Issue 1.01

Problem/Issue Arising from monthly social meetings between the physics graduate students and the physics faculty was the request, supported by the majority of the graduate students, that they would like to have a bonafide teaching experience. [November 2009]

Solution: In 2010 the college of Eastern Utah and USU merged requiring their course offerings be aligned, i.e. one shared catalogue. USU physics department decided it would separate the laboratory sections of PHYS 2210 and 2220 from the face-to-face calculus based introduction to physics lectures and recitations. Thus PHYS 2215 and PHYS 2225 laboratory courses of 1 credit each were created and first offered in Fall 2011.

These 1-credit laboratory courses were also of interest to the engineering college who requested that the syllabus contain two new elements: report writing and introductions to error analysis.

This new pair of 1-credit laboratory couples also provided a potential answer to the graduate student request to have a bonafide teaching experience. The department faculty approved the following concept:

1. A faculty member would be the master teacher who would prepare the graduate students to be teachers of the labs (hence the graduate student would be the official teacher of record for their sections of PHYS 2210 and PHYS 2220).
2. James Coburn, the department's laboratory supervisor and experiment specialist could be responsible for day-to-day oversight of these laboratories as well as the graduate students.
3. Through regular meetings between all the involved personnel (grad student teachers, faculty master teachers, and James Coburn) the normalization of individual classes, updates to syllabus, as well as problem resolution would be executed.
4. The time commitment of one 1-credit laboratories was evaluated to be between 1/3 and ¼ of a graduate student teaching assistantship.

A prototype teaching experience was held in summer 2010 with both PHYS 2215 and PHYS 2225 being tested.

In Fall 2011 and each spring and fall semester since both PHYS 2215 and PHYS 2225 has been offered. Each semester between 8 and 11 sections of each lab are run. Hence over 6 semesters a total of 113 sections have been executed. The maximum enrollment being 18 students per section with an average of about 15.

Assessment:

After the Fall 2011 and Spring 2012 semesters the feedback from students in the labs and from the graduate student teachers was rather consistent that the syllabi for both laboratories was demanding an output level equivalent to 2 credits rather than the targeted 1 credit.

After a detailed review, the syllabi were revised to return the effort levels to a 1 credit level. Subsequent reviewing of the courses in 2013 and 2014 confirm this has been a satisfactory adjustment.

A second major concern, a plea for help, came from the graduate students during the first semester (Fall 2011) They were concerned that their grading, emphasis of how to distribute grades, and overall outcomes was not uniform across all the sections.

The solution came from one of our graduate students, Jeff Hazboun, who showed and explained the rubric method he had used. The leadership team and graduate student teachers refined the rubric such that each teacher fully understands the concept and emphasis points used in the rubric. This has proven to be a very powerful normalizing tool between the teachers and a key learning point of how students can be evaluated even when their work is often quite qualitative.

Quantitative assessment of the program is most readily found in the student evaluation of each section. USU has adopted the IDEA system. Hence for each laboratory section there is an IDEA evaluation. [The obvious concerns here are that 1. Each class is less than 20, 2. Not all students submit an IDEA evaluation, and 3. The assessment presented below only considers the RAW SUMMARY EVALUATION.] Table 1 provides a 6 semester tabulation of these evaluations for each section of PHYS 2215. A small number of sections have the label UG attached to the evaluation.

These refer to a laboratory course taught by a senior undergraduate and will be discussed separately. The graduate student semester averages range from 3.39 to 3.7 on a scale of 0 to 5. A lowest graduate student value of 2.5 and maximum of 4.3 is found. Figure 1 graphically shows this information with semester average, semester lowest, and semester highest being shown.

