

This is the program assessment of data collected during 2023-2024 academic year for the B.S. in Data Science offered through the department of Applied Mathematics at Oregon Institute of Technology.

What you Did – The Plan

Section 1 – Program Mission

NWCCU's standards for accreditation require that institutions offer "programs with appropriate content and rigor that are consistent with its mission" (1.C.1.)

In this section, list the following:

- **Program Mission:**

The mission of the Bachelor of Science in Data Science program at the Oregon Institute of Technology is to prepare students for professional practice or graduate school. A graduate will be prepared with the technical skills necessary to gain actionable insights from data, the ability to effectively communicate these insights as a member of an interdisciplinary team, and the necessary foundation in ethics, mathematics, and computer science to thrive in the evolving field of data science.

Graduates are expected to be able to function as an independent data scientist at moderate sized companies or as a member of an analytics team at larger corporations. Professionally, this program will set graduates up to be life-long learners within the field of data science and data supported decision making which will allow them to gradually branch into management positions or graduate school as their career progresses. At five to ten years, graduates are expected to be able to function as project leads for data analytics, data science, or machine learning teams or to actively contribute to teams in artificial intelligence project teams.

- **Mission Alignment:**

Data science is a new and fast-growing field with roots in computer science, mathematics, statistics, geomatics and management: its applications span many other fields, including engineering, healthcare, business and various technologies. Thus a data science program aligns well with Oregon Tech's mission of providing "statewide educational opportunities for the emerging needs of Oregonians" with "innovative and rigorous applied degree programs in the areas of engineering, engineering technologies, health technologies, management, and the arts and sciences". The primary goal of a data science program should be to produce graduates who are cross trained in the foundational disciplines and who can apply these techniques to any of the fields mentioned above. This cross training spans the disciplines of management, mathematics, and engineering and will support data-driven decision making and, perhaps more importantly, to be able to design specialized solutions to data problems spanning many fields of study.

A data science program builds on Oregon Tech's signature areas of focus, including geographic information systems, computer science, healthcare and management. The mathematics department has a strong faculty of applied mathematicians and statisticians. Students enrolled in Oregon Tech's data science program will have the benefit of small student to faculty ratios and will be given many opportunities to learn by doing through junior and senior year courses focused in various applications

of data science to real world data, adding to Oregon Tech's "intimate, hands-on learning environment, focusing on application of theory to practice".

Oregon Tech's priority is to meet industry's need for skilled workers. Data science is a blossoming field with a combination of job titles and positions that these graduates could fill. Jobs range from research in science and medicine to technology jobs within companies in marketing and targeted advertising. Other jobs include self-automated learning systems (cars that drive themselves for example), governmental positions in data management and reporting. With an advanced degree, someone trained in data science could do research in a variety of fields including statistics, business/management, survey sampling, bioinformatics, and many others.

- **Changes to the Mission:** At present, there are no changes to the mission associated with the data science program; however, significant changes are being submitted to the curriculum in order to match feedback from industrial advisors and to meet the ever changing needs within data science, machine learning, and artificial intelligence.

Section 2 – Program Student Learning Outcomes

NWCCU's standards for accreditation require that programs must "culminate in achievement of clearly identified student learning outcomes." (1.C.1.)

A.) Educational Objectives

The following educational objectives are what faculty expects graduates to be able to accomplish a few years after the commencement of their careers and stem directly from the program mission. The alumni from the program should be:

- 1) prepared for the professional practice of data science or acceptance into a graduate program,
- 2) prepared with the necessary foundation in mathematics, statistics, and computer science in order to thrive in an evolving field,
- 3) able to identify and incorporate ethical considerations in their work,
- 4) able to identify, collect and analyze data necessary for actionable insights, and
- 5) able to effectively communicate findings.

