Assessment Cycle 2022-23 (Academic Programs)

Atmospheric Sciences BS

Mission

The mission of the Department of Atmospheric Science is to provide top quality undergraduate and graduate education and conduct significant research in the atmospheric sciences.

Academic Year 2022-23

Atmospheric Sciences BS Learning Outcomes

Outcome 1.1 Scientific Method MET

Graduates should be able to use the scientific method to guide their research.

MEASURES	RESULTS	ACTIONS
Proposal The proposal is a written report containing a background/introduction (which includes a statement of the problem and a literature review) and methodology for how the study will be conducted. The grading rubric contains an section titled 'Methodology' which assesses the student's ability to use the scientific method in guiding their research. Direct - Assignment *Senior Project I: ATSC 492* **Target** Cumulative student average score of 7.0 or better out of 10 on the rubric section 'Methodology'	MET **Analysis** Overall the students scored very well on the Methodology section of their proposal. The average score of the six students was 8.6 out of 10 which meets our threshold of 7.0 out of 10.	**Maintain Assessment Strategy** Our assessment strategy will remain the same for now. The ability to access data directly from the course in Blackboard may result a change in our assessment strategy or method in the future.
Interim Report The interim report is a written report that includes improvements/revisions to proposal as well as the new sections of data and preliminary analysis/results at a minimum. Additional sections of discussion and conclusions may be added if their research has progressed to that point. The grading rubric contains an section titled 'Methodology' which assesses the student's ability to use the scientific method in guiding their research. Direct - Assignment *Senior Project I: ATSC 492* **Target** Cumulative student average score of 7.0 or better out of 10 on the rubric section 'Methodology'	MET **Analysis** Overall the students scored very well on the Methodology section of their proposal. The average score of the six students was 8.5 out of 10 which meets our threshold of 7.0 out of 10.	**Maintain Assessment Strategy** Our assessment strategy will remain the same for now. The ability to access data directly from the course in Blackboard may result a change in our assessment strategy or method in the future.
Draft of Final Report The interim report is a written report that includes improvements/revisions to proposal as well as the new sections of data and preliminary	MET **Analysis**	**Maintain Assessment Strategy** Our assessment strategy will remain the same for now. The ability to access data directly from the course in Blackboard may result a change in our assessment strategy or method in the future.

analysis/results at a minimum. Additional sections of discussion and conclusions may be added if their research has progressed to that point. The grading rubric contains an section titled 'Methodology' which assesses the student's ability to use the scientific method in guiding their research. Direct - Assignment *Senior Project II: ATSC 493* **Target** Cumulative student average score of 7.0 or better out of 10 on the rubric section 'Methodology'	Overall the students scored very well on the Methodology section of their proposal. The average score of the six students was 8.3 out of 10 which meets our threshold of 7.0 out of 10.	
Final Report The interim report is a written report that includes improvements/revisions to proposal as well as the new sections of data and preliminary analysis/results at a minimum. Additional sections of discussion and conclusions may be added if their research has progressed to that point. The grading rubric contains an section titled 'Methodology' which assesses the student's ability to use the scientific method in guiding their research. Direct - Assignment *Senior Project II: ATSC 493* **Target** Cumulative student average score of 7.0 or better out of 10 on the rubric section 'Methodology'	MET **Analysis** Overall the students scored very well on the Methodology section of their proposal. The average score of the six students was 8.0 out of 10 which meets our threshold of 7.0 out of 10.	**Maintain Assessment Strategy** Our assessment strategy will remain the same for now. The ability to access data directly from the course in Blackboard may result a change in our assessment strategy or method in the future.

Conclusion

Our graduating students have met the learning objective to be able to use the scientific method to guide their research. The metrics that we have used measure this is the average of the student's score on the 'Methodology' section of their capstone research papers. The average score decreased from 8.6 out of 10 on their first paper (Proposal) to an average score of 8.0 out of 10 on their Final Report. Faculty tend to be more critical as the student's gain experience in scientific writing which may account for the decreased score.

