Physics Department Academic Program Assessment Plan AY2025

Undergraduate (B.S. and B.A) Program Goals

Throughout our B.S. and B.A. curriculums, the main goal is to instill problem solving skills in our students. Physics as a profession is built on a foundation of basic physical principles and using those principles to address physical scenarios with the goal of understanding future behavior of the systems under study. Each course in our program requirements is meant to introduce these fundamental principles in a variety of subfields (e.g., mechanics, electromagnetism, quantum mechanics, thermodynamics) and present problems of increasing complexity, developing the students' problem-solving acuity as they progress through the program.

Student Learning Outcomes

Broadly, each of our core requirements and elective courses are designed to help students develop basic problem-solving skills, including

- Understanding of basic physical principles
- Application of principles to physical systems
- Analytical thinking and logical reasoning
- Mastery of computational skills required to analyze physical systems
- Analysis of results
- Presentation of results in both written and oral forms

Assessment of Student Learning

1. Direct Methods - Clear and compelling evidence of student learning
   A. Coursework
   B. Senior Writing Requirement
   C. ETS Major Field Test in Physics

A. Coursework

Physics majors must complete a carefully designed series of courses, both required and elective, which are taught by department faculty. It is the duty of the department's Undergraduate Affairs Committee (UGAC) to monitor these courses, making changes from time to time to improve student preparation and to respond to students' career goals. The chair and the vice-chair work with the UGAC closely in this aspect of their work, and take the lead, still coordinating with the committee, in monitoring the daily and weekly progress of classes.

B. Senior Writing Requirement

Each student is required to write a technical paper as part of the Senior Seminar class PHYS 49901, which is itself a requirement for all graduating seniors. The paper must contain at least one equation and one figure; the goal is to give students an idea of what writing a technical paper is like, and to give the department a sense of each student's development towards technical writing competence. Many physics majors, especially

those interested in further studies in graduate school, like to get research experience as undergrads. To reflect this, honors theses and senior theses may be presented to fulfil the senior writing requirement, especially because we certainly encourage and facilitate our students to gain this research experience.

C. ETS Major Field Test in Physics

Our major assessment tool for our undergraduate programs is our capstone course, PHYS 49901. This course now comprises our GELO 6.1 learning goals and includes a writing assignment in the form of an honors thesis or similar research paper, a presentation on this work, an exam covering our core curriculum, and a reflection essay. Up until 2017, we had been using the Physics GRE exam for this course but switched to the ETS Major Field Test (MFT) in Physics as we felt the questions were of a form more familiar to our undergraduate students. Over the 9 academic years from fall 2016 through spring 2025, we had 144 students take the MFT. This does not include students graduating in the spring of 2020 due to the shutdown of campus in March of that year due to Covid. Nor does it include the fall of 2022 where we simply neglected to administer the exam. Below are shown results from this exam over those years, both pre- and post-Covid, along with the national means from the exam. Our students had outcomes that compared well to the national sample pre-Covid and even had a higher than national mean score in 2019. Their performance did decrease slightly post-Covid, even compared to the national mean, but since AY2023 it appears to have recovered to pre-pandemic levels, only slightly below the national mean in the AY2025 data (see Table 1 and Figure 1).

Table 1: ETS Major Field Test Results (2017 – 2025)

# students	Average score	Mean score	Median score	Min score	Max score	Academic cohort	Spring year	National mean
24	148.5	147.7	149.5	120	172	2016–2017	2017	150.1
21	143.6	143.1	141	125	172	2017–2019	2018	149.9
22	151.2	150.7	151.5	128	172	2018–2019	2019	149.7
0	0	0	0	0	0	2019–2020	2020	149.7
22	140.8	140.47	139.5	123	161	2020–2021	2021	149.6
26	137.1	136.67	135.5	120	157	2021–2022	2022	149.3
10	147.1	146.37	148.5	125	167	sp 2023	2023	149.3
16	143.4	142.9	144	123	174	2023–2024	2024	149.3
23	145.8	145.1	141	123	177	2024–2025	2025	149.5

