UG Student Workload Task Force

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Spring 2021 (Updated Fall 2021)

PURDUE MECHANICAL ENGINEERING

Summary

- Many students report being overloaded and burned out.
- ME faculty workload expectations are up to 30% higher than the University standard.
  - ME expectation: 15 credit hour load = 45 – 60 hr/wk
  - Student feedback indicates workloads generally consistent or higher than the ME faculty expectations.
- ME Forum data and Advising Office feedback indicate that workload often depends on the lead instructor.
- Student-reported workload has increased in upper-level courses since 2011. Seems to be primarily in lab-based courses.
- Two components: objective and perceived workload

Why this Task Force?

- Reports of high student stress and overload.
- Increased awareness of mental health and well-being (Pedrelli et al., 2014)
  - 12% of college students suffer from an anxiety disorder
  - 7-9% of college students suffer from depression
- Student burnout correlates with significant professional problems (Robins et al., 2018)
  - poor performance
  - less ethical decisions
  - increased turnover
  - less organizational commitment (Neumann et al., 1990)
- Expectation of burnout may affect recruitment (Neumann et al., 1990)

A To-Do List from a High Achieving ME354 Student

- *ME 315*
  - *Monday lecture and quiz*
  - *Wednesday lecture and quiz*
  - *Friday lecture and quiz*
  - *Homework due Wednesday*
  - *Prelab due every other Sunday*
  - *Lab report due every other Monday*
  - *Lab homework due every other Monday*
  - *Lab project*
  - *2 hour lab every week*
- *ME 375*
  - *Tuesday pre-lecture video and quiz*
  - *Thursday pre-lecture video and quiz*
  - *Friday pre-lecture video and quiz every other week*
  - *Tuesday lecture*
  - *Thursday lecture*
  - *Friday lecture every other week*
  - *Homework due Thursday*
  - *Prelab due every other Monday*
  - *3 hour lab every other week*
  - *Robot project*
- *ME 354*
  - *Monday lecture*
  - *Wednesday lecture*
  - *Friday lecture*
  - *Homework due Thursday*
  - *Discussion group every other week*
  - *Quiz every other Friday*
  - *Project deliverables due once a week*
- *ME 35401*
  - *3 hour lab every week*
  - *Deliverables and memo due every week*

Purdue Semester Credit Hour Guidelines

https://www.purdue.edu/registrar/documents/forms/Credit_Hr_Guidelines.pdf

Lecture, Recitation -

Normally, one credit hour is associated with a class meeting for 50 minutes per week for an entire semester (or the equivalent 750 semester-minutes, excluding final exams). Another widely repeated standard states that each in-class hour of college work should require two hours of preparation or other outside work.

3 credit hour class: 9 hr/wk
=> 15 credit hour load: 45 hr/wk

Conversations with various faculty: 2 – 3 out-of-class hr/wk/cr

3 credit hour class: 9 – 12 hr/wk
=> 15 credit hour load: 45 – 60 hr/wk

PlanOfStudy2020.xlsx

https://engineering.purdue.edu/ME/Undergraduate

soph

Fall 20 (3)	Hr/Wk	Crs
ME 200	13	3
ME 270	13	3
ME 290	3	1
MA 261	13	4
PHYS 241	13	3
CGT 163	9	2
Total	64	16

Spr. 20 (4)	Hr/Wk	Crs
ME 263 (L)	18	3
ME 274	13	3
MA 262	13	4
ECE 20001	13	3
ECE 20007 (L)	5	1
Total	62	14

Sum. 20 (5)	MM* Hr/Wk	Sum** Hr/Wk	Crs
Internship			
Econ El. (Econ)		6	3
Gen. Ed. (GE-2)		6	3
Total	0	24	6

junior

Fall 20 (5)	Hr/Wk	Crs
ME 309 (L)	18	4
ME 365 ((L) Even Wks)	15	3
ME 323	13	3
MA 303	13	3
Total	59	13

Spr. 20 (6)	Hr/Wk	Crs
ME 354	15	3
ME 35401 (L)	3	1
ME 375 ((L) Odd Wks)	15	3
ME El. (ME-1)	15	3
Tech. El. (TE-1)	13	3
Total	61	13

Sum. 20 (6)	MM* Hr/Wk	Sum* Hr/Wk	Crs
Internship			
Gen. Ed. (GE-3)		6	3
Total	0	12	3

senior

Fall 20 (7)	Hr/Wk	Crs
ME 315 (L)	18	4
MSE 230	13	3
ME El. (ME-2)	15	3
Tech. El. (TE-2)	13	3
Wrld/Cult El (WAC)	6	3
Total	65	16

