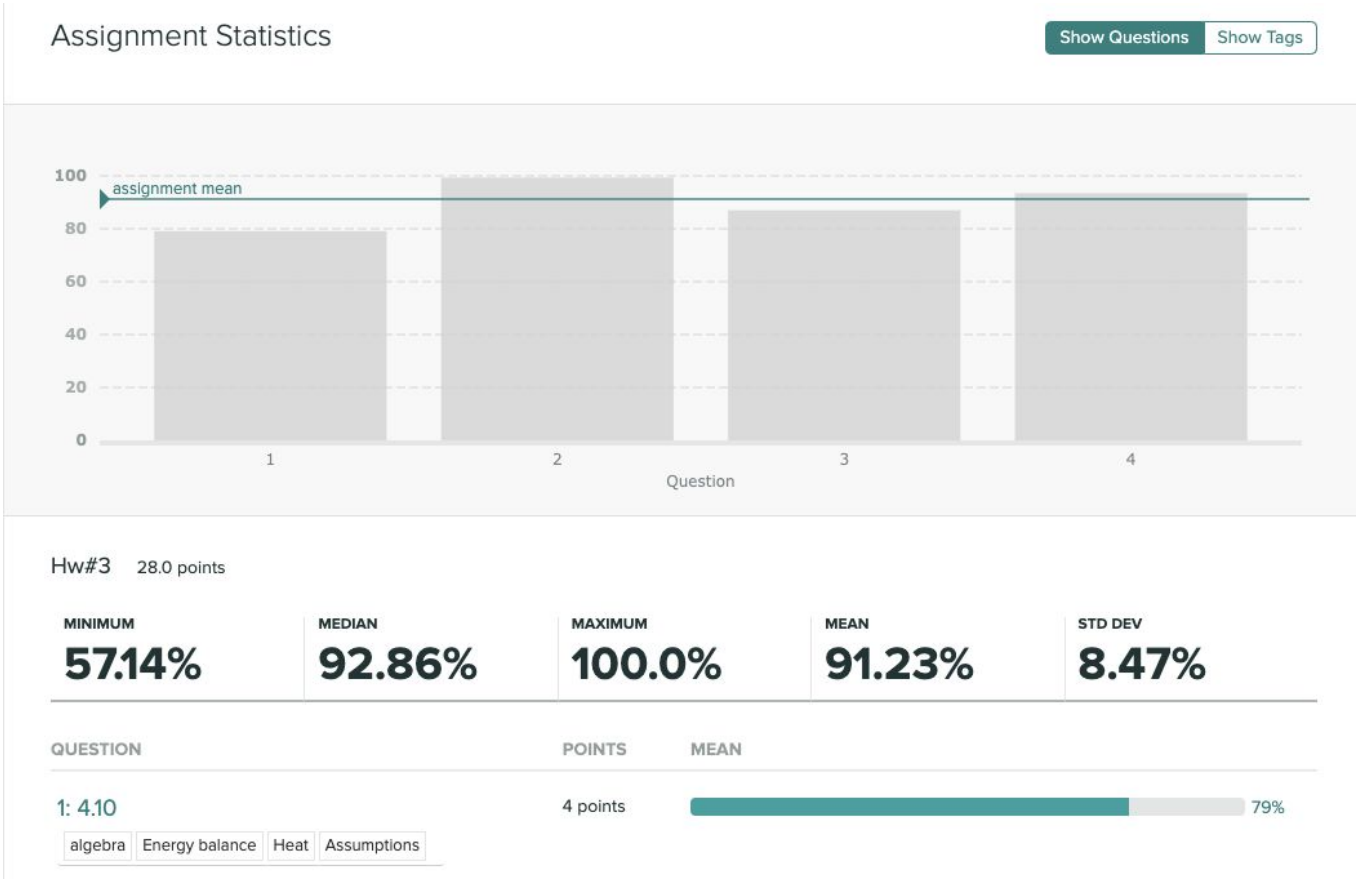
STUDENT

TOTAL POINTS
27 / 28 pts

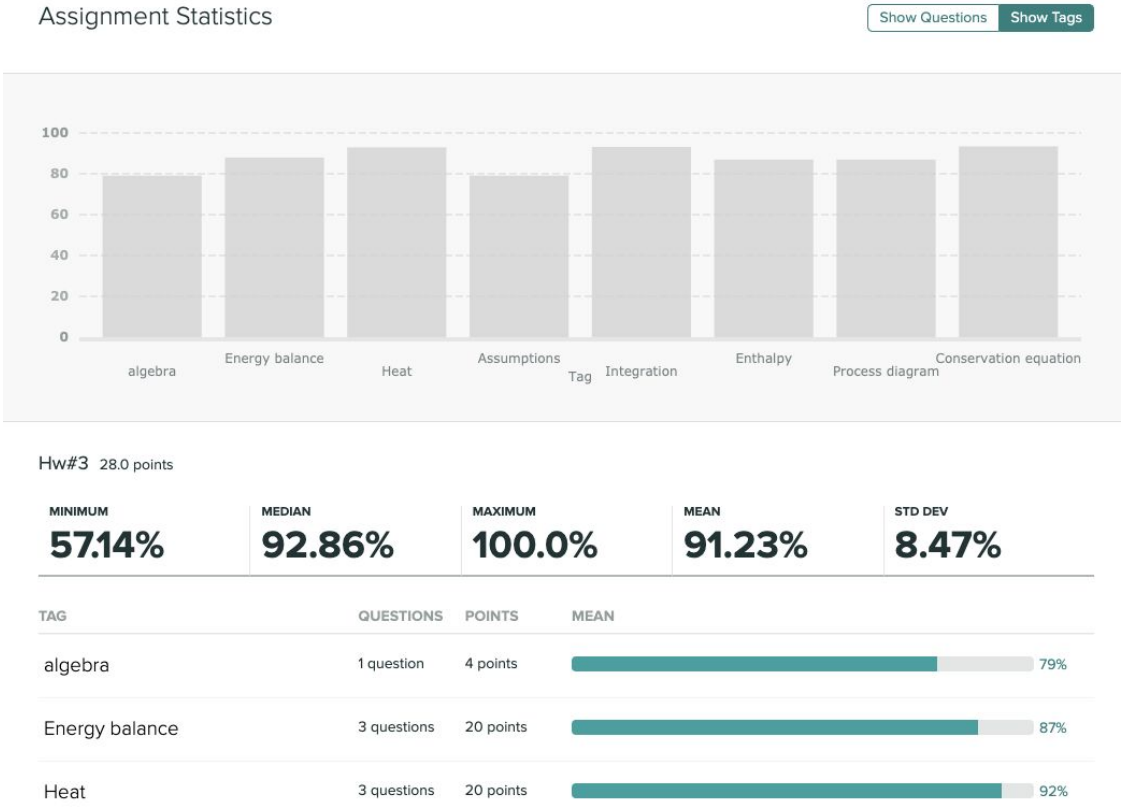
QUESTION 1
4.10 **3** / 4 pts

− 0 pts	Correct
− 2 pts	The problem is asking you how much heat must be removed from a liver not the energy lost in the system. You are calculating how much energy is removed from the liver. How did you know the energy is leaving the liver in form of heat? You have to make some assumptions in order to relate H and Q.
✔ − 1 pts	**It was good you started from the general energy balance equation. However, the system is a close system, so the enthalpy change in your case should be neglected. Moreover, the system is not steady state.**
− 0 pts	Pretty good assumptions. Pretty close to the real situation.
− 1 pts	Why m*H=Q?
− 1 pts	How did you know Q=delta H?
− 1 pts	It was good you started from the general energy balance equation. However, the system is a close system, so there is no energy flowing out the system. How did you know Q be 0? If Q was 0, why was not your answer 0 as well?

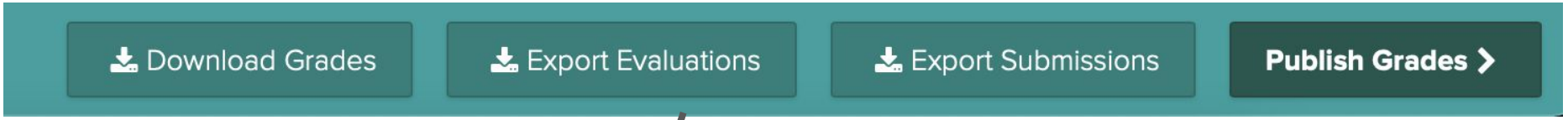
View performance statistics from a problem based on overall performance



View performance statistics based on tags for an assignment



Gradescope allows you to export your data in many different ways for additional analysis



CSV of grades

Question level detail

PDFs that were submitted

This presentation will share the outcomes of a Gradescope and University of Illinois Partnership to improve assessment and student learning in a curriculum