Outcome 1.2 Analyze Data MET

Graduates should be able to demonstrate the ability to apply their knowledge of computer skills and programming to analyze data

MEASURES	RESULTS	ACTIONS
Final Project Students use shell scripts and Python programs to parse and/or convert data from binary. Students also using python or other software to plot data. This project demonstrates the student's ability to apply their knowledge of computer skills and programming to analyze data Direct - Project *Computer Concepts in Meteorology: ATSC 270* **Target** Cumulative student score of 70% or better	MET **Analysis** The 9-person class was split into three equal groups for the final project, and the grades for the final project for each group were: 100, 100, and 99. This indicates that the students have met this learning objective.	**Maintain Assessment Strategy** Our assessment strategy will remain the same for now. The ability to access data directly from the course in Blackboard may result a change in our assessment strategy or method in the future.

First Step: A Simple Diffusion Model Students learn the starting point into the blowing snow model with an exercise on using the diffusion equation (a PDE with a 2nd derivative) on a single column grid. We learn the concepts of initial and boundary conditions, begin to explore numerical stability, and use our first numerical scheme to solve a PDE. This assignment demonstrate the ability of students to apply their knowledge of computer skills and programming to analyze data at a high level. Direct - Assignment *Numerical Methods in Meteorology: ATSC 405* **Target** Cumulative student score of 70% or better	MET **Analysis** The average score of the class for this measure was 88.4% which exceeds our threshold for having met this learning outcome. Two students scored 100% while another two scored 70% indicating a wide range of abilities in their ability to analyze data using computer programming.	**Maintain Assessment Strategy** Our assessment strategy will remain the same for now. The ability to access data directly from the course in Blackboard may result a change in our assessment strategy or method in the future.

General Outcome Actions

ACTIONS
Maintain Assessment Strategy Our assessment strategy will remain the same for now. The ability to access data directly from the course in Blackboard may result a change in our assessment strategy or method in the future.

Conclusion

The data indicates that students in our program have the required skills to use computers to analyze data. There is a wide variability in those abilities but all students met the threshold.

Outcome 1.3 Mathematics Application in Research MET

Graduates should be able to apply their knowledge of mathematics and physical sciences in research.

MEASURES	RESULTS	ACTIONS
Assignment Average The course make use of assignments to assess the students ability to use math and science skills to solve problems. There were twenty-one assignments thoughout the semester. *Atmospheric Thermodynamics: ATSC 350* **Target** An average class score of 70% or greater.	MET **Analysis** The average class score was 82.4% which exceeded our threshold of 70%. This indicates that our students have met the learn outcome of using math and physical science skills. Only two of the sixteen students in the class failed to meet this goal.	**Maintain Assessment Strategy** Our assessment strategy will remain the same for now. The ability to access data directly from the course in Blackboard may result a change in our assessment strategy or method in the future.

General Outcome Actions

ACTIONS
Revise Measurement / Assessment **Not Started** Our program only assesses the student's ability to use math and physical science skills at the junior level. We ask our students to use those skills in research during their capstone experiences. We need to add an assessment of these skills during their senior year. This will required a modification to the rubrics used in ATSC 493 Senior Project II. Recommended Due Date: 08/15/2024

Conclusion

The assessment indicates that an overwhelming majority of our students are able to use their math and physical science skills to solve problems.

Outcome 1.4 Atmospheric Sciences Application in Research MET

Graduates should be able to apply their knowledge of atmospheric sciences in research.

MEASURES	RESULTS	ACTIONS
Interim Report The interim report is a written report that includes improvements/revisions to proposal as well as the new sections of data and preliminary analysis/results at a minimum. Additional sections of discussion and conclusions may be added if their research has progressed to that point. The grading rubric contains an section titled 'Results' which assesses the student's ability to apply their knowledge of atmospheric sciences in research. Direct - Assignment *Senior Project I: ATSC 492* **Target** Cumulative student average score of 7.0 or better out of 10 on the rubric section 'Results'	MET **Analysis** Overall the students scored very well on the Results section of their Interim Report. The average score of the six students was 9.4 out of 10 for the item "Figures/tables show relevant variable relatioinships" and 9.3 out of 10 for the item "Data analysis and synthesis". Both of these greatly exceed our threshold of 7.0 out of 10. This metric assesses the very preliminary result from the student's research.	**Maintain Assessment Strategy** Our assessment strategy will remain the same for now. The ability to access data directly from the course in Blackboard may result a change in our assessment strategy or method in the future.
Draft of the Final Report The interim report is a written report that includes improvements/revisions to proposal as well as the new sections of data and preliminary analysis/results at a minimum. Additional sections of discussion and conclusions may be added if their research has progressed to that point. The grading rubric contains an section titled 'Results' which assesses the student's ability to apply their knowledge of atmospheric sciences in research. Direct - Assignment *Senior Project II: ATSC 493* **Target** Cumulative student average score of 7.0 or better out of 10 on the rubric section 'Results'	NOT MET **Analysis** The rubrics show mixed results on the Draft of the Final Report for this learning objective . The average score of the six students was 6.8 out of 10 for the item "Figures/tables show relevant variable relatioinships" and 6.8 out of 10 for the item "Data analysis and synthesis". This did not meet our threshold of 7.0 out of 10. The reason that the score did not meet the threshold is that two of the six students either showed no or minimal results of their research.	**Revise Curriculum** IN PROGRESS Students felt that they did not have time to achieve meaningful results when the Draft of the Final Repoprt was due. The department's Undergraduate Program Committee suggested that a new course be offered during the spring semester of their junior year to introduce the students to research methods. We hope to have the course in place by the fall 2024 semester. Recommended Due Date: 08/15/2024