The design of our current PSLO's came from a web scrape of hundreds of industry jobs of data science. These job postings were analyzed to see what skills and talents employers find necessary for their new employees. Furthermore, the National Academy of Sciences Report "Data Science for Undergraduate: Opportunities and Options" was reviewed and employed in order to identify these core skills. During this period of review, several methods have been employed to vet and confirm the educational objectives. First, a faculty member took a leave of absence to work at an industry leading company to understand real-world practice and needs for data science graduates. Secondly, a number of industry experts were consulted about the demands of recent graduates from a data science program. Finally, a review of current needs, trends, and practices was assessed from a webscrape associated with jobs within the fields of data analytics, data science, machine learning engineering, and artificial intelligence engineering. All of these methods confirmed that the expected eleven outcomes are critical to our program; however, given institutional outcomes in communication and teamwork, we have removed the programmatic student learning outcomes on these topics in order to more closely align with institutional practice. Similarly, our previous outcome number 8 was recognized to be a component of another outcome and was removed.

B.) PSLOs: Graduates of the program will be able to:

- 1) translate a real world question into mathematical language.

The ability to transform a real world problem into a strategy and metric for comparison and improvement is a critical tool for any data scientist. Direct measures of this may include the identification of a loss function which is dependent of the structure of the response variable and methodology of estimation or classification. Indirect measures will include client feedback and successful job placement as this is a standard question in all interviews for this field.

- 2) design an efficient and cost-effective data collection strategy.

Big data storage and retrieval is costly in terms of both storage and processing time for both upload/download and structure processing. An efficient management of data “collection” (both from a storage and retrieval) prospective is a requirement for any data science project. Direct measures of this include assessment of database design and algorithm efficiency as assessed by projects within the coursework. Indirect measures may be obtained by considering client opinions on projects and similar input.

- 3) apply ethical standards necessary in data collection, analysis, and storage.

Ethics of practice are considered in all stages of the data science workflow from data collection and storage to presentation. Direct measures of ethical standards will include specific scenario based questions and student responses to exam and assignment questions. Employer specific questionnaires and client feedback would be necessary in order to assess ethical practice.

- 4) construct a reproducible workflow with project documentation.

Reproducible workflow and documentation allows for others to read a data scientists work and verify assumptions and methodology. It is part of ethics and professionalism. Direct assessment of this can be observed through project documentation.

- 5) design, create, and manage data storage framework.

Database and flat file storage of data keeps a workflow consistent, cost effective and reproducible. Measurement of a student’s understanding and ability can be directly measured from student project and course grades.

- 6) clean, impute, analyze, and structure features for modeling data.

Direct measures of a student’s ability to clean, impute, and structure data can be taken from class assignments and

- 7) produce sophisticated visualizations and quantitative summaries of data.

Data representation for business intelligence and data based decision making is a crucial skill for data scientists. In addition, the choice of proper features, determination of appropriate

tuning and other parts of the training process require innovative graphics and quantitative summaries. Direct assessment may include the creation of graphics and quantitative summaries on various data sets.

8) optimize and validate predictive analytics.

This is another objective that needs to be simplified and combined with others about creating and implementing an effective analysis plan.

Section 3 – Curriculum Map

NWCCU's standards for accreditation requires that programs must demonstrate "an appropriate breadth, depth, sequencing, and synthesis of learning" of student learning outcomes. (1.C.2)

As we progress with this program, significant updates are being recommended to the curriculum map for the Data Science program. Firstly, the over-abundance of junior and senior project classes was not supported by industry advisory recommendations. They strongly recommended that all core data science course have a project component and that breadth is more important than depth. Correspondingly, it is critical for a student transcript to demonstrate the exact skills that students have achieved by name. As such, the "project" courses will be replaced with sequences of courses that align with the major topics (network analysis, data visualization, modern methods, time series analysis, supervised statistical machine learning, unsupervised statistical machine learning, deep learning, and reinforcement learning.) More topics are available to explore as elective courses as our enrollment grows.