ILLINOIS
Bioengineering
GRAINGER COLLEGE OF ENGINEERING

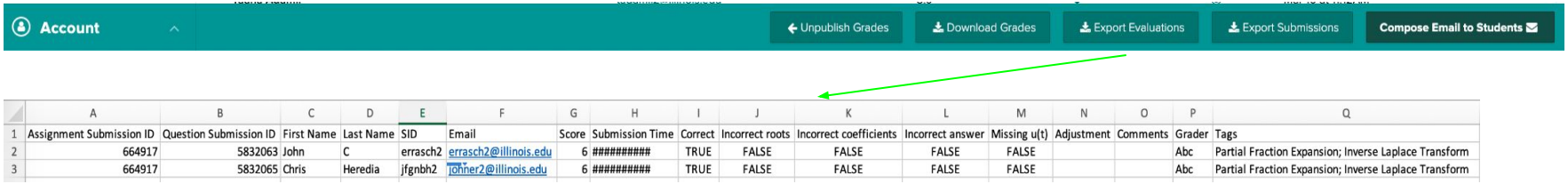
Background and motivation on assessment needs in engineering programs

gradescope
by turnitin

History and capabilities of Gradescope

Leveraging Gradescope to improve student learning across courses

Our code scrapes information from the CSV files and creates tag-based summaries beyond the basic bar charts



	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1	Assignment Submission ID	Question Submission ID	First Name	Last Name	SID	Email	Score	Submission Time	Correct	Incorrect roots	Incorrect coefficients	Incorrect answer	Missing u(t)	Adjustment	Comments	Grader	Tags
2	664917	5832063	John	C	errasch2	errasch2@illinois.edu	6	##########	TRUE	FALSE	FALSE	FALSE	FALSE			Abc	Partial Fraction Expansion; Inverse Laplace Transform
3	664917	5832065	Chris	Heredia	jfgnbh2	johner2@illinois.edu	6	##########	TRUE	FALSE	FALSE	FALSE	FALSE			Abc	Partial Fraction Expansion; Inverse Laplace Transform

```
extension = 'csv'
path = r'Data'
all_filenames = [i for i in glob.glob(path + "/*." + format(extension))]
```