Final Report The interim report is a written report that includes improvements/revisions to proposal as well as the new sections of data and preliminary analysis/results at a minimum. Additional sections of discussion and conclusions may be added if their research has progressed to that point. The grading rubric contains an section titled 'Results' which assesses the student's ability to apply their knowledge of atmospheric sciences in research. Direct - Assignment *Senior Project II: ATSC 493* **Target** Cumulative student average score of 7.0 or better out of 10 on the rubric section 'Results'	MET **Analysis** Overall the students scored very well on the Results section of their Interim Report. The average score of the six students was 9.1 out of 10 for the item "Figures/tables show relevant variable relatioinships" and 8.8 out of 10 for the item "Data analysis and synthesis". Both of these exceed our threshold of 7.0 out of 10. This metric assesses final results from the sudent's research. It indicates that students have mastered the learning objective.	**Maintain Assessment Strategy** Our assessment strategy will remain the same for now. The ability to access data directly from the course in Blackboard may result a change in our assessment strategy or method in the future.

General Outcome Actions

ACTIONS
Revise Curriculum IN PROGRESS The department's Undergraduate Program Committee suggested that a new course be offered during the spring semester of the junior year to introduce the students to research methods. Topics that are offered in ATSC 492 Senior Project will be moved to the new course. This will allow students to start their reseach projects earlier. We hope to have the course in place by the fall 2024 semester. Recommended Due Date: 08/15/2024

Conclusion

The assessment indicates that overall students are meeting this learning objective. There seems to be a problem with students not meeting this objective in the Draft of the Final Report. This report is due during the middle of the final semester (spring semester of the senior year). Students have expressed concern with the ability to meet the deadline of this report. They feel that they have not had enough time to perform their research and analysis to have meaningful results when the report is due. We plan to revise the curriculum with the addition of a research methods class during the spring of their junior year. This will give the students another semester to start and conduct their research.

Outcome 1.5 Ethical Assessment MET

Graduates should demonstrate their ability to ethically access information, evaluate the credibility of the source, and use the information.

MEASURES	RESULTS	ACTIONS
Annotated Bibliography Students create a written annotated bibliography which contains a summary and evaluation of their reference sources. Students should obtain, paraphrase, and evaluate at least six references. The annotated bibliography demonstrates the students ability to ethically access information, evaluate the credibility of the source, and use the information. Direct - Assignment	MET **Analysis** The class average of the annotated bibliography assignment was 97%. The exceeds our threshold of 70% to meet this learning objective. Graduating senior in our program have demonstrated that they can ethically access information, evaluate the credibility of the source and use the information.	**Maintain Assessment Strategy** Our assessment strategy will remain the same for now. The ability to access data directly from the course in Blackboard may result a change in our assessment strategy or method in the future.

Senior Project I: ATSC 492 **Target** Student cumulative score of 70% or better		

General Outcome Actions

ACTIONS
Maintain Assessment Strategy Our assessment strategy will remain the same for now. The ability to access data directly from the course in Blackboard may result a change in our assessment strategy or method in the future.

Conclusion

The data indicates that graduating senior in our program can ethically access information, evaluate the credibility of the source and use the information.

Outcome 1.6 Measurement MET

Graduates should be able to accurately measure atmospheric properties.