2215	Fall 2011	Spr 2012	Fall 2012	Spr 2013	Fall 2013	Spr 2014
1	3.7	2.9	4.2	3.5	4.0	4.2 UG
2	3.8	3.3	4.0	3.5	4.3	4.3 UG
3	4.1	2.8	3.8	4.0	3.8 UG*	4.2 UG
4	3.8	3.2	3.3	3.7	3.4 UG	4.0 UG
5	3.9	4.0	2.9	3.1	3.7 UG	4.4 UG
6	3.6	4.3	3.9	2.9	3.6	3.2
7	3.7	3.4	3.8	4.0	3.3	4.1
8	3.4	2.9	3.3	3.8	3.3	3.3
9	2.5	3.2	3.5 UG	3.8	3.7	3.7
10		3.9		4.0		3.7

Figure 1

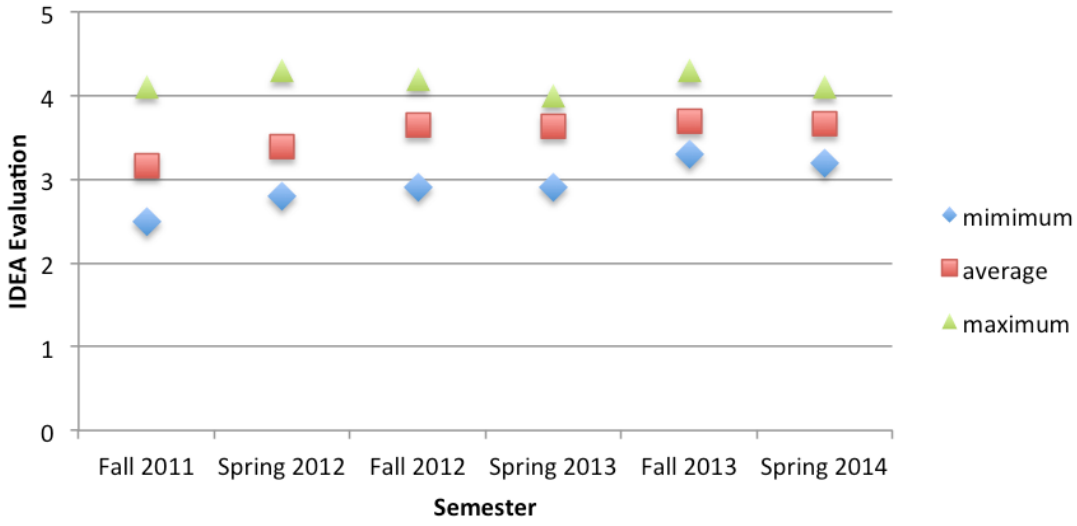


Table 1
PHYS 2215
Labs and Evaluations

Table 2 provides a 6 semester tabulation of these evaluations for each section of PHYS 2225. The graduate student semester averages range from 3.74 to 4.11. A lowest graduate student value of 2.5 and a highest of 4.7 in present. Figure 2 shows this data graphically with the semester's average, minimum, and maximum evaluations being shown for each semester.

2225	Fall 2011	Spr 2012	Fall 2012	Spr 2013	Fall 2013	Spr 2014
1	3.5	3.3	4.3	3.7	3.5	3.8
2	4.2 UG	3.3	4.0	3.9	3.5	3.7
3	3.7 UG	4.4	3.6	4.4	3.9	4.5
4	3.9	4.0	4.2	4.1	3.9	4.1
5	4.3	3.8	3.7	3.6	4.2 UG	4.1
6	4.1	4.3	2.6	3.0	3.4 UG	3.8
7	2.5	4.7	4.0	3.3	4.0 UG	4.2
8	4.4	3.9	4.3	3.3	3.8 UG	4.2
9		3.7	4.3	4.4	4.3 UG	4.4

