Maryland
STATE DEPARTMENT OF EDUCATION

Program of Study Guide: Machine Learning & Data Science

Comprehensive guidelines and course standards for the Machine Learning & Data Science program of study

Office of College and Career Pathways

July 2025

MARYLAND STATE DEPARTMENT OF EDUCATION

MARYLAND STATE BOARD OF EDUCATION

Table of Contents

Document Control Information

Title:	Program of Study Guide: Machine Learning & Data Science
Security Level:	Not for Distribution
File Name:	MachineLearningDataScience.docx

DOCUMENT HISTORY

Document Version	Date	Summary of Change
1.0	October 2024	Initial Document
2.0	November 2024	Revision
3.0	November 2024	Revision
4.0	December 2024	Revision
5.0	January 2025	Revision

Purpose

The purpose of this document is to communicate the required Career and Technical Education (CTE) academic standards for the Networking Program of Study. The academic standards in this document are theoretical and performance based. The standards contain content from multiple state departments of education, the College Board, and the Computer Science Teachers Association (CSTA) and have been reviewed and vetted by members of the Maryland business and industry community.

In addition to academic standards, the Maryland State Department of Education (MSDE) has incorporated into this document Labor Market Information (LMI) definitions and explanations for the Program of Study; program aligned Industry Recognized Credentials; and Work-Based Learning resources and requirements by course level.

This document is intended for use by educational administrators and practitioners. A similar document is available for each state-approved CTE Program of Study.

Sources of Standards

The development of the Machine Learning and Data Science Program of Study (POS) is informed by several authoritative sources that provide comprehensive guidelines and frameworks. These sources collectively offer a robust foundation for developing comprehensive and industry-aligned standards for the program, ensuring that students acquire the necessary skills and knowledge to succeed in the fields of machine learning and data science.

Below is a list of these sources, along with descriptions, their applications in course development, and corresponding web links

1. **Advance CTE's Career Clusters Framework**
   A. **Description:** The Advance CTE framework provides a nationally recognized structure for organizing career and technical education (CTE) into Career Clusters. Each cluster represents a grouping of occupations and industries, with the Public Service and Safety Career Cluster.
   B. **Use:** The framework serves as a foundational guideline for developing Emergency Services standards, ensuring alignment with industry-specific expectations, and highlighting essential knowledge and skills for each level of study.
   C. **Source:** Advance CTE Career Clusters: https://careertech.org/career-clusters/

2. **IBM Data Science Professional Certificate Objectives**
   A. **Description:** IBM's Data Science objectives provide a comprehensive breakdown of skills required for entry-level data scientists, covering Python programming, data analysis, machine learning, and data visualization.
   B. **Use:** These objectives serve as the foundation for both introductory (Data Science I) and advanced (Data Science II) standards, guiding skill progression in data science and machine learning.
   C. **Source:** IBM Data Science Professional Certificate on Coursera: https://www.coursera.org/professional-certificates/ibm-data-science

3. **Microsoft Certified: Azure Data Scientist Associate**
   A. **Description:** This certification validates skills in designing and implementing a data science solution on Azure, including working with machine learning models, running experiments, and optimizing model performance.
   B. **Use:** Ideal for data scientists looking to deploy data science solutions on Azure, it provides the skills needed to manage and optimize machine learning models in a cloud environment.
   C. **Source:** https://learn.microsoft.com/en-us/certifications/azure-data-scientist/

4. **Johns Hopkins AI and Data Science Laboratory**
   A. **Description**: Johns Hopkins University's lab offers resources and research, emphasizing interdisciplinary approaches, ethical considerations, and applications in various fields.
   B. **Use:** Relevant for Machine Learning and Data Science III and IV, providing insights into advanced applications.
   C. **Source:** https://ai.jhu.edu/

5. **ISTE (International Society for Technology in Education) Standards for Students**
   A. **Description**: ISTE standards emphasize digital literacy and computational thinking, foundational skills for ethical and effective data science practices.
   B. **Use:** These standards encourage skills in problem-solving, computational thinking, and responsible data use, essential for foundational and advanced data science learning.
   C. **Source:** ISTE Standards for Students – https://www.iste.org/standards/for-students/

6. **Google Cloud Data Engineering and Machine Learning Course Materials**
   A. **Description:** Google Cloud's curriculum includes advanced data engineering and machine learning modules covering cloud infrastructure, model deployment, and data security.
   B. **Use:** Introductory Google Cloud content aligns with Machine Learning and Data Science I, while more advanced modules on data engineering and model deployment are ideal for Machine Learning and Data Science II.
   C. **Source:** Google Cloud Training – https://cloud.google.com/training/

7. **Bootstrap World for Data Science**
   A. **Description:** Leverage students' curiosity about the world around them to inspire real data analysis and original research.
   B. **Use:** Lessons are available for data visualization, measures of center and spread, programming, linear regression, and more.
   C. **Source:** bootstrapworld.org https://www.bootstrapworld.org/materials/fall2024/en-us/courses/data-science/resources/pages/implementation-options.html/

8. **Prince George's Community College - Data Science and Analysis Certificate**
   A. **Description:** Focuses on practical data science skills and includes modules in machine learning fundamentals.
   B. **Use:** This degree prepares students for entry-level positions in the field of data science and analysis.
   C. **Source:** PGCC Data Science and Analysis Certificate – https://www.pgcc.edu/programs-courses/program-finder/data-science-and-analysis-certificate/

Course Descriptions

Course Level	Course Information	Description
Required Core: Course 1	Machine Learning and Data Science I SCED: <15-2051> Grades: 9-12 Prerequisite: None Credit: 1	Machine Learning and Data Science I introduce students to the fundamentals of machine learning and data science, covering basic data handling, statistical analysis, and foundational ML algorithms. The course emphasizes hands-on skills with tools like Python and basic data visualization. Students will also explore career pathways in data science, develop employability skills, and integrate academic concepts into practical data-driven scenarios, preparing for entry-level certifications in data analysis.
Required Core: Course 2	Machine Learning and Data Science II SCED: <15-2051> Grades: 10-12 Prerequisite: Machine Learning and Data Science I Credit: 1	Machine Learning and Data Science II builds upon foundational ML/DS skills by introducing students to intermediate-level concepts essential for applying machine learning models and performing complex data analysis. This course focuses on advanced algorithms, data visualization, and project-based applications, equipping students with skills to pursue certifications in data analytics or machine learning.
Optional Flex: Course 1	Machine Learning and Data Science III SCED: <15-2051> Grades: 11-12 Prerequisite: Machine Learning and Data Science I and II Credit: 1	Machine Learning and Data Science III is designed to expand students' understanding of advanced machine learning techniques, ethical data use, and emerging trends in artificial intelligence. Building on the knowledge from ML/DS I and II, students will learn to implement neural networks, manage data ethics, and explore AI applications in fields like computer vision and NLP (Natural Language Processing).
Optional Flex: Course 2	Career Connected Learning I SCED: <XX> Grades: 11-12 Prerequisite: Machine Learning and Data Science I and II Credit: 1	This flexible, work-based learning course introduces students to real-world applications of classroom knowledge and technical skills through on-the-job experiences and reflective practice. Students engage in career exploration, skill development, and professional networking by participating in youth apprenticeships, registered apprenticeships, pre-apprenticeships, internships, capstone projects, or other approved career-connected opportunities. Variable credit (1–3) accommodates the required on-the-job training hours and related instruction. By

		integrating industry standards, employability skills, and personalized learning goals, Career Connected Learning I equips students to make informed career decisions, develop a professional portfolio, and build a strong foundation for success in postsecondary education, training, or the workforce.
Optional Flex: Course 3	Career Connected Learning II SCED: <XX> Grades: 11-12 Prerequisite: Career Connected Learning I Credit: 1	This flexible, work-based learning course introduces students to real-world applications of classroom knowledge and technical skills through on-the-job experiences and reflective practice. Students engage in career exploration, skill development, and professional networking by participating in youth apprenticeships, registered apprenticeships, pre-apprenticeships, internships, capstone projects, or other approved career-connected opportunities. Variable credit (1–3) accommodates the required on-the-job training hours and related instruction. By integrating industry standards, employability skills, and personalized learning goals, Career Connected Learning I equips students to make informed career decisions, develop a professional portfolio, and build a strong foundation for success in postsecondary education, training, or the workforce.

Dual Enrollment and Career Connected Learning Experiences Must be Aligned to the CTE Core.

Industry-Recognized Credentials and Work-Based Learning

Industry-Recognized Credentials: The standards in this document are aligned to the following certifications:

By the end of Machine Learning and Data Science I: IBM Data Science Professional Certificate or Google Data Analytics Certification

By the end of Machine Learning and Data Science II: Microsoft Certified: Azure Data Scientist Associates or CompTIA Data+

Optional Credentials (via the Flex Course options): AWS Certified Solutions Architect (AWS-SA)

Work-Based Learning Examples and Resources

Course I: Career Awareness	**Course II: Career Preparation**	**Flex Courses: Career Preparation**
• Industry Visits • Guest Speakers • Participation in Career and Technical Student Organizations • Postsecondary Visits – Program Specific Site Tours • Mock Interviews	• All of Career Awareness plus the following: • Job Shadow • Paid and Unpaid Internships	• Paid and Unpaid Internships • Apprenticeships (including at the LEA and State Level for ethical hacking, computer tech services)

Labor Market Information: Definitions and Data

Labor market information (LMI) plays a crucial role in shaping Career and Technical Education (CTE) programs by providing insights into industry demands, employment trends, and skills gaps. This data helps education leaders assess the viability of existing programs and identify opportunities for new offerings. By aligning CTE programs with real-time labor market needs, schools can better prepare students for in-demand careers and ensure that resources are effectively utilized to support pathways that lead to high-quality, sustainable employment.

Standard Occupational Code (SOC) and Aligned Industry:

Indicator	Definition	Pathway Labor Market Data
High Wage[1]	Those occupations that have a 25th percentile wage equal to or greater than the most recent MIT Living Wage Index for one adult in the state of Maryland, and/or leads to a position that pays at least the median hourly or annual wage for the DC-VA-MD-WV Metropolitan Statistical Area (MSA).Note: A 25th percentile hourly wage of $24.74 or greater is required to meet this definition.	**Standard Occupational Code:** 15-2051, Data Scientist Hourly Wage/Annual Salary: 25th Percentile: $38.37 / $79,810.00 50th Percentile: $51.93 / $108,020.00 75th Percentile: $70.99 / $147,670.00 **Standard Occupational Code:** 15-2051, Data Scientist Hourly Wage/Annual Salary: 25th Percentile: $50.16 / $104,330.00 50th Percentile: $64.76 / $134,700.00 75th Percentile: $80.18 / $166,780.00
High Skill	Those occupations located within the DC-VA-MD-WV Metropolitan Statistical Area (MSA) with the following education or training requirements: completion of an apprenticeship program; completion of an industry-recognized certification or credential; associate's degree, bachelor's degree, or higher.	**Typical Entry-Level Education:** Many positions require a master's degree in computer science or a related field. Some entry-level roles may accept a bachelor's degree with relevant experience or certifications.
In-Demand	Annual growth plus replacement, across all Maryland occupations, is 405 openings between 2024-2029.	**Annual Openings:**

[1] Living Wage Calculator: https://livingwage.mit.edu/states/24

Labor Market Information Data Source

Lightcast Q4 2024 Data Set. Lightcast occupation employment data are based on final Lightcast industry data and final Lightcast staffing patterns. Wage estimates are based on Occupational Employment Statistics (QCEW and Non-QCEW Employees classes of worker) and the American Community Survey (Self-Employed and Extended Proprietors). Occupational wage estimates are also affected by county-level Lightcast earnings by industry. Foundational data for the state of Maryland is collected and reported by the Maryland Department of Labor.

Methodology for High Wage Calculations

To combine labor market data across multiple Standard Occupational Classifications (SOCs), a weighted average approach was used to ensure accurate representation of the marketplace. Median wages for each SOC were weighted based on their respective employment levels, reflecting the relative demand for each occupation. This method ensures that occupations with higher employment contribute proportionately to the overall wage calculation. Additionally, job openings from all relevant SOCs were summed to determine the total projected demand. For example, if Mechanical Engineers account for 67% of total employment and Electrical Engineers for 33%, their respective wages are weighted accordingly, and job openings are aggregated to provide a comprehensive view of labor market opportunities. This approach delivers a balanced and accurate representation of both wages and employment demand for the program.

Methodology for In-Demand Calculations

The baseline for annual job openings, taking into account new positions and replacement positions, was determined by taking the average of all annual job openings between 2024 and 2029 across all 797 career sectors at the 5-digit SOC code level. For the 2024-2029 period, average job openings (growth + replacement) is 405.

Course Standards: Machine Learning & Data Science I

1. **GENERAL REQUIREMENTS** This course is recommended for students in Grades 9-10.

2. **INTRODUCTION**
   A. Career and Technical Education (CTE) instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.
   B. The Digital Technology Career Cluster focuses on building linkages in IT and data science occupations for entry-level, technical, and professional careers related to the analysis, processing, and visualization of data and machine learning applications.
   C. The Machine Learning and Data Science program of study emphasizes careers and educational pathways related to the design and implementation of data processing systems, machine learning models, and artificial intelligence tools. This program covers the analysis and ethical use of data in real-world scenarios, supporting careers in data analytics and artificial intelligence.
   D. Machine Learning and Data Science I introduces students to the fundamentals of data science, covering data collection, statistical analysis, and basic machine learning algorithms. The course emphasizes hands-on skills with tools like Python and data visualization software. Students will also explore career pathways in data science, develop employability skills, and integrate academic concepts into practical data-driven scenarios, preparing for entry-level certifications in data analysis.
   E. Students will participate in at least two Career-Connected Education and Work-Based Learning experiences in this course, which might include informational interviews, virtual shadowing, or collaborative projects relevant to the program of study.
   F. Students are encouraged to participate in extended learning experiences through aligned Career and Technical Student Organizations (CTSOs). CTSOs are a cocurricular requirement in the Carl D. Perkins Act, and alignment to CTSO activities is an expectation for CTE programs in the state of Maryland.

3. **KNOWLEDGE AND SKILLS.**
   A. **The student demonstrates the necessary skills for career development, maintenance of employability, and successful completion of course outcomes. The student is expected to:**
      1. Identify and demonstrate positive work behaviors that enhance employability and job advancement, such as regular attendance, promptness, proper attire, maintenance of a clean and safe work environment, and pride in work.
      2. Demonstrate positive personal qualities such as flexibility, open-mindedness, initiative, active listening, and a willingness to learn.
      3. Employ effective reading, writing, and technical documentation skills.
      4. Solve problems using critical thinking techniques and structured troubleshooting methodologies.
      5. Demonstrate leadership skills and collaborate effectively as a team member.

   B. **The student identifies various career pathways in the data science and machine learning fields. The student is expected to:**
      1. Develop a career plan that includes the necessary education, certifications, job skills, and experience for specific roles in data science and machine learning.

2. Create a professional resume and portfolio that reflect skills, projects, certifications, and recommendations.
3. Demonstrate effective interview skills for roles in data science and machine learning.

C. **The student develops technology and digital literacy skills. The student is expected to:**
   1. Use technology as a tool for research, organization, communication, and problem-solving.
   2. Use digital tools, including computers, cloud platforms, and data science software, to access, manage, and analyze information.
   3. Demonstrate proficiency in using emerging and industry-standard technologies, including data visualization tools, programming languages like Python, and data management applications.
   4. Understand ethical and legal considerations for technology use, including principles of data protection, intellectual property, and responsible data handling.

D. **The student integrates core academic skills into data science practices. The student is expected to:**
   1. Demonstrate the use of clear communication techniques, both written and verbal, that are consistent with industry standards.
   2. Apply mathematical concepts such as probability, statistics, and algebra in data analysis and machine learning applications.
   3. Use scientific principles, such as data collection methodologies and hypothesis testing, in data-driven decision-making.

E. **The student understands and operates data science workflows. The student is expected to:**
   1. Describe the functions and characteristics of data science tools and environments, including Jupyter notebooks, Python libraries, and cloud-based data services.
   2. Identify components required for modern data science projects, including data storage, data pipelines, and processing power.
   3. Select the appropriate data analysis techniques based on the type and scale of the data and project requirements.
   4. Explain the importance of data cleaning, preparation, and validation in building accurate and reliable machine learning models.
   5. Discuss the impact of data science applications, such as predictive analytics, natural language processing, and computer vision, on industries and society.
   6. Interpret data visualizations and documentation to understand data trends and patterns.

F. **The student implements data collection, analysis, and visualization techniques. The student is expected to:**
   1. Select appropriate data sources and collection methods for different types of data science projects, including structured and unstructured data.
   2. Explain data storage standards, data processing concepts, and database management techniques.
   3. Configure data pipelines to ingest, clean, and transform data for analysis.
   4. Perform data analysis tasks, including descriptive statistics, data transformations, and exploratory data analysis.

5. Use data visualization tools to represent data in meaningful ways, facilitating data-driven insights.
6. Implement security measures for data protection, including access controls and data encryption.
7. Diagnose and resolve data-related issues such as incomplete data sets, data drift, and inconsistencies.
8. Application of Machine Learning Algorithms

G. **The student applies machine learning algorithms and models to data. The student is expected to:**
   1. Explain the purpose and structure of machine learning models, including supervised, unsupervised, and reinforcement learning.
   2. Compare algorithms such as linear regression, decision trees, clustering, and neural networks, understanding differences in their application and effectiveness.
   3. Design and apply machine learning models that include feature selection, model training, validation, and evaluation.
   4. Configure and verify model parameters for effective predictions in both supervised and unsupervised learning tasks.
   5. Explain concepts like overfitting, underfitting, and regularization in the context of model accuracy and generalization.
   6. Troubleshoot model performance issues and interpret model results using tools like confusion matrices, precision, recall, and F1 scores.

Course Standards: Machine Learning & Data Science II

1. **GENERAL REQUIREMENTS** This course is recommended for students in Grades 10-12

2. **INTRODUCTION**
   A. Career and Technical Education (CTE) instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.
   B. The Digital Technology Career Cluster focuses on building linkages in IT and data science occupations for entry-level, technical, and professional careers related to the analysis, processing, and application of data science and machine learning.
   C. The Machine Learning and Data Science program of study emphasizes careers and educational pathways related to data analysis, machine learning model deployment, and advanced data science techniques. This program covers data engineering, algorithm optimization, and real-world applications of machine learning in various sectors.
   D. Machine Learning and Data Science II focuses on deeper data science concepts, advanced machine learning algorithms, model optimization, and real-world deployment. The course introduces students to complex data processing, model evaluation, and ethical AI practices.
   E. Students will participate in at least two Career-Connected Education and Work-Based Learning experiences in this course, which might include virtual internships, mentorship with industry professionals, or project-based learning activities relevant to the program of study.
   F. Students are encouraged to participate in extended learning experiences through aligned Career and Technical Student Organizations (CTSOs). CTSOs are a cocurricular requirement in the Carl D. Perkins Act, and alignment to CTSO activities is an expectation for CTE programs in the state of Maryland.

3. **KNOWLEDGE AND SKILLS**
   A. **The student demonstrates the necessary skills for career development, maintenance of employability, and successful completion of course outcomes. The student is expected to:**
      1. Identify and demonstrate positive work behaviors that enhance employability and job advancement, such as regular attendance, promptness, proper attire, maintenance of a clean and safe work environment, and pride in work.
      2. Demonstrate positive personal qualities such as flexibility, open-mindedness, initiative, active listening, and a willingness to learn.
      3. Employ effective reading, writing, and technical documentation skills, particularly in reporting data analysis findings and model evaluations.
      4. Solve problems using critical thinking techniques and structured methodologies in data processing, model tuning, and troubleshooting data science pipelines.
      5. Demonstrate leadership skills and collaborate effectively as a team member in data science projects, sharing insights and problem-solving strategies.
      6. Implement safety and data security procedures, including proper handling of data, adherence to data privacy regulations, and maintaining ethical standards in data use.

   B. **The student identifies various career pathways in the information technology field. The student is expected to:**
      1. Develop a career plan that includes the necessary education, certifications, job skills, and experience for specific roles in data science and machine learning.

2. Create a professional resume and portfolio that reflects skills, projects, certifications, and recommendations relevant to data science.
3. Demonstrate effective interview skills for roles in data science and machine learning, focusing on technical and analytical expertise.

C. **The student develops technology and digital literacy skills. The student is expected to:**
1. Use technology as a tool for research, organization, communication, and problem solving in data-related tasks.
2. Utilize digital tools, including computers, cloud platforms, collaboration tools, and data visualization software, to manage, process, and analyze information.
3. Demonstrate proficiency in using industry-standard technologies, including programming languages (Python, R), data processing libraries, and cloud computing platforms.
4. Understand ethical and legal considerations for technology use, including data privacy principles, intellectual property, and responsible AI practices.

D. **The student integrates core academic skills into data science practices. The student is expected to:**
1. Demonstrate the use of clear communication techniques, both written and verbal, that are consistent with industry standards in data presentation and reporting.
2. Apply mathematical concepts such as statistics, probability, and linear algebra in data analysis and machine learning model development.
3. Use scientific principles, such as data collection methods and hypothesis testing, in data-driven problem-solving.

E. **Students will develop skills to design and implement advanced data processing architectures, including hybrid and scalable data pipelines. The student is expected to:**
1. Differentiate and configure cloud and on-premises data storage solutions, such as databases, data lakes, and data warehouses.
2. Explain and design data partitioning strategies for scalable data processing (e.g., sharding, chunking).
3. Create data flow diagrams that include hybrid and cloud-based components, focusing on scalability and fault tolerance.

F. **Students will understand and apply advanced data modeling techniques to support complex data analysis. The student is expected to:**
1. Implement data schemas, normalization, and entity-relationship models to organize data effectively.
2. Configure and analyze machine learning models (e.g., regression, clustering, neural networks) for various applications.
3. Troubleshoot data preprocessing and model performance issues using diagnostic tools and evaluation metrics.

Course Standards Machine Learning & Data Science III

A. GENERAL REQUIREMENTS This course is recommended for students in Grades 11-12

B. INTRODUCTION

A. Career and Technical Education (CTE) instruction in Machine Learning and Data Science provides content aligned with challenging academic standards and essential technical knowledge for students to prepare for roles in data science, artificial intelligence, and advanced data analytics.
B. The Digital Technology (DT) Career Cluster in this course focuses on foundational to advanced skills in data science, including machine learning methodologies, model evaluation, and application in real-world AI scenarios.
C. Machine Learning and Data Science III introduces students to deep learning, natural language processing (NLP), clustering, and unsupervised learning techniques, with a focus on ethical data practices. Students engage in hands-on projects that simulate industry applications and develop skills to build and evaluate sophisticated machine learning models.
D. Students will participate in at least two Career-Connected Education and Work-Based Learning experiences, including industry internships or project collaborations with professionals in the field.
E. Students are encouraged to participate in extended learning experiences through aligned Career and Technical Student Organizations (CTSOs), fulfilling cocurricular requirements under the Carl D. Perkins Act.

C. KNOWLEDGE AND SKILLS

A. **The student demonstrates the skills necessary for career development, employability, and successful course completion. The student is expected to:**
   1. Demonstrate professional work behaviors like punctuality, adaptability, initiative, and problem-solving.
   2. Create and present a portfolio showcasing advanced data science projects and certifications.
   3. Demonstrate professional work behaviors like punctuality, adaptability, initiative, and problem-solving.
   4. Develop interview skills