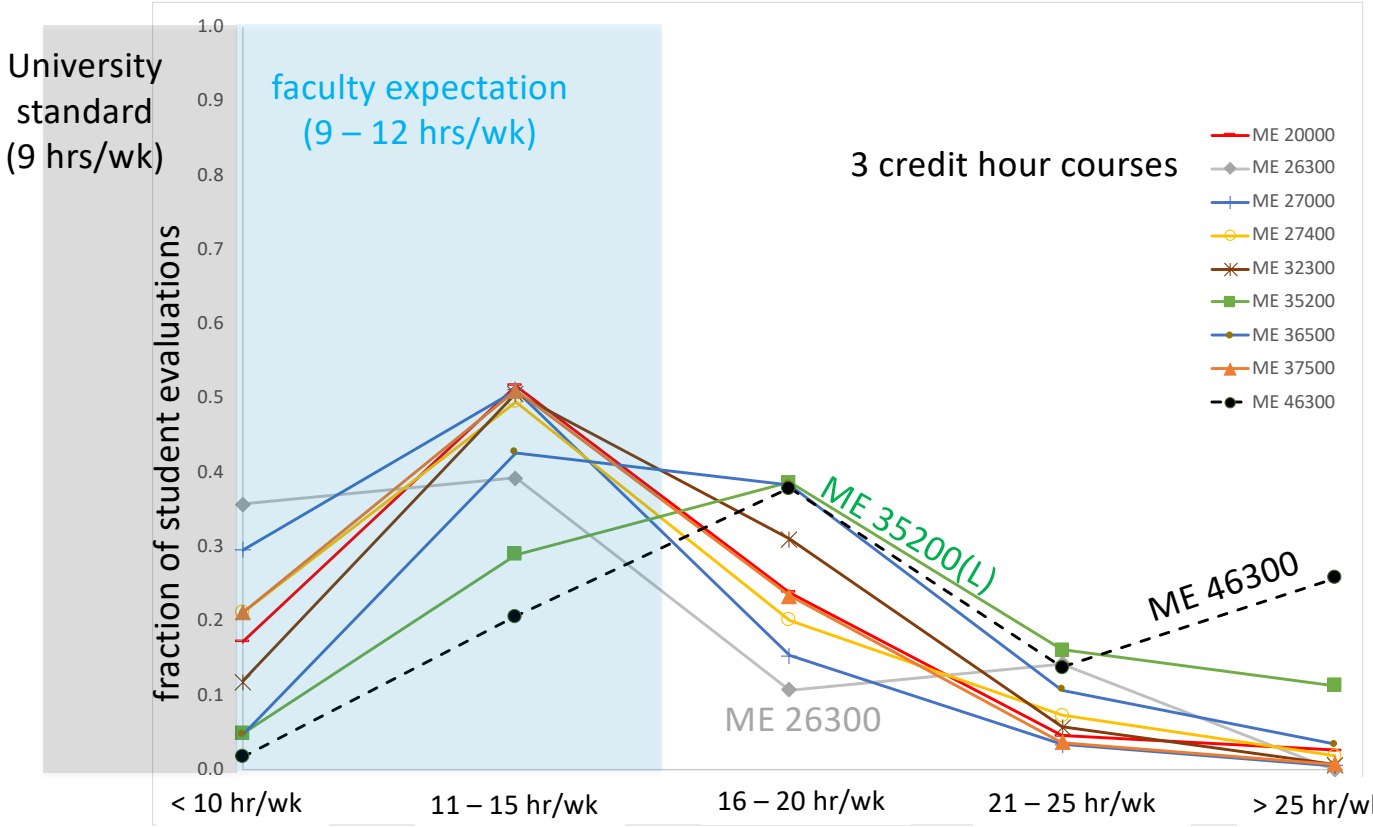
Spr. 20 (8)	Hr/Wk	Crs
ME 463 (L)	18	3
Tech. El. (TE-3)	13	3
ME El. (ME-3)	15	3
Free El. (free)	6	3
Gen Ed. (GE - 4)	6	3
Total	58	15

Sum. 20 (9)	MM* Hr/Wk	Sum** Hr/Wk	Crs
Total	0	0	0

Feedback from the UG Advising Office

- In general, the highest workloads are in lab courses.
  - ME308001, ME31500(L), ME36500(L), ME 37500(L), ME354001, ME32301(?)
- Toughest semesters are:
  1. 1st semester junior year then 1st semester sophomore year
  2. Likely to change due to lecture-lab transitions (ME309, ME352, ME323)
- Significant workload variability for the same course depending on who's the lead.
- Having so many exams in the same week is a significant source of stress.
- The 90+% on-time graduation rate is due, in part, to having core courses available during the summer.
  - If a student has no AP credit, then they would need to take summer courses to graduate on time.
  - Only have 3 free elective credit hours, 1 hour of which is likely going to be used for Data Science.
- It's difficult to have experiential learning when the course loads are so high, e.g., study abroad, teams, etc.
- Even for high GPA students, break days are needed to avoid burnout.
- We have a broader distribution of academic skills as more students are admitted to the program. Are these students at the low GPA end of the distribution?
- The possibility of the J-term schedule is a concern. We need to avoid delivering the same information in a semester with one less week.
- Most faculty only have familiarity with one or two courses and don't see the whole of the curriculum. Unaware of the work expectations of other courses.