		PSLO								ISLO					
Semester	Course	1	2	3	4	5	6	7	8	Com	Team	Ethics	IA	QL	DivP
Freshmen	Social Science Elective														F
Fall	STAT 201			F	F	F	F			F					
	WRI 121									F					
	Humanities Elective														F
Freshmen	Social Science Elective														
Winter	CST 116														
	GIS 134							F							
	WRI 122									F					

	Humanities Elective															F
Freshmen	MATH 251	F														
Spring	Social Science Elective															
	CST 126															
	SPE 111									F						
Sophomore	MATH 252	F														
Fall	Lab Science Elective													F		
	CST 136															
	WRI 227									P						
Sophomore	MATH 254															
Winter	MATH 361	F	F	F				F					F		F	
	Lab Science Elective													F		
	MIS 275			F		F										
Sophomore	STAT 211	P	P	F	F		F	F		P			F			
Spring	Social Science Elective															
	SPE 221											F				
	CST 211				F	F										
Junior	STAT 395		P		P			P		P	P					
Fall	MATH 465	P														

	MATH 362	P						P	F					P	
	MATH 341														
Junior	MATH 451														
Winter	STAT 396	P	P		P					P	P				
	GIS 316														
	STAT 441	P			P		P	P	F				P		
Junior	MATH 342														
Spring	STAT 412	P						P						P	
	STAT 442	P			P		P		P						
	STAT 397	P			P	P	P	P		P	P		P		P
	MIS 311			P		P									
Senior	MIS 312					P									
Fall	CST 324					P									
	STAT 495	C			C		C	C	P	C				C	
	GIS 306														
Senior	MATH 327														
Winter	GIS 332														
	STAT 496	C			C		C	C	C	C				C	
	PHIL 331			P								P			
	or														
	PHIL 342											P			
	MIS 334					P									
Senior	STAT 405	C	C		C		C		C	C			C		

Spring	STAT 497	C	C	C	C	C	C	C	C	C	C	C	C	C	C	
	STAT 467	C				C		C	C					C		C
	WRI 350				C					C						
	or															
	WRI 345				C					C						
	or															
	WRI 327				C					C						
	CST 475		C	C		C										

Section 4 – Assessment Cycle

Data Science B.S. Cycle for PSLOs and ISLO's			
Outcome	2023/2024	2024/2025	2025/2026
PSLO 1	Act	Plan	Stat 211
PSLO 2	Act	Plan	Stat 211
PSLO 3	Act	Plan	Stat 201
PSLO 4	STAT 405	Act	Plan
PSLO 5	STAT 405	Act	Plan
PSLO 6	STAT 211	Act	Plan
PSLO 7	Plan	STAT 407	Act
PSLO 8	Plan	STAT 441/442	Act
ISLO: Communication	Plan	Stat 405	Act
ISLO: Teamwork	Plan	Stat 405	Act
ISLO: Ethical Reasoning	Act	Plan	STAT 201
ISLO: Inquiry & Analysis	STAT 405	Act	Plan
ISLO: Quantitative Lit	STAT 405	Act	Plan
ISLO: Diverse Perspectives	Act	Plan	Stat 211

Section 5 – Assessment Data Collection Processes

NWCCU's standards for accreditation require that institutions engage in "an effective system of assessment to evaluate the quality of learning in its programs" that "recognizes the central role of faculty in establishing quality, assessing student learning, and improving instructional programs." (1.C.5.)

In this section, explain the rules for the sample collection process for student work that is to be evaluated this academic year. Include the following information:

- **Performance Target:** 75% of students scoring 3 or higher with at least 25% of students scoring 4 or higher on a scale of 1 to 5 associated with the outcomes.
- **Activity:**
 - **STAT 407** – Outcome 7: Project on unsupervised learning for classification. Data exploration and visualization will be assessed.
 - **STAT 441/442** – Outcome 8: Project requires predictive machine learning algorithm to be developed and implemented (Shallow learning for 441 and deep learning for 442). Project will be assessed on the overall analysis plan, implementation, and validation methods.
 - **STAT 405** – Communications: Team project final report and presentation was assessed during spring of 2024 (This course is designed to assess this PLSO and is offered on an every-other-year schedule.)
 - **STAT 405** – Teamwork: Team project final report and presentation was assessed during spring of 2024 (This course is designed to assess this PLSO and is offered on an every-other-year schedule.)
- **Sample:** List the number of student artifacts (number or percentage of class) were assessed in each activity.
 - **STAT 407:** Expect 4 students to be assessed (full class)
 - **STAT 441/442:** Expect 4 students to be assessed (about 44% of the course is composed of data science majors)
 - **STAT 405:** 5 students assessed (100% of the class)
 - **STAT 405:** 5 students assessed (100% of the class)
- **Accountability:** The primary course instructor is responsible for grading all coursework projects that are to be assessed for this. There is no secondary source of reliable grading at present. A rubric will be employed for consistency of grading across the projects.
- **Representation:** There is only one instructor and one course that can be assessed for each of these classes (as this is the only instructor who currently teaches these courses.) The course is offered on the Klamath Falls campus, though daily Zoom lectures are offered in order to provide access to students in Wilsonville.
- **Rubric:** Rubrics have yet to be developed for course activities at this time.

What you Found – The data collected

Section 6 – Assessment Data and Interpretations

1.C.6 Consistent with its mission, the institution establishes and assesses, across all associate and bachelor level programs or within a General Education curriculum, institutional learning outcomes and/or core competencies. Examples of such learning outcomes and competencies include, but are not limited to, effective communication skills, global awareness, cultural sensitivity, scientific and quantitative reasoning, critical analysis and logical thinking, problem solving, and/or information literacy.

1.D.2 Consistent with its mission and in the context of and in comparison with regional and national peer institutions, the institution establishes and shares widely a set of indicators for student achievement including, but not limited to, persistence, completion, retention, and postgraduation success. Such indicators of student achievement should be

disaggregated by race, ethnicity, age, gender, socioeconomic status, first generation college student, and any other institutionally meaningful categories that may help promote student achievement and close barriers to academic excellence and success (equity gaps).

1.C.1 The institution offers programs with appropriate content and rigor that are consistent with its mission, culminate in achievement of clearly identified student learning outcomes that lead to collegiate-level degrees, certificates, or credentials and include designators consistent with program content in recognized fields of study.

1.C.9 The institution's graduate programs are consistent with its mission, are in keeping with the expectations of its respective disciplines and professions and are described through nomenclature that is appropriate to the levels of graduate and professional degrees offered. The graduate programs differ from undergraduate programs by requiring, among other things, greater: depth of study; demands on student intellectual or creative capacities; knowledge of the literature of the field; and ongoing student engagement in research, scholarship, creative expression, and/or relevant professional practice.

In this section, present the data for **2023-2024** academic year specific to the program.

Performance Criteria	Assessment Methods	Performance Target	Results	Interpretation	Equity Gap?
PSLO4-	Direct: Assignments in Classes assessed	75% of students scoring 3 or higher with 25% scoring 4 or higher	80% > 3 80% > 4	Yes Yes (And also funny because they learned a very important lesson on data validation)	Yes. Cannot report due to small sample size.
PSLO5	Direct: Assignments in Classes assessed	75% of students scoring 3 or higher with 25% scoring 4 or higher	80% > 3 60% > 4	Yes Yes	Yes.
PSLO 6	Was not assessed due to having no students in the class.				
ISLO - Inquiry and Analysis	Direct: Assignments in Classes assessed	75% of students scoring 3 or higher with 25% scoring 4 or higher	80% > 3 40% > 4	Yes Yes	Yes.
ISLO – Quantitative Literacy	Direct: Assignments in Classes assessed	75% of students scoring 3 or higher with 25% scoring 4 or higher	80% > 3 80% > 4	Yes Yes	Yes.
Graduation Rate	University Dashboard	6-year rate >50%			
Retention	University Dashboard	1-year rate >75%	80%	Yes	One student of 5 graduated and 1 left the institution
Post Graduation	Employment	6 months post-	100%	Yes	No

Success	survey	graduation employment >75%			
DFWI	Average Oregon College Rating for Math Departments	All program <12%	20%	No	Of 5 students, one stopped attending classes.