MEASURES	RESULTS	ACTIONS
Upper Air Measurement Lab Students will launch a radiosonde and record the data as it measures the upper atmosphere Direct - Assignment *Meteorological Instrumentation: ATSC 240* **Target** Average score of 70% or better for class	MET **Analysis** The average score of the class for the upper air measurement lab was 100% This exceeds our target threshold. All students were able to record upper air data from the radiosonde ascent.	**Maintain Assessment Strategy** Our assessment strategy will remain the same for now. The ability to access data directly from the course in Blackboard may result a change in our assessment strategy or method in the future.
Pressure Measurement Lab Students calibrate pressure transducers and perform calculations based on their measurement of atmospheric pressure. Direct - Assignment *Meteorological Instrumentation: ATSC 240* **Target** Average score of 70% or better for class	MET **Analysis** The average score of the class for the pressure measurement lab was 97% This exceeds our target threshold. All but one student met this requirement. This indicates that students can calibrate pressure sensors and measure atmospheric pressure.	**Maintain Assessment Strategy** Our assessment strategy will remain the same for now. The ability to access data directly from the course in Blackboard may result a change in our assessment strategy or method in the future.

Temperature Measurement Lab Students construct and calibrate liquid-in-glass thermometers. Direct - Assignment *Meteorological Instrumentation: ATSC 240* **Target** Average score of 70% or better for class	MET **Analysis** The average score of the class for the pressure measurement lab was 98% This exceeds our target threshold. All students were able to construct and calibrate a thermometer as well as make measurements and estimate the uncertainty in those measurements.	**Maintain Assessment Strategy** Our assessment strategy will remain the same for now. The ability to access data directly from the course in Blackboard may result a change in our assessment strategy or method in the future.
Humidity Measurement Lab Students perform measurements with a sling psychrometer, an Assman psychrometer and an electric hygrometer. Direct - Assignment *Meteorological Instrumentation: ATSC 240* **Target** Average score of 70% or better for class	MET **Analysis** The average score of the class for the humidity measurement lab was 94% This exceeds our target threshold. All students met this requirement. This indicates that students can measure atmospheric humidity using psychometers and hygrometers. They can also use these measurements in calculations as estimate the error in their measurements.	**Maintain Assessment Strategy** Our assessment strategy will remain the same for now. The ability to access data directly from the course in Blackboard may result a change in our assessment strategy or method in the future.
Snow Measurement Lab Students will measure snowfall, snow depth and snow water equivalent. Direct - Assignment *Meteorological Instrumentation: ATSC 240* **Target** Average score of 70% or better for class	MET **Analysis** The average score of the class for the pressure measurement lab was 94% This exceeds our target threshold. All but one student met this requirement. This indicates that students can measure snowfall, snow depth, snow water equivalent and can estimate the errors associated with those measurements.	**Maintain Assessment Strategy** Our assessment strategy will remain the same for now. The ability to access data directly from the course in Blackboard may result a change in our assessment strategy or method in the future.
Error Analysis Lab Students will estimate the uncertainty in their measurements and calculate the propagation of those errors in calculations. Direct - Assignment *Meteorological Instrumentation: ATSC 240* **Target** Average score of 70% or better for class	MET **Analysis** The average score of the class for the error analysis lab was 91% This exceeds our target threshold. All but one student met this requirement. This indicates that students can make measurements and estimate the uncertainty in their measurements.	**Maintain Assessment Strategy** Our assessment strategy will remain the same for now. The ability to access data directly from the course in Blackboard may result a change in our assessment strategy or method in the future.
Wind Measurement Lab Students will calibrate pitot (pressure) tubes and propvane anemometers and record measurements. Direct - Assignment *Meteorological Instrumentation: ATSC 240*	MET **Analysis** The average score of the class for the wind measurement lab was 97% This exceeds our target threshold. All students met this	**Maintain Assessment Strategy** Our assessment strategy will remain the same for now. The ability to access data directly from the course in Blackboard may result a change in our assessment strategy or method in the future.

Target Average score of 70% or better for class	requirement. This indicates that students can calibrate wind sensors and measure wind speed and direction.	

General Outcome Actions

ACTIONS
Maintain Assessment Strategy Our assessment strategy will remain the same for now. The ability to access data directly from the course in Blackboard may result a change in our assessment strategy or method in the future

Conclusion

All metrics incdicate that this learning outcome has been met.