Figure 2

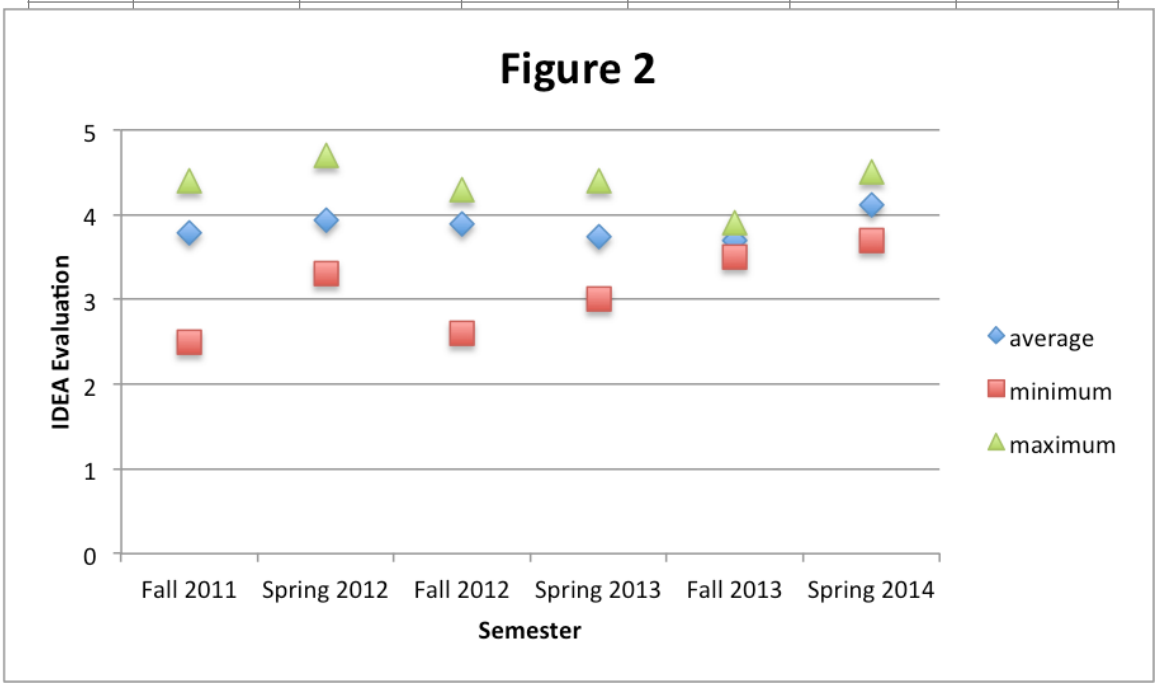


Table 2
PHYS 2225
Labs and Evaluations
Fall 2011–Fall 2014

For both classes the evaluations individually carry little statistical significance, but over the six semesters a relatively uniform evaluation is found. Perhaps the most significant finding is that the spread of evaluations for a given semester is somewhat less during the last three semesters than in the earlier semesters. Could this be attributed to providing the students a clear description of how they will be evaluated, i.e. use of a rubric? More importantly the range of values 3.5 to 4.5 is consistent with how the mentors are viewing the performance of the graduate teachers.

An independent, customer-based assessment has come from both the Electrical and Computer Engineering and Mechanical and Aerospace Engineering department heads, and their ABET review preparation faculty. They have reviewed the syllabi, and examples of student reports which include error analysis. They have been sufficiently impressed/satisfied that whereas currently many of their engineering majors need only take one of the two laboratories they are now requiring that students take both laboratories.

Great as this news is, it provides a new problem for Physics in how to staff these additional sections.

Issue 1.02

Problem/Issue How will the PHYS 2215 and PHYS 2225 laboratory sections be staffed once the finite supply of graduate student teachers is fully used?