Fall 2019 Student Evaluation Data



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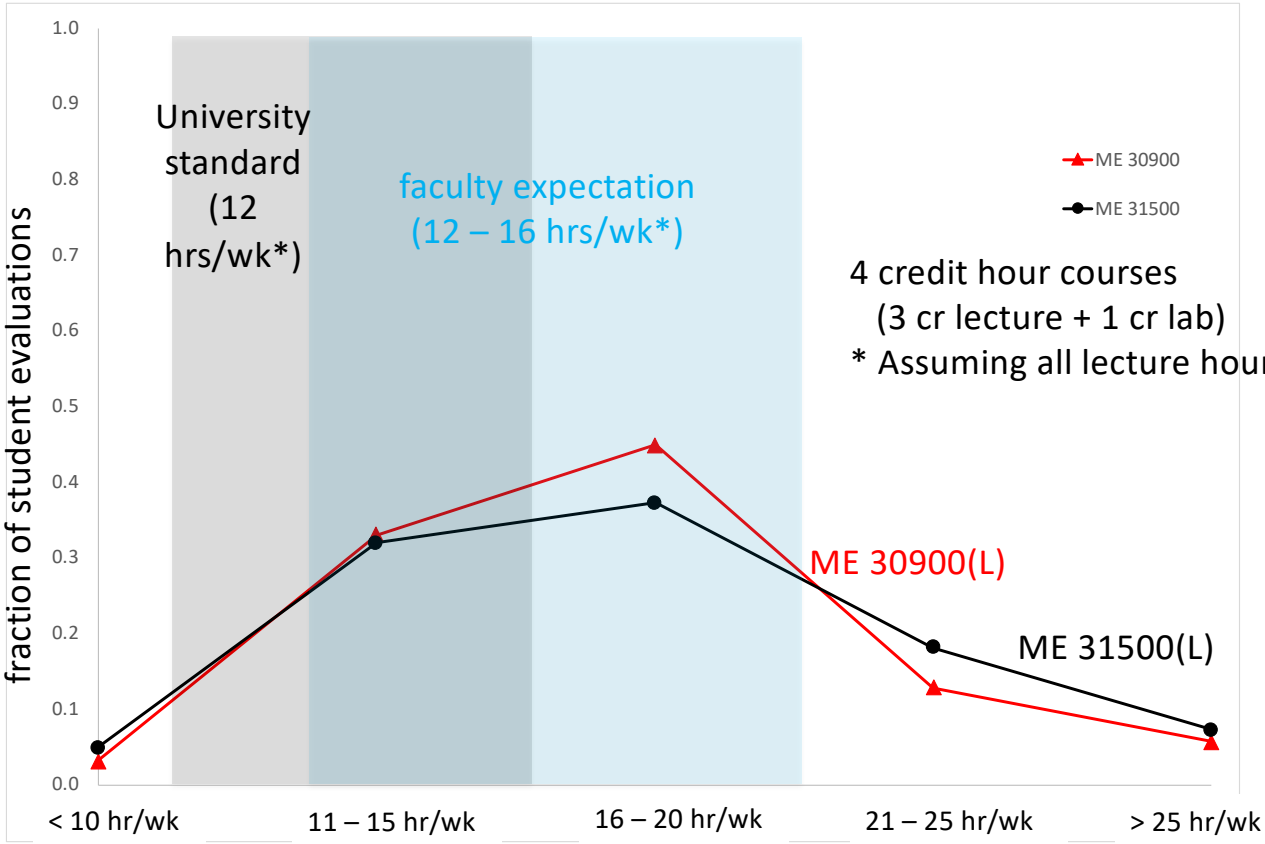
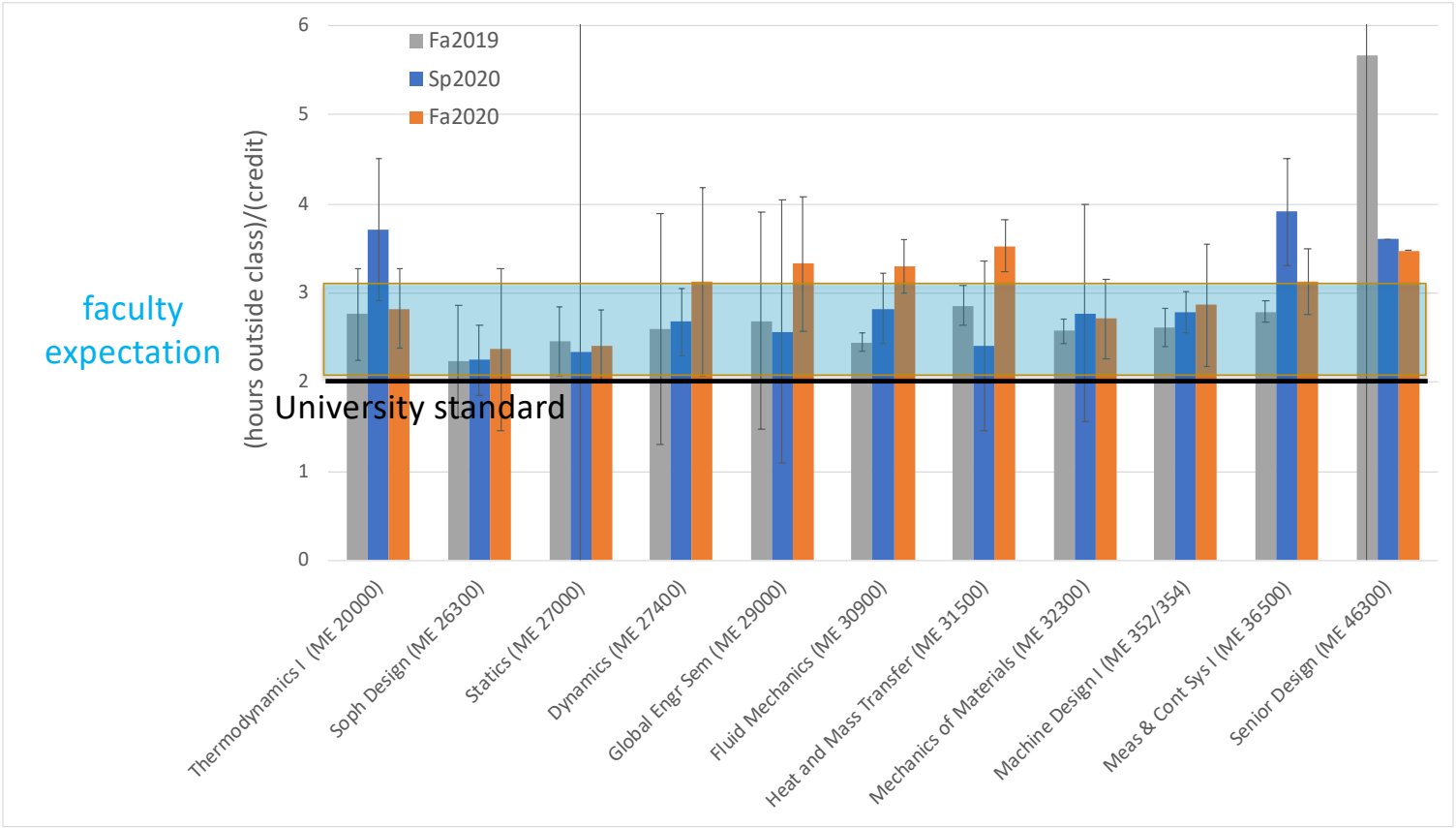


