online, Prof. Kronholm informed me the Math Department was giving me the chance MATH080 in Summer Session II, 2020.

I was grateful for the opportunity to teach a math course during summer session. My approach was to teach MATH080 like PHYS135A/B. I made no assumptions about the students' math preparation. The students engaged in warm-ups, TT and PER modules, and PhET modules. Alhtough PhET stands for Physics Education Technology, that organization now has statistics simulations. There are modules that are particularly useful for illustrating probability distributions. Our theme for the course was to *keep it simple.* After the students completed their final projects, they shared very positive course reviews[13].

2.4 Analysis of Course Evaluations: Introductory Courses

Question Number	Text
10	This course had clear goals and objectives.
11	This course was academically challenging.
12	This course offered useful learning tools (such as lectures, discussions, readings, assignments and/or examinations).
13	This course had grading criteria that were clearly identified.
14	This course improved my understanding of the material.
15	This course increased my interest in the subject matter.
16	Overall, I would recommend this course to others.
17	The professor used class time effectively and demonstrated preparation for class.
18	The professor's teaching style and/or enthusiasm for the material strengthened my interest in the subject matter.
19	The professor was able to explain complicated ideas.
20	The professor challenged students to think critically and/or imaginatively about the course material.
21	The professor provided clear and timely feedback.
22	The professor encouraged meaningful class discussions.
23	The professor was receptive to differing views.
24	The professor was available for help outside of class.
25	Overall, I would recommend this professor to others.

Table 2.2: The listing of standard course evaluation quesions.

The course evaluations for all courses described in Sec. 2.3 are shared below. On the evaluations, questions 10-16 pertain to the course, and questions 17-25 pertain to the professor. Table 2.2 lists the standard questions.

Algebra-Based Physics

The course evaluation data for algebra-based physics is shown in Tab. 2.3. Table 2.3 (left) contains the results for the course, while Tab. 2.3 (right) contains the results for the professor. The question definitions are listed in Tab. 2.2. The data cover four courses in this category from Fall 2019 through Spring 2021. The courses taught in 2021 were taught through the module system, while those in 2019 and 2020 were done through semesters. Fall courses (135A) cover units

[13]Example final project presentations are included in the supporting materials.

Question	F2019	S2020	S2021 (1)	S2021 (2)
10	4.8	4.9	4.6	5.0
11	4.7	4.9	4.8	4.9
12	4.7	4.7	4.5	5.0
13	4.8	4.8	4.5	5.0
14	4.5	4.6	4.3	5.0
15	4.0	4.2	4.1	4.9
16	4.5	4.7	3.9	4.9

Question	F2019	S2020	S2021 (1)	S2021 (2)
17	4.6	4.7	4.5	4.9
18	4.6	4.4	4.4	4.9
19	4.3	4.5	4.2	5.0
20	4.6	4.7	4.4	5.0
21	4.8	4.9	4.0	5.0
22	4.6	4.6	4.4	5.0
23	4.7	4.8	4.8	5.0
24	4.8	4.8	4.9	5.0
25	4.7	4.5	4.5	4.9

Table 2.3: (Left) Course evaluation results for PHYS135, course questions. (Right) Course evaluation results for PHYS135, professor questions. F2019: Fall 2019, PHYS135A. S2020: Spring 2020, PHYS135B. S2021 (1 or 2): Spring 2020, PHYS135B sections 1 and 2.

and vectors, kinematics, forces, energy, and momentum. Spring courses (135B) cover electromagnetism topics like charge, fields, current, DC circuits, and magnetism.

In general, the results are much higher than in my first years at Whittier College. I attribute the successes to FPC recommendations and the hard work of my students. I am pleased to find that my section of PHYS135B section 2 (module 2) received near perfect scores from those that responded, despite being taught in the module system. The seven week module posed serious challenges for introductory physics students. Those near perfect scores were earned when both students and professors were experiencing burnout. Desite all the student success, several trends are visible in the algebra-based physics data that merit discussion.

I have been watching Question 15 results since Fall 2017. The question is about increasing interest for physics. Question 9 (not shown in Tab. 2.3) reveals a related point: "I had a strong desire to take this course." Students regularly enter 3.0/5.0 for that question. The online PEGP reports now provide data regarding why many students take the course. Most students *are required* to take it for their major. My job for Question 15 is to inspire an appreciation for physics in students who are being forced to take a course they do not want to take. For this reason, I introduced article bonuses and self-designed projects, to reach the *curiosity* learning focus and the overall theme of *shared meaning* (Sec. 2.1). The average for all four instances of 135 is 4.3, which is higher than my last report (4.25).

In addition to Question 15, I was expecting a second trend. Although most of the results in Tab. 2.3 are high, the Spring 2021 section 1 (module 3) are lower on average than the others. There are three reasons why this occurred, and all can be remedied. This was my module 3 course that followed the module 2 PHYS135B (section 2). I was blocked from seeing the course evaluations for module 2 before teaching module 3. In module 2, we *barely* reached the topic of applications of magnetism. While teaching section 2 (module 2, 135B), I kept remembering my mantra to *control the pace,* learned from prior FPC recommendations and experiences. It turns out even the module 2 students were sharing that the pace was pretty quick, especially given that the course was only seven weeks long.

Module 2 ended before we could address all the magnetism content, but the students that responded gave me high scores. I planned to cover magnetism in more detail, but there was just not enough time. The module system and the pandemic took my magnets![14] Ask any physicist: can your students learn electromagnetism in seven weeks, meeting five days per week? The answer would likely be that most *human beings* cannot learn physics that fast. I felt it was an issue of integrity that I try to cover more magnetism for the module 3 students. The module 3 students, however, were burned out, and some wrote exactly that in the written response section. Had I been able to see the module 2 data before teaching module 3, I would not have pushed us harder to reach magnetic applications.