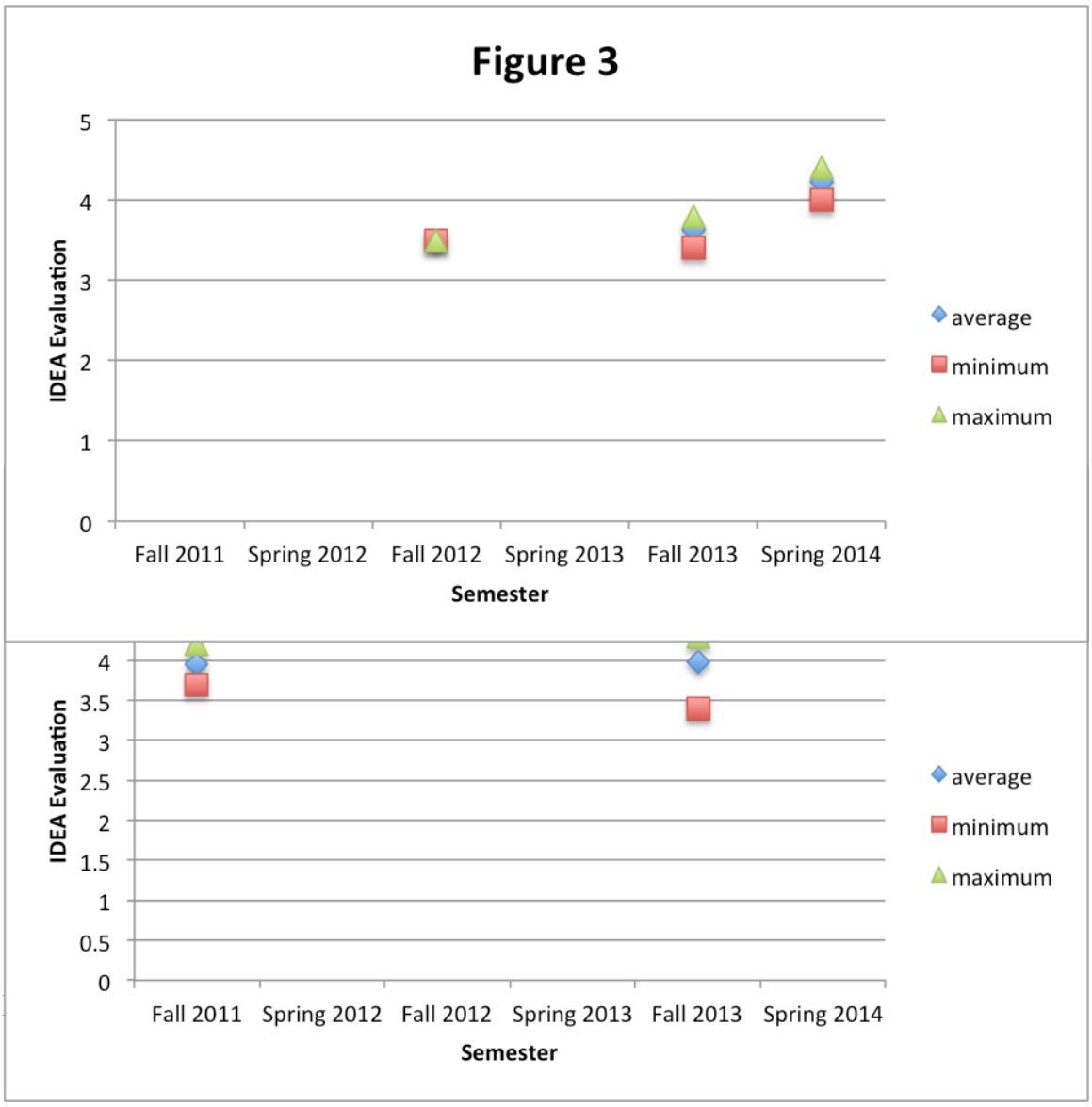
Solution: When these two laboratory courses were initiated as a consequence of removing the laboratories from the PHYS 2210 and PHYS 2220 calculus based introduction to physics, the impact on who would be required to take the additional 2 credits was unclear. Physics majors, yes, but they are a minority customer for this course. The engineers still had to evaluate how these additional courses would meet ABET requirements. In fact we developed the syllabi to include error analysis and report writing in response to engineer's inputs as we developed the syllabi.

The solution to the staffing problem has been to select the most suitable senior undergraduate physics majors and offer them the opportunity to teach a laboratory section.