ME Forum Feedback



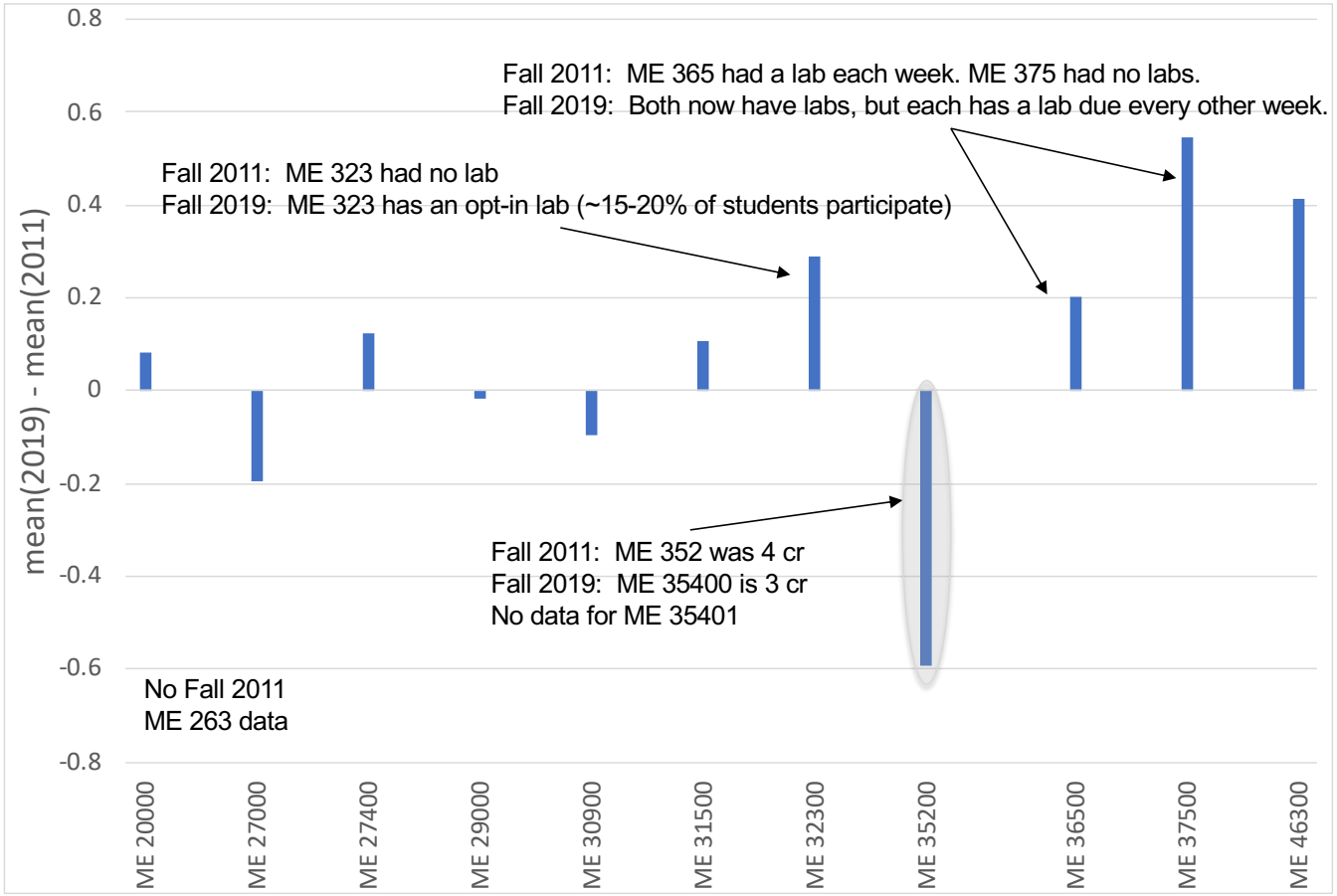
Comparison of Fa 2011 and Fa 2019 Workload Data

Methodology for finding the "mean"

Category	Score
< 10 h/wk	1
11 – 15 h/wk	2
16 – 20 h/wk	3
21 – 25 h/wk	4
> 25 h/wk	5

$$\bar{S} = \sum_{i=1}^{i=5} f_i S_i$$

f_i is the number fraction of students reporting score S_i



Brief Review of Workload Literature

- Workload affects learning quality
- Perceived vs. objective workload
- Good student-student relationships help students cope with workload => Allow students to choose the groups.
- Intrinsic motivation helps reduce perceived workload.
- Projects have lower perceived workload. Busy work and debugging have high perceived workload.
- Well-defined course structure helps reduce perceived workload.
- Answering questions helps reduce workload since students don't need to spend time looking for answers.
- More in the literature on this topic!

Summary

- Many students report being overloaded and burned out.
- ME faculty workload expectations are up to 30% higher than the University standard.
  - ME expectation: 15 credit hour load = 45 – 60 hr/wk
  - Student feedback indicates workloads generally consistent or higher than the ME faculty expectations.
- ME Forum data and Advising Office feedback indicate that workload often depends on the lead instructor.
- Student-reported workload has increased in upper-level courses since 2011.
- Workload trends for some classes are expected to change as courses re-structure, e.g., ME 352/354, ME 309/308, ME323.
- Two components: objective and perceived workload

Recommendations

- Review objective workload expectations for your course
  - lecture time + reading (2-5 min/pg) + external lecture video time + external example video time + time-per-homework-problem + study time + office hours time + … [Create weekly task lists and spreadsheets to estimate.]
  - How can we reduce busy work?
  - Re-evaluate what topics are important (Sputnik-era assumptions?)
  - Most potential impact: Lab course workload (1 credit hr labs)
  - Workload consistency between lead instructors
- Can we re-order some courses in the Plan of Study to balance workload?
  - (refer to back-up slide for example)

Recommendations…

- Methods for reducing perceived workload
  - Improve student intrinsic motivation, e.g., ARCS model for motivation
  - Have a well-defined course structure
    - e.g., weekly task lists (refer to back-up slide for example)
    - well-designed Brightspace page
    - consolidate information
    - minimize information overload
  - Encourage student-formed study groups and teams
    - e.g., group homework assignments
    - in-class groups
  - Minimize loss-of-confidence incidents
    - Unclear or inconsistent policies and grading
    - Mistakes in lecture, problem statements, solutions
    - Delayed and uninformative responses to questions, emails, grading feedback