- Of the five students in the program this last year, one persisted to graduation, two juniors progressed to their senior year, and one sophomore moved to their junior year. Of these, all are above a 3.0 grade point average. Given the numbers at the moment, we are pleased with student performance in the program overall. There has been a real struggle with keeping faculty in the program and keeping students (due to faculty leaving). In spite of the turmoil, students have performed very well on significant projects including student competitions, student research, and meeting the objectives of the program. Students self reflections in class demonstrate awareness of weaknesses, an understanding of where to look for resources, and a continued interest in learning outside of the classroom. While the demonstrated rates of retention and DFWI are below the goals, we are confident that this will improve with the improvement in stability in the program and increased sample size as our enrollment has grown substantially this year.
- In terms of workforce, our graduate of the program has successfully transitioned into full employment within the field and is highly valued within their workplace. They have recently requested to be added to the industry advisory board.

Evidence of Improvement in Student Learning

The evidence of improvement in Student Learning can be presented either in narrative or tabular format. It should include the following items:

We have little to no history to build off of for the evaluation of any assessment results as of yet. Due to turmoil in the department staffing, most of the faculty in the program who taught the primary classes left the institution and no one was qualified to teach the upper division courses. Our main focus has been training and obtaining faculty who are capable to teaching the coursework and rebuilding the program into a sustainable model. We have achieved this at this time and are now able to support the growth and continued delivery of this program.

Performance Criteria	Previous Action Plan	Previous Data	Current Data	Interpretation
PSLO4	N/A			
PSLO5	N/A			
PSLO 6	N/A			
ISLO IA	No Action Needed	100%	80%	
ISLO QL	No Action Needed	100%	80%	
Graduation Rate	N/A	N/A	?	
Retention	Build and Maintain Faculty	100%	80%	
Post-Graduation Success	Graduate a student	0%	100%	YAY!
DFWI	Build and Maintain Faculty			

How are you using the data? – Our program is very young and has just graduated its first student. We will track trends into the future, but for now there is insufficient history to be able to build trends for most

Section 7 – Data-driven Action Plans:

NWCCU’s standards for accreditation require that institutions “uses the results of its assessment efforts to inform academic and learning support planning and practices.”(1.C.7.)

Action Driver	Action Taken /# students impacted	Accountable Person	Resources Needed	Outcome Measure
Retention Focus	Complete overhaul of program and training of faculty. Intrusive advising practices and interventions for attendance	Instructor of STAT 201 and 211	Student computer lab with appropriate software installs Advising office Peer tutoring in CSET department	Retention rate reported in fall 2025
Advisory Board Feedback + Change in faculty expertise	Complete overhaul of program	Program Director	Time to fill out and submit a mountain of documents	Change in 2025 catalogue

Section 8 – Closing the Loop: Reflection on previous work

NWCCU’s standards for accreditation require that institutions provide evidence of “continuous improvement of student learning.” (1.C.7.)

As the only

- **Discuss last year’s Action Plans:** as the only faculty member in the department who was active in delivering this program was on a leave of absence to gain industry experience and insights during fall term, no-one in the department stepped in to cover the assessment for the last year. Hence, there were no official action plans. Unofficially, a significant amount of work was being taken to redevelop the curriculum into a sustainable model for the school.
- **Discuss programmatic Improvements**

Due to the fact that we have no faculty that were qualified to offer some of the courses that were built into the program, a significant overhaul of the program is under development. One faculty member is pursuing a Doctoral degree and has reached the candidacy stage (and is therefore able to teach all of the newly identified coursework in the program). Other faculty are pursuing further education through online courses in order to provide further support for the program. The curriculum changes reflect industrial experience, discussions with advisory board members, and a new delivery schedule that will relieve the pressures of under enrolled classes. We have further fixed communication issues for potential students (the recruiting materials had contact information for faculty who haven’t worked here in years) and performed significant

recruiting over the past year. Given this, there has been a significant return with a high student enrollment for this fall and general departmental support and positivity surrounding the program. We are ready to grow again.