Assessment

Tables 1 and 2 proved the IDEA evaluations for both the graduate and undergraduate teachers. The undergraduate evaluations are labeled UG. For 4 semesters of the 6 shown undergraduates were needed, and in the last two semesters a significant number were needed. In Fall 2013, 9 out of 19 sections were taught by undergraduates and in Spring 2014, 5 out of 21 were taught by undergraduates. Reviewing these undergraduate teacher

evaluations provides a very satisfactory outcome when their evaluation averages and extremes are compared with those of the graduate students. Figures 3 and 4 provide a graphic
summary of the average, minimum, and maximum evaluations for PHYS 2215 and PHYS 2225 respectively. Perhaps the most useful piece of information is that the lowest scores of the undergraduate teacher is significantly higher than those for the graduate student. This is explained by noting the undergraduate teachers are selected based on the Physics advisor's recommendation of the suitability or readiness of the student to teach. Whereas the whole graduate pool of TAs are used which has a broad teaching capability.



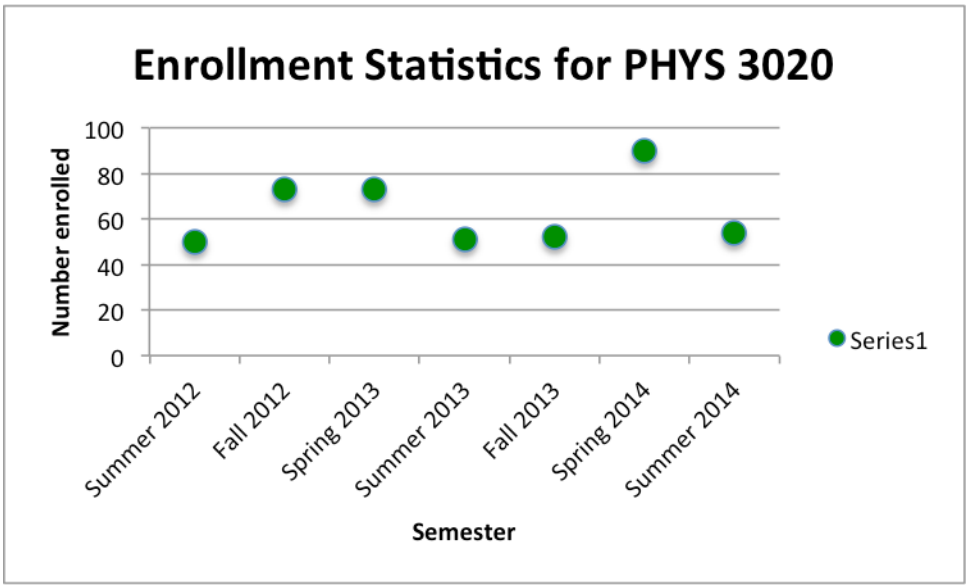
Development of the first USU Physics Department on-line course. In the spring of 2012 the department had seriously begun to think/debate about on-line offerings. The major rational is that USU is the lead university for Utah's regional higher educational system, and over the past 5 years its role in leading this effort, monitoring the academic offerings has increased. Hence courses which would have appeal or be of benefit to Utahn's unable to participate in a campus degree program were important. On-line offerings in particular are decreed important from this perspective.