Recommendations…

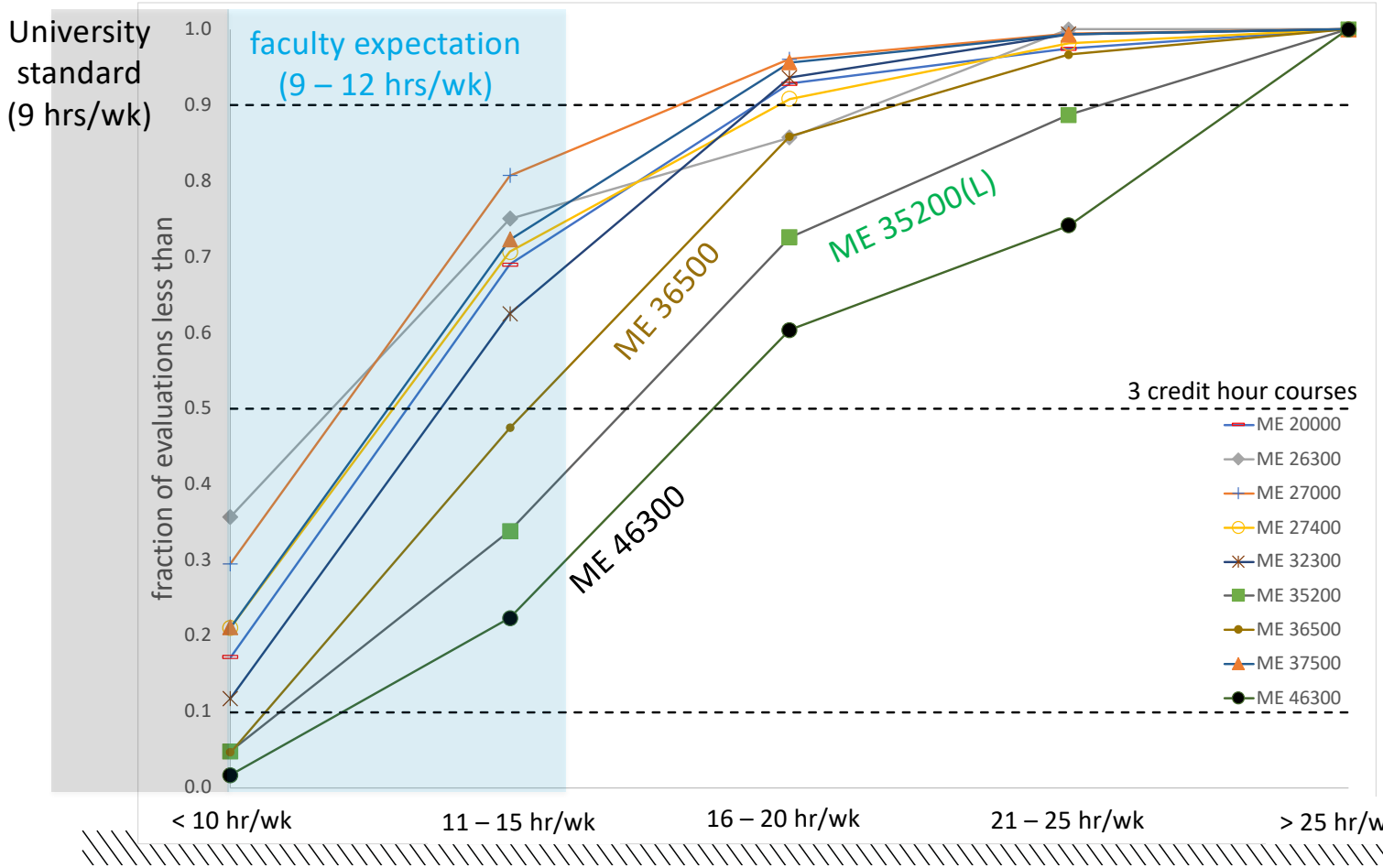
- More methods for reducing perceived workload
  - Minimize tedious and little-value-added work
    - e.g., provide partially-completed notes
    - e.g., allow the use of symbolic computation and numerical calculation software, Python libraries, etc.
  - Provide a clear path to success
    - Grading rubrics
    - Practice exams
    - Examples of good lab reports, project reports, etc.

Recommendations…

- Additional methods for reducing stress
  - Provide periodic breaks in workload, e.g., review sessions before exams
  - Coordinate exams between courses so they're not back-to-back
    - e.g., Course coordinators for ME 308, ME 323 , and ME365 can try to schedule exams for different weeks
  - Fewer high-stakes assessments and more low-stakes assessments
    - More time consuming, but improved confidence in statistics
  - Encourage students to seek help early
    - Words and attitudes matter – be kind and supportive (faculty + TAs)
    - Meet in "neutral" territory
  - Provide a support network, e.g., peer network, access to timely help (Piazza, tutorial room, office hours, SI, tutors)

Questions and Discussion

Fall 2019 Student Evaluation Data



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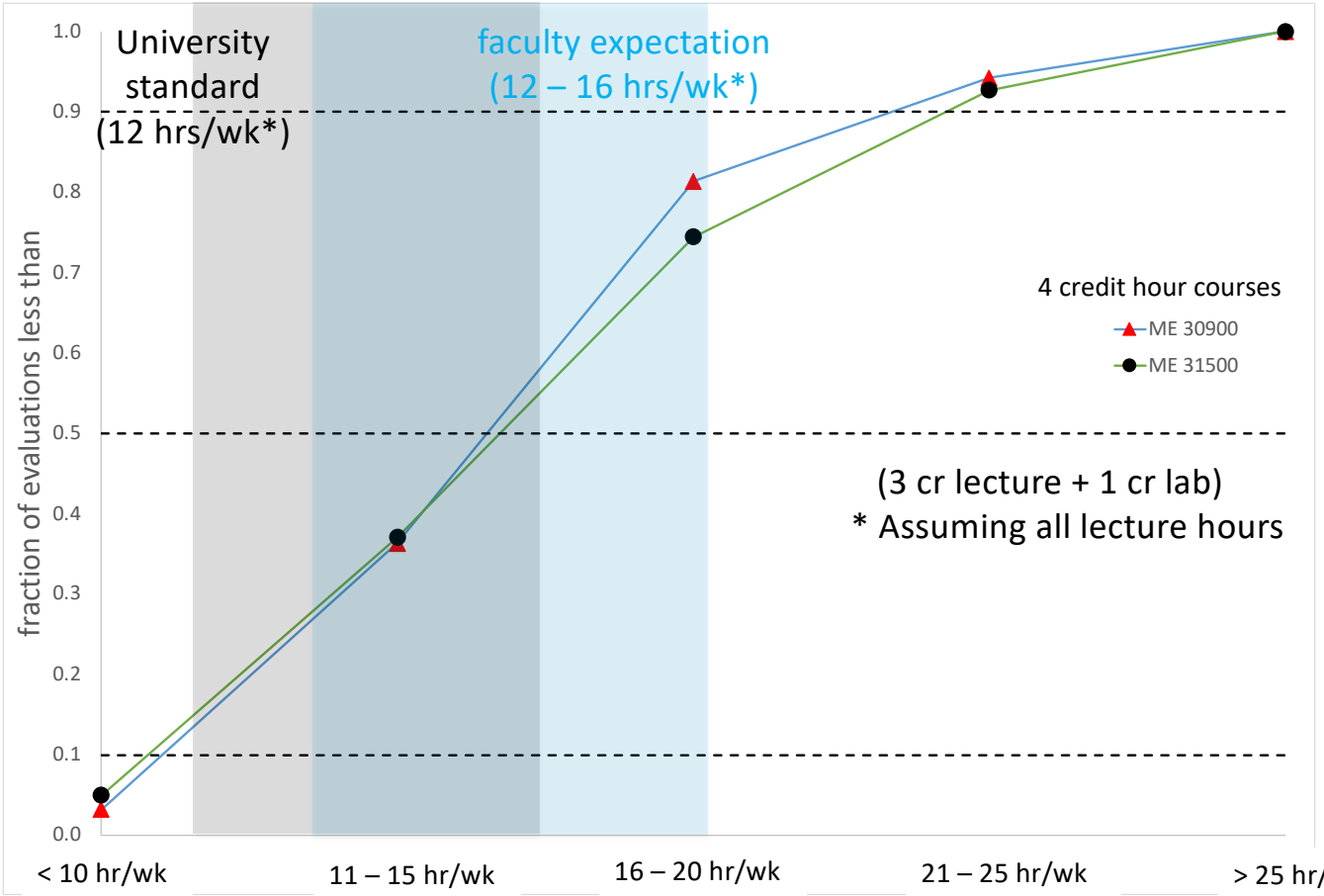