- **Improvements in Assessment Process:** At this point, no changes will be made to the assessment process. We need to build a history before investigation of any changes can take place..
- **Faculty Discussion:** Faculty are very positive about changes to the program and are taking active roles in supporting the program now.

Section 9 – Executive Summary

Answer the following questions regarding activities in your program this past academic year:

1. What are the top 3 continuous improvements your program has made in the last year, and what evidence/data did you use to make those changes? (For example: hired faculty, purchased more equipment, curriculum changes, etc.)
 - a. Program Changes -> industry experience + advisory board
 - b. Faculty development -> Faculty paid out of pocket to get retrained through graduate coursework. (Dean support was provided for one faculty to take a certificate class but not for the faculty member who enrolled in a doctoral program)
 - c. Faculty involvement – An active departmental committee has finally been formed and a program director has been nominated
2. Provide 3 examples of student achievement in your program over the last year. (For example: graduation, persistence, retention, DFWI rates, presentations, participation in student competitions, etc.)
 - a. We have our first graduate
 - b. Students completed a substantial student research project where they fine-tuned a large language model to be able to read and automatically comment code in python 3.
 - c. Enrollment more than doubled in fall term of 2024 thanks to an increased interest in the program and outreach by faculty.
3. Provide 3 examples of student success stories for your program over the last year. (For example: job placement, published papers, paper or poster presentations, participation in student competitions, industry impact, etc.)
 - a. Our first graduate has landed a job in the field and is performing well at that job.
 - b. Students have completed multiple student research projects (but continue to refuse to present their work)
 - c. We have had an 80% retention rate in the program (including one graduate).
4. Describe your efforts so far in closing equity gaps in your program? How have you assessed and identified equity gaps? What does your disaggregated data show? What actions have you taken to help students achieve their potential (For example: project-based experiences, inclusivity exercises, TILT assignment instructions, etc.)?

With the low enrollment in the program, there is insufficient data to support whether or not there is an equity gap. In terms of the students we lost, institutional resources were employed in a timely manner, but it is not clear what else could have been done.

Program Assessment Report Feedback Rubric

2023-24 Assessment Report

Program:

Department Chair:

Program Assessment Report Author:

Rubric Measure	Well Developed, Progressing or Not included.
Program mission is aligned to University Mission	X
Educational Objectives Wording is Actionable	X
PSLO's are justified by Professional Standards	X
PSLO'S are aligned to ISLO	X
Curriculum Map: Scaffolding indicates Foundational, Practice, and Capstone Assessments by course	X
Assessment Cycle is three years or less to cover all PSLO and ISLO	X
Actions taken by programs on assessment during each year of the cycle are specified	X
During collection year, courses/assignments are specified that align to PSLO at FP&C levels	X
Rubric: Criteria for grading the assignment is described (may include as an appendix)	X
Sample: Number of samples reviewed is specified	X
Accountability: Reviewer of the assignment are specified	X
Assessment data is collected across all locations and modalities	
Performance Targets of acceptability are indicated	X
Results include: Graduation, Retention, Persistence, DFWI, Post Grad Success, Equity Gaps, PSLO, ISLO	X
Interpretation: Current results are compared against performance targets	X
Interpretation: Current results are compared against previous years of data	X
Interpretation: Current results are compared against some external comparator	X
Action drivers: Items not meeting performance targets have actions planned	X
Action drivers: Additional action plans for overall department improvement are indicated	X
Action plans: Specifics of accountability and timelines are indicated	X
Action plans: Actions are linked to identification of resources needed	X
Faculty discuss trends in the data	X
Faculty discuss previous action plan success given new data	X
Faculty discuss the assessment process and make any improvements necessary	X

Directions: Please provide comments on any item that is not graded as well developed.