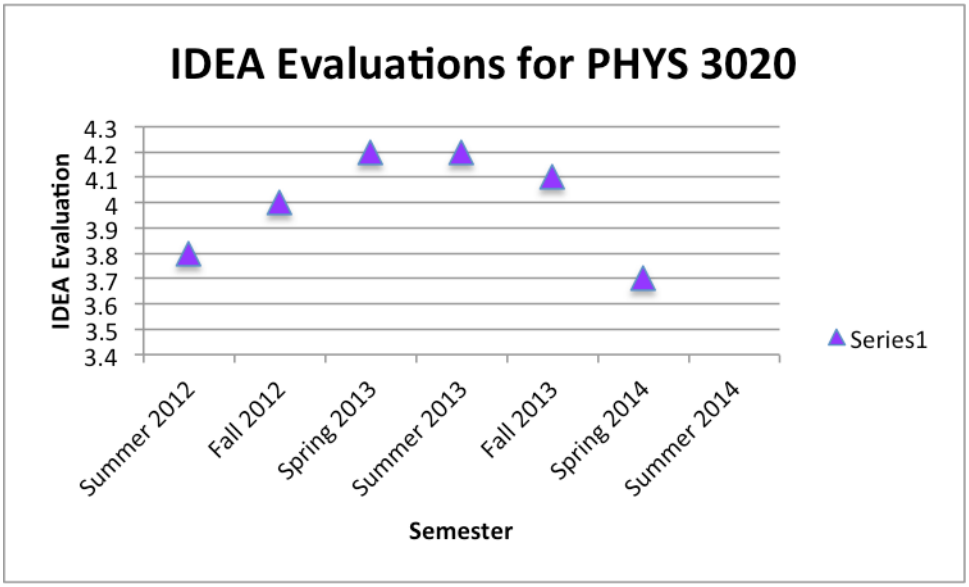
Solution: None of our faculty had familiarity with on-line course development or execution. But a graduate student, Jeff Hazboun, had completed his Physics MS degree in PER topic at the University of Oregon. He in fact offered to develop an on-line course on the topic of the Universe at the 3000 level (junior), but one with minimal math pre requisites to satisfy the needs of a broad population in need of a science class at this level In the spring of 2012 this development was approved and Jeff proceeded to develop the on-line course using the resources of the FACT center. Note, the relevance of this on campus support cannot be belittled. See below.

The course has now been offered every semester beginning summer 2012. Table 1 lists the enrollment figures for the 6 completed classes, along with the students evaluation. Currently a seventh class is being taught and its enrollment is also listed. The course is formally entitled PHYS 3020 The Universe. The developer, Jeff Hazboun, taught the course for the first 5 semesters, and now Jodie Gillispie is teaching it for the second time. Figures 1 and 2 graphically summarize the enrollment and IDEA evaluations.

Table 1: PHYS 3020 Statistics

Semester Taught	Number enrolled	IDEA Evaluation	Teacher
Summer 2012	50	3.8	Jeff Hazboun
Fall 2012	73	4.0	Jeff Hazboun
Spring 2013	73	4.2	Jeff Hazboun
Summer 2013	51	4.2	Jeff Hazboun
Fall 2013	52	4.1	Jeff Hazboun
Spring 2014	90	3.7	Jodie Gillispie
Summer 2014	54	____	Jodie Gillispie


Enrollment Statistics for PHYS 3020
Number enrolled
100
80
60
40
20
0
Summer 2012
Fall 2012
Spring 2013
Summer 2013
Fall 2013
Spring 2014
Summer 2014
Semester
Series1


IDEA Evaluations for PHYS 3020
IDEA Evaluation
4.3
4.2
4.1
4
3.9
3.8
3.7
3.6
3.5
3.4
Summer 2012
Fall 2012
Spring 2013
Summer 2013
Fall 2013
Spring 2014
Summer 2014
Semester
Series1

Assessment: Although none of the physics faculty participated in the development of the course the fact is that the PHYS 3020 has been a successful product based on consistency of enrollment and the IDEA student evaluations. In both Jeff's and Jodie's first semester of teaching the class the summary evaluation were 3.8 and 3.7. Neither of these are unexpected and Jeff's subsequent evaluations were 4 or above.

The tangible success measured is that each time the course enrollment exceeds that needed for the department to break even with the cost of a TA. This measure is crucial since on-line courses follow a prescribed fiscal return to the department based on course credits and enrollment.

The other measures are the specific student comments which again talk about the success in presenting the materials on-line. In this case the development of the course products, mini lectures, interaction boards, attention to electronic mail, are all complemented and seldom referred to negatively. This comes back to how the course was developed and more importantly having human resources (FACT Center) familiar with "lesson-learned" from prior on-line developments. Jeff Hazboun's knowledge and ability to work with the staff at the FACT center to generate a focused product has been successful. The mid-course corrections were negligible and the lesson to be learned is that resources are available and having an appreciation for on-line teaching and how it differs from formal face-to-face teaching is important.

Another important finding is that there is a significant population prepared to be educated at this 3000 level via on-line offerings. The enrollment has typically been an equal number of students from the main USU campus as from Utah regions with about 10% from outside of Utah.