The second reason the numbers are lower for that section had to do with grading. Module 3 was a perfect storm of course work, committee service, finishing a research paper, advising thirty students, and caring for a one-year-old. In retrospect, I should have exchanged my written midterm for something automatically graded using OpenStax Tutor. When the students submitted midterms, I realized I was not going to be able to finish grading them quickly. Now that we are returning to the semester format, this problem will be solved with a longer semester and more efficient midterm design.

The third reason Spring 2021 135B-01 scores were lower has to do with the topic of *vectors*. An example of a vector is force, which is both an amount and a direction (150 lbs. *downward*). To understand electromagnetism, one needs to be able to multiply vectors. Knowledge of electric and magnetic forces, and the ensuing effects in circuits, motors, and generators relies on this knowledge. In PHYS135B section 1 (module 3), students were struggling more than usual with vectors. Vectors are usually instroduced in 135A, but I was not the intstructor for PHYS135A that Fall. When I polled the students in module 3 to learn if vectors were covered in 135A, they uniformly said "no." I recalibrated my course on-the-fly, reviewing vector content. This comming Fall 2021, I will be teaching all sections of 135A. I will help the students practice with vectors, and this will help them in the long run with 135B.

Calculus-Based Physics

The data in Tab. 2.4 pertains to two sections of calculus-based physics. I taught PHYS150 in Fall 2019, and PHYS180 in Spring 2020. Like algebra-based physics, mechanics is covered in the first course and electromagnetism is covered in the second. I do not identify any significant downward trends relative to my last report. The scores from PHYS180 in the last report were near perfect, but the class size was $N = 8$, rather than $N = 26$ (PHYS150) and $N = 24$ (PHYS180) for this round. The exception to these remarks is the usual Question 15 (PHYS150), but that is not unexpected from a large sample. Some students take PHYS150 thinking they want to major in physics or 3-2 engineering, for example, and switch majors when they realize they are more interested in other topics. For example, I had one advisee this year switch from physics to Digital Art and Design.

After reading through the written assessments, I noticed several comments for which I can provide a remedy. First,

[14] Do you remember that phrase from the curricular discussions? Don't take my magnets! Good times.

Question	F2019	S2020
10	4.8	5.0
11	4.9	5.0
12	4.9	4.9
13	4.9	4.9
14	4.7	4.9
15	4.3	4.7
16	4.8	4.9

Question	F2019	S2020
17	4.9	5.0
18	4.7	5.0
19	4.6	4.7
20	4.8	5.0
21	4.8	4.9
22	4.7	4.9
23	4.8	5.0
24	5.0	5.0
25	4.8	5.0

Table 2.4: (Left) Course evaluation results for PHYS150/180, course questions. (Right) Course evaluation results for PHYS150/180, professor questions. F2019: Fall 2019, PHYS150. S2020: Spring 2020, PHYS180.

Question	Result
This course had clear and objective outcomes.	4.8
This course was academically challenging.	4.5
This course offers useful learning tools.	4.8
This course had grading criteria that were clearly identified.	4.8
This course improved my understanding of the material.	4.8
This course increased my interest in the subject matter.	4.5
This course provided interactions between students that were meaningful.	4.5
This course is as rigorous as the typical on-campus course.	4.3
Overall, I would recommend this course to others.	4.8

Question	Result
The professor demonstrated preparation for the class.	4.8
The professor's teaching style and/or enthusiasm for the material strengthened my interest in the subject matter.	4.5
The professor was able to explain complicated ideas.	4.3
The professor challenged students to think critically.	4.8
The professor provided clear and timely feedback.	4.5
The professor encouraged meaningful discussions.	4.5
The professor was receptive to differing views.	4.8
The professor was available to help.	4.8
Overall, I would recommend this professor to others.	4.8

Table 2.5: (Top) Course evaluation results for MATH080, course questions. (Bottom) Course evaluation results for MATH080, professor questions. Su2020: Summer 2020. Note: the questions for summer online courses are slightly different than courses during the academic year. See text for details.

some students mention problems with the *ExpertTA* homework system. I have moved to OpenStax Tutor, which is cheaper and better-designed. Some students mentioned that three shorter midterms worked well for them, and others mentioned that the third one falls too close to finals season. I have since switched to two midterms. In algebra-based physics, I am moving to one midterm, and the final project design is due when the second midterm would have occurred. In both algebra and calculus-based physics, the final exam is optional, and I provide clear grading criteria for final/no-final on the syllabus. Most of the other comments were positive, especially for PHYS180 during the rapid transition to remote learning. One student suggested keeping the tutorial videos going even after returning from quarantine. I am following through on this request by creating at least one video tutorial per week for each course.

Elementary Statistics

Teaching elementary statistics (MATH080) in Summer 2020 was a useful experience. The students really appreciated the chance to take it over the Summer. The numbers in Tab. 2.5 are not that different from Tabs. 2.3 and 2.4. Before the pandemic, online math courses were not allowed by Math Department policy. I was likely the first Whittier College professor to ever teach one. I am grateful to the Math Department for trusting me with the responsibility of teaching MATH080. I taught this course in the same way I teach PHYS135A/B. Before Summer 2020, there were concerns from math professors about *quality control*. Similar to algebra-based physics, students are taking a must-pass course for graduation, but need help with math. Instructors are under pressure to reduce content and slow the pace. I found that the students learned the material and applied it successfully in their final projects[15]. Of the $N = 4$ students that responded, they shared that the Summer course was *almost* as rigorous as the semester version (4.3/5.0). However, they also report that the course had useful learning tools, that it increased their interest, and that it improved their understanding.

[15]Examples in supporting material.