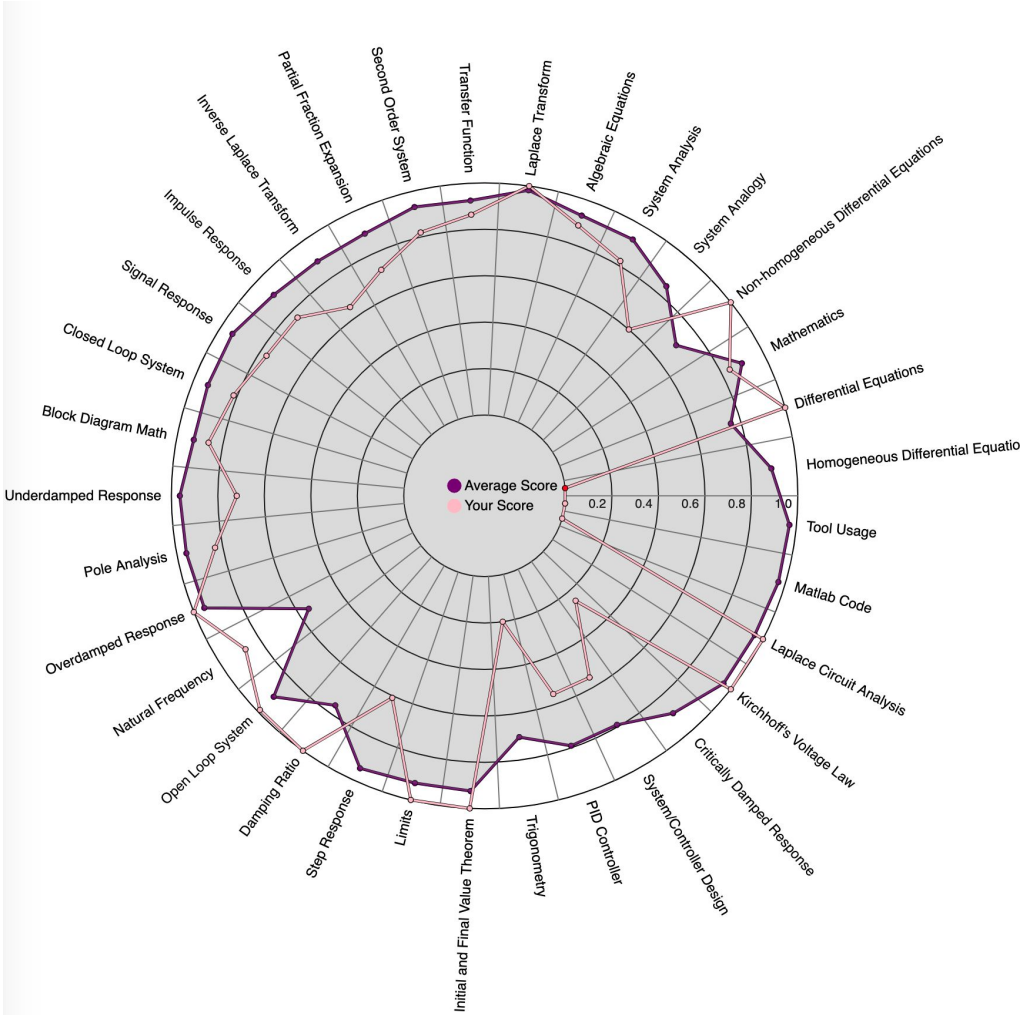
{ Student 1 : { tag 1: ['...', '...', …

tag 2: ['...', '...', …

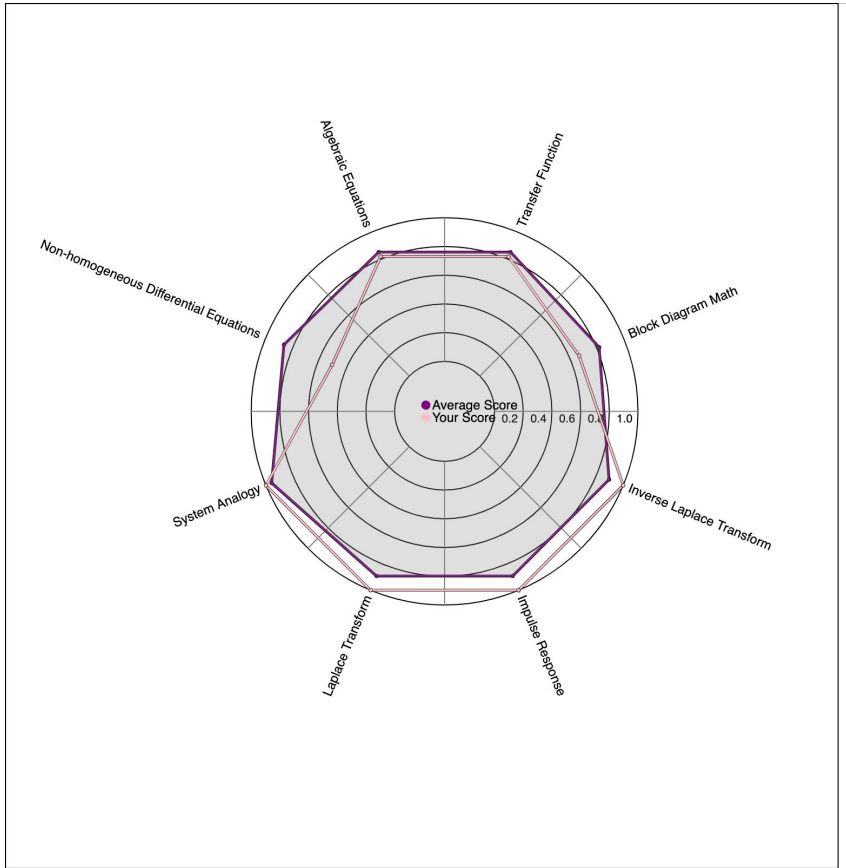
. .