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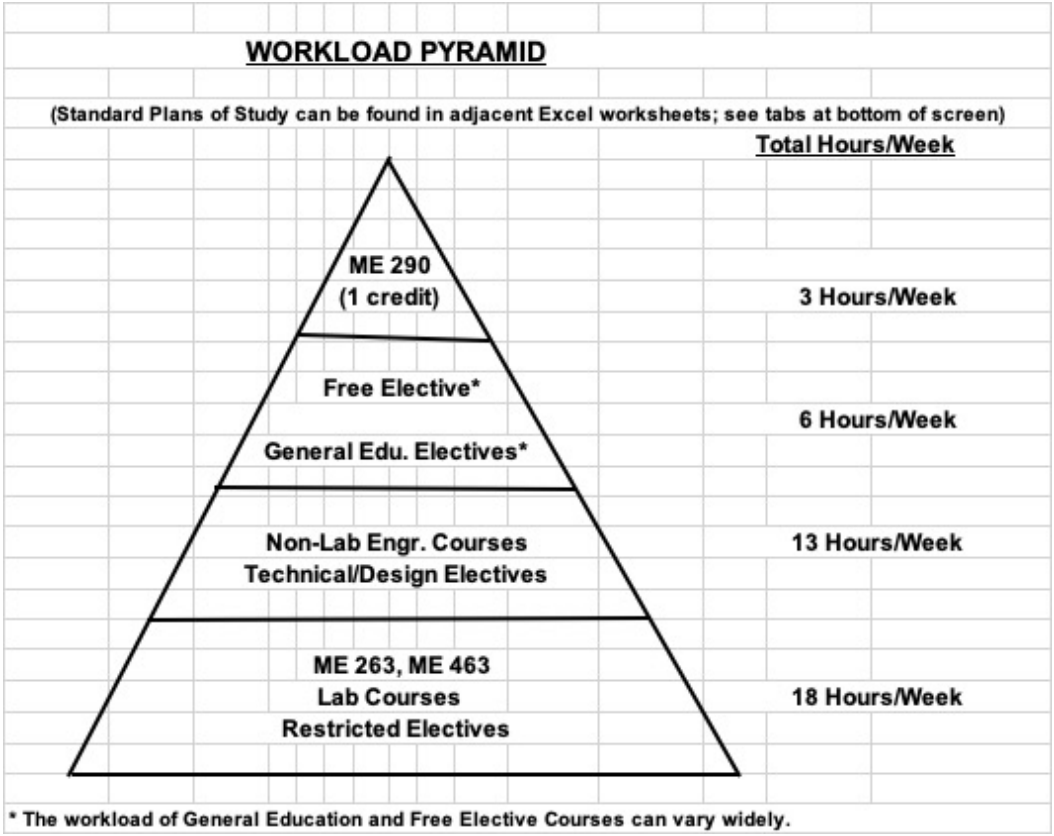


Recommendations…

- Is there a better way to measure student workload?
  - End-of-semester evaluation: hard to remember
  - Ask students to report back on time spent on homework, project, and lab assignments?
- If the J-term passes…
  - Need to remove content
  - Good opportunity to redesign courses
  - Offer labs during J-term?

Example Time Budget Spreadsheet

3	number credit hours for the course
Minutes per Task	
2	time to read one page from a textbook
80	time to complete one homework problem*
45	time seeking outside help per week, e.g., office hours, tutorial room, SI help
60	time studying per week, e.g., reviewing notes, watching lecture videos, watching example videos, re-reading, working examples
Tasks per Week	
24	pages of reading
5	homework problems
Minutes per week	
48	reading
400	working homework problems
45	time seeking outside help per week, e.g., office hours, tutorial room, SI help
60	time studying per week, e.g., reviewing notes, watching lecture videos, watching example videos, re-reading, working examples
553	total minutes
9.2	**hrs/wk outside of class**
3.1	**(hrs/wk outside of class)/(credit hr)**
***Estimated Time to Complete One Homework Problem**	
3	problems per two hour (120 min) exam
40	minutes per exam problem
2	ratio of time spent on a problem when first seeing it (homework) to time spent after having studied (exam)
80	minutes per homework problem