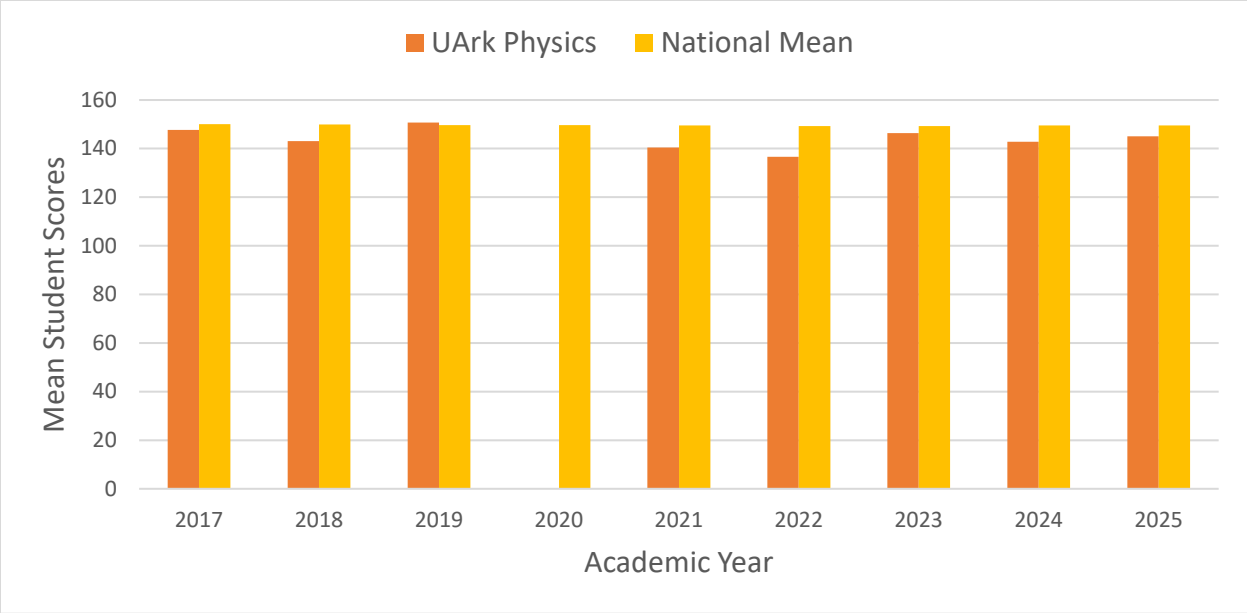

Figure 1: Results of the ETS Major Field Test in Physics from the years 2017 to 2025 for the UArk Physics Department as compared to a national sample. We were unable to administer the exam in spring 2020 due to the Covid pandemic. Student performance has held steady for AY2025.

2. Indirect Methods – Exit interview

In recent years the department chair has conducted exit interviews with most students, primarily with a view to learning about their placement after graduation. Since it is a non-trivial exercise to actually meet with each graduating student, the occasion for these interviews has often been facilitated by the senior students' participation in the senior seminar class (PHYS49901). We have worked during the past year to make this process more formal, by developing an exit interview form to include as an assignment in this class, with questions about placement and undergraduate experience and a space for student feedback on this time in the department. Also included is a space for notes from the chair or the instructor of PHYS49901 to record results from any available in-person exit interview.

B.S. vs. B.A. programs

The number of students enrolling in our B.A. program has dropped substantially from the mid-2000s to the present. However, we typically have a few pursuing a B.A. in Physics at any given time. While we routinely discuss eliminating this program, almost all of the students in the program plan to become physics teachers at the high school level. Given the need for qualified physics teachers, we are reluctant to eliminate this career path, choosing instead to tailor the program on an individual basis for these students.

The number of students in our B.S. program has remained steady over the last few years, with an average of 20 students joining the program as freshmen each year. While we do lose some of these students as they move through their undergraduate years, we also

add transfer students and double-majors (particularly from the MEEG program), graduating about 20 students per year with a B.S. in physics.

Timelines for Data Collection and Analysis

Data is collected as part of our PHYS 49910 Senior Seminar capstone course. The department Vice Chair is responsible for communicating the data collection methods to the course instructor each semester. Data will be kept in a central location available to the Chair, Vice Chair, and office staff for use in program reviews. The data will also be made available to our Undergraduate Affairs Committee as they evaluate our program for needed changes.

Use of Results

Our program remains strong and has shown improvement as we move away from the shutdown of campus in spring 2020. Fundamental physics does not change much over time. However, new discoveries are continuously being found, and our major challenge as we move forward is to keep our course offerings and material fresh and up to date. Luckily we have a relatively young (and young at heart) faculty who continue to develop elective courses designed to address advances in physics (e.g. biophysics, quantum computing, astrophysics, materials science) that will appeal to students and prepare them for careers in these areas or to continue in a graduate degree program.

The ETS MFT of physics covers a variety of subfields, and we will evaluate the performance of our students in these subfields with the goal of enhancing our curriculum in areas where our students are performing below national norms.