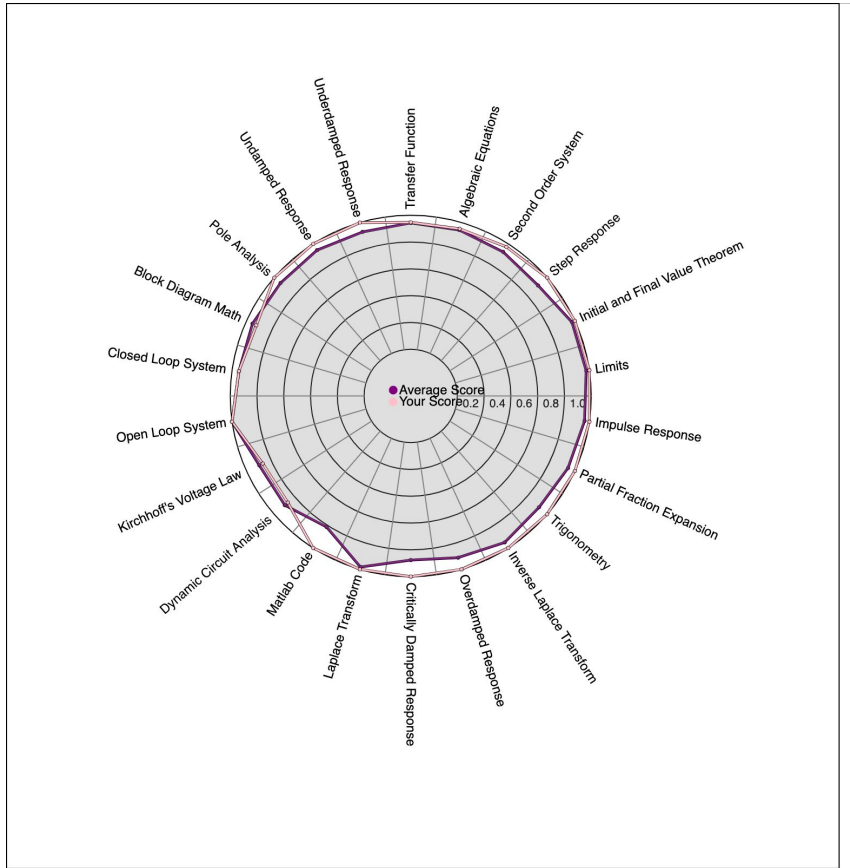
. .

Student x:

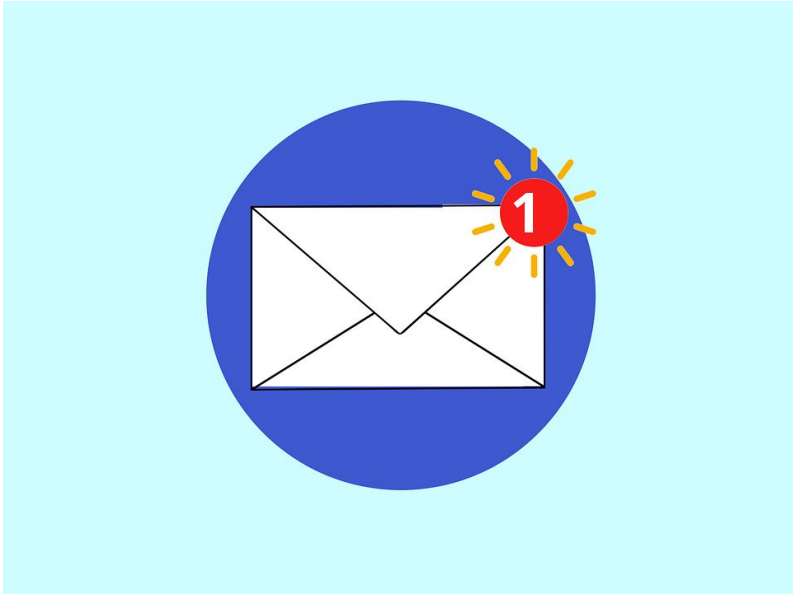

Average Score
Your Score
0.2
0.4
0.6
0.8
1.0
Laplace Transform
Algebraic Equations
System Analysis
System Analogy
Non-homogeneous Differential Equations
Mathematics
Differential Equations
Homogeneous Differential Equatio
Tool Usage
Matlab Code
Laplace Circuit Analysis
Kirchhoff's Voltage Law
Critically Damped Response
System/Controller Design
PID Controller
Trigonometry
Initial and Final Value Theorem
Limits
Step Response
Damping Ratio
Open Loop System
Natural Frequency
Overdamped Response
Pole Analysis
Underdamped Response
Block Diagram Math
Closed Loop System
Signal Response
Impulse Response
Inverse Laplace Transform
Partial Fraction Expansion
Second Order System
Transfer Function

Because the data is outside of the assignment now, we can track cumulative performance across a course or multiple courses





Mail merge allows me to distribute these to students privately along with a message for them



Faculty use results in different ways

Review overall performance to inform

- Tailored office hours
- Supplemental lecture or reviews
- Retakes or performance informed grading
- Inform course design and assessment design
- Compare cohort performance across years - assessment for course changes

Individual consultations with students on performance

Students use results in different ways

Identify areas to study for exam preparation

See tangible progress in skills/knowledge regardless of grades

Request help on specific topics

In summary, by leveraging the tagging function in Gradescope, you can provide ***actionable feedback to students*** within a class, ***track progress on skills and concepts across a course or curriculum***, and ***simplify your continuous improvement assessment process***.

Jenny Amos
jamos@illinois.edu