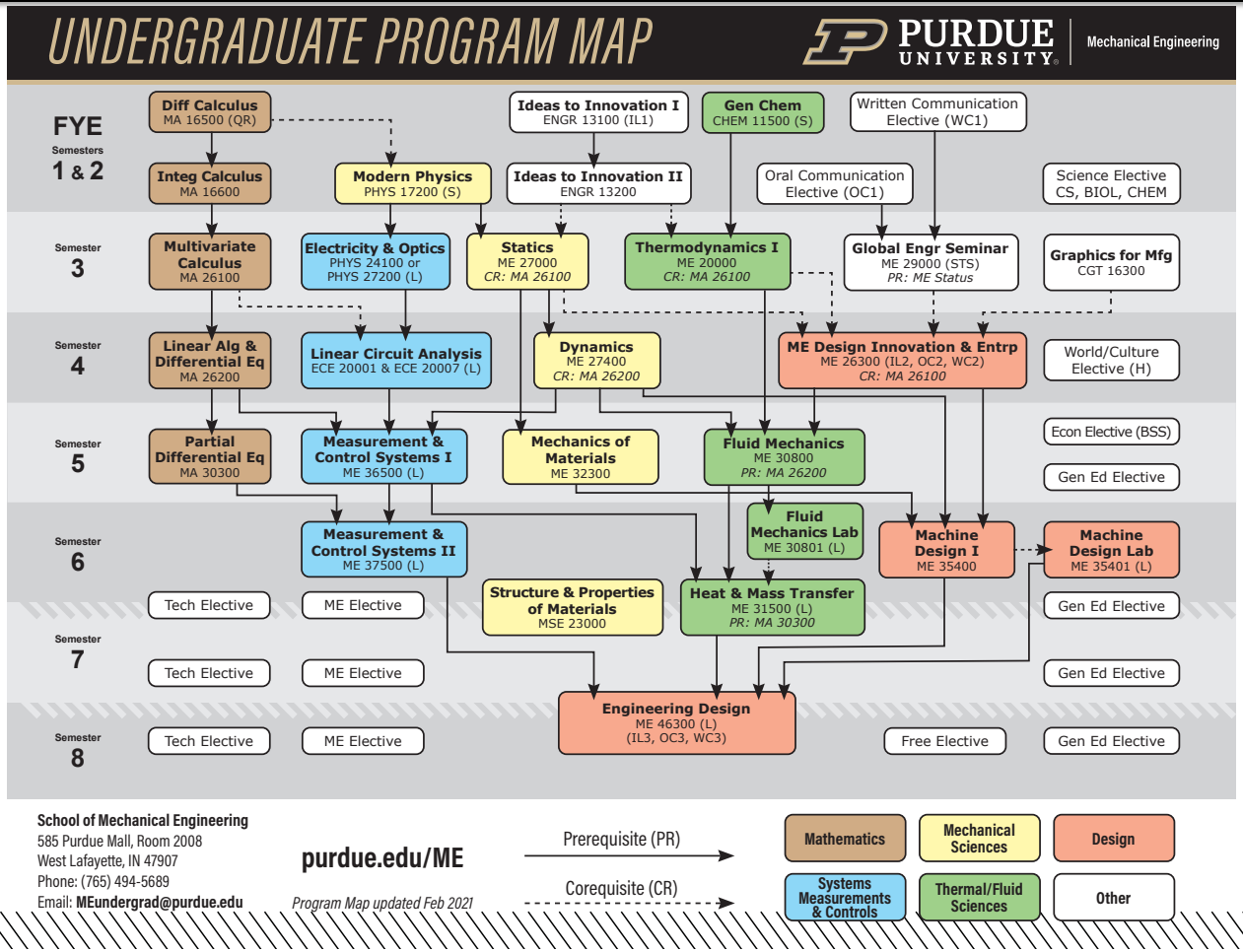
Information Overload Examples

- More locations for administrative content, e.g., lectures, multiple handouts, Brightspace, Gradescope, Piazza, emails, etc.
  - Brightspace pages are often poorly organized
- From Transformative Education 2.0 Update (2021 Oct 07): Student Engagement Team found that ~250 emails go out to a student from when they've been admitted to Purdue through the fall (students are overwhelmed and confused)
- The ME UG Office now posts information on the UG Blog (one location). Previously they were sending out a large number of emails which were often ignored.

Additional Thoughts

- The backgrounds of students in our program have changed over time.
  - e.g., students with less hands-on experience, e.g., working on farms, cars, etc.
- Faculty are good at adding content, but poor at removing it.
  - e.g., video lectures + reading + in-class meeting
  - e.g., extra lab, extra data sciences course, fewer free electives
- We have a broad distribution of student skills. Should we target our workload expectations for the top 10% of students, top 50%, etc.?

ME UG Program Map



Example ME309 Weekly Checklist

ME30900 (Sp21) – Checklist
Week 07: We, Mar 03 – Tu, Mar 09

We're now at the half way point in the semester. Now is a good time to review your study habits and performance in the course and make mid-course corrections, if needed.

This week we start by spending an additional lecture on the Linear Momentum Equation for accelerating coordinate systems. It's an important topic and, thus, deserves extra emphasis. The rest of the week focuses on dimensional analysis. Dimensional analysis is a powerful tool and, fortunately, easy to apply once the parameters that are significant to the system are identified. The hard part is identifying the significant parameters. Dimensional analysis is used to efficiently present data, simplify experimental studies, and perform scale-model testing. It's worthwhile to mention that dimensional analysis can be applied to fields other than fluid mechanics.

✓	Task
	We, Mar 03: Review homework solutions and examine where mistakes may have been made
	We, Mar 03: Attend TA help hours/contact instructors to resolve homework difficulties
	We, Mar 03: Study in preparation for Quiz 06
	Read textbook: pp. 111 – 117
	Watch online video lecture: Linear Momentum for Non-Inertial FORs (lecture notes)
	If needed, read Wassgren notes: Linear Momentum for Non-Inertial FORs
	We, Mar 03: Participate in lecture
	Review/practice online Linear Momentum for Non-Inertial FORs
	Th, Mar 04: Take Quiz 06
	Fr, Mar 05: Review quiz solutions and examine where mistakes may have been made
	Read textbook: pp. 246 – 254
	Watch online video lecture: Dimensional Analysis - Introduction (lecture notes); Buckingham-Pi Theorem; Method of Repeating Variables (lecture notes)
	If needed, read Wassgren notes: Introduction; Buckingham-Pi Thm and Method of Repeating Variables
	Fr, Mar 05: Participate in lecture
	Review/practice online Dimensional Analysis
	Read textbook: pp. 256 - 267
	Watch online video lecture: Dimensional Analysis (Similarity and Scaling) (lecture notes)
	If needed, read Wassgren notes: Dimensional Analysis (Similarity and Scaling)
	Mo, Mar 08: Participate in lecture
	Review/practice online Dimensional Analysis (Modeling and Similarity)
	Throughout the week: Work on Hmk 07
	Throughout the week, if needed: Attend TA help desk sessions, review Piazza posts, meet with instructor
	Tu, Mar 09, before 11:59 P.M.: Submit Hmk 07

Example Modified Plan of Study

ME 200	13	3
ME 270	13	3
ME 290	3	1
MA 261	13	4
PHYS 241	13	3
CGT 163	9	2
Total	**64**	**16**

ME 263 (L)	18	3
ME 274	13	3
MA 262	13	4
ECE 20001	13	3
ECE 20007 (L)	5	1
Total	**62**	**14**

	Hr/Wk	Hr/Wk	
Internship			
Econ El. (Econ)		6	3
Total	**0**	**12**	**3**

Fall 20 (5)	**Hr/Wk**	**Crs**
ME 30800	13	3
ME 365 ((L) Even Wks)	15	3
ME 323	13	3
MA 303	13	3
Gen. Ed. (GE-2)	6	3
Total	**60**	**15**

Spr. 20 (6)	**Hr/Wk**	**Crs**
ME 354	15	3
ME 35401 (L)	3	1
ME 375 ((L) Odd Wks)	15	3
ME El. (ME-1)	15	3
Tech. El. (TE-1)	13	3
ME 30801 (L)	5	1
Total	**66**	**14**

Sum. 20 (6)	**MM***	**Sum***	**Crs**
	Hr/Wk	**Hr/Wk**	
Internship			
Gen. Ed. (GE-3)		6	3
Total	**0**	**12**	**3**

Fall 20 (7)	**Hr/Wk**	**Crs**
ME 315 (L)	18	4
MSE 230	13	3
ME El. (ME-2)	15	3
Tech. El. (TE-2)	13	3
Wrld/Cult El (WAC)	6	3
Total	**65**	**16**

Spr. 20 (8)	**Hr/Wk**	**Crs**
ME 463 (L)	18	3
Tech. El. (TE-3)	13	3
ME El. (ME-3)	15	3
Free El. (free)	6	3
Gen Ed. (GE - 4)	6	3
Total	**58**	**15**

Sum. 20 (9)	**MM***	**Sum****	**Crs**
	Hr/Wk	**Hr/Wk**	
Total	**0**	**0**	**0**

ARCS Model for Motivation

Attention • Interesting or counter-intuitive facts • Humor • Demonstrations • Active participation	**Relevance** • Real world applications • Link to previous experience • Student control of their learning
Confidence • Clear path to success (guidelines, consistency, reasonable expectations) • Quality and timely feedback • Staged difficulty – opportunity for growth • Resources for help • Student control of their learning	**Satisfaction** • Applying knowledge outside of class • Positive experiences • External rewards: praise, grades • Immediate application of knowledge

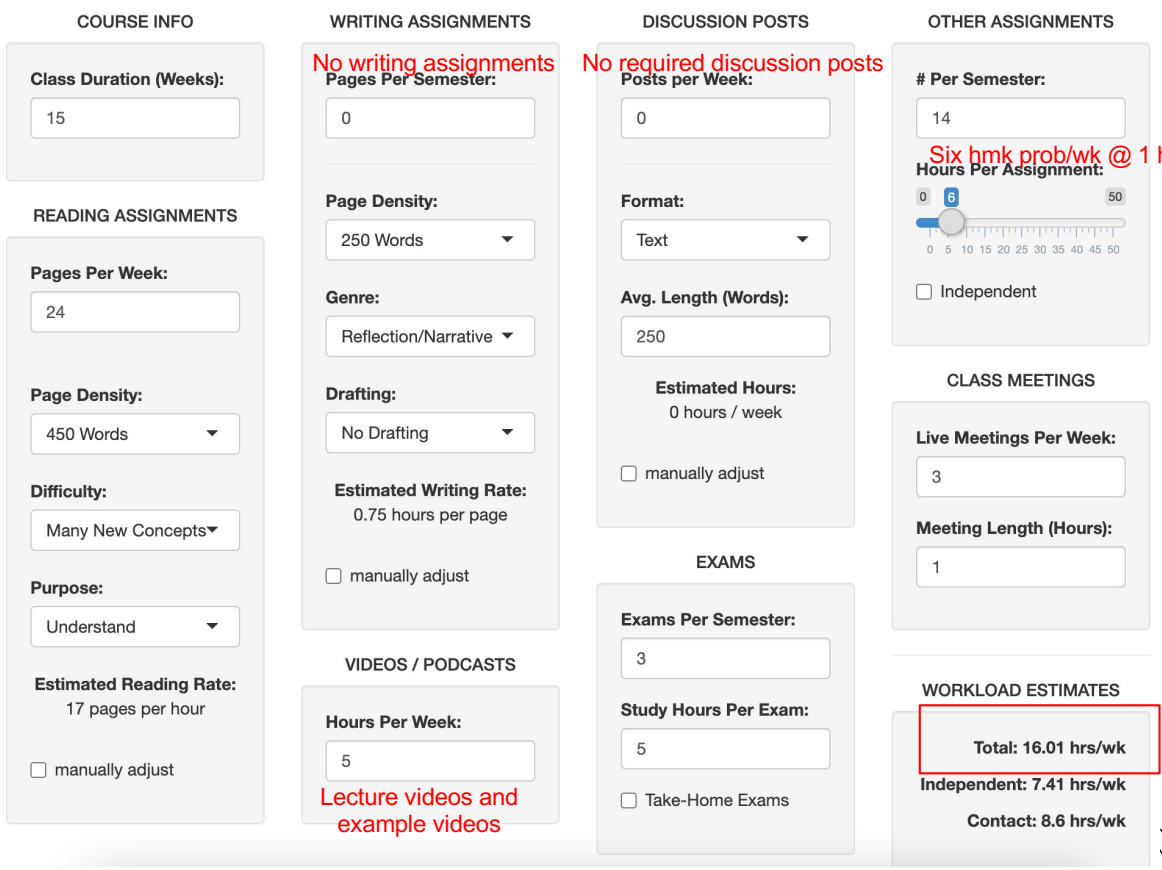
(Keller, 1984)

References

- Keller, J.M., 1984, ”Development and use of the ARCS model of instructional design”, *Journal of Instructional Development*, Vol. 10, Article 2.
- Neumann, Y., Finaly-Neumann, E., and Reichel, A., 1990, “Determinants and consequences of students’ burnout in universities”, *The Journal of Higher Education*, Vol. 61, No. 1, pp. 20 – 31.
- Pedrelli, P., Nyer, M., Yeung, A., Zulauf, C., and Wilens, T., 2015, “College Students: Mental Health Problems and Treatment Considerations”, *Acad Psychiatry*, Vol. 39, No. 5, pp. 503 – 511.
- Robins, T.G., Roberts, R.M., and Sarris, A., 2018, “The role of student burnout in predicting future burnout: exploring the transition from university to the workplace”, *Higher Education Research & Development*, Vol. 37, No. 1, pp. 115 – 130.

Online Workload Estimator

https://cat.wfu.edu/resources/tools/estimator2/



Example for ME30800 (no lab)

ME 352 vs. ME 35400 + ME 35401

From Beth Hess:

- The transition from 352/452 to 354/452 began in Spring 2019.
- Until Summer 2020 the course numbers were still 352 and 452. The 4th credit hour of 352 was used mostly as a recitation (time to work on homework and projects and quizzes were also given in the lab), but the content of 352 was shifting.
- Beginning Fall 2020, ME 354 was entirely the “old 452” material and a 3-hour lecture. ME 35401 began Fall 2020 as a 1-hour lab.
- So the data from Spring 2019 - Summer 2020 are a little muddled. Fall 2018 and prior was “old 352 and 452” and Fall 2020 and since are “new 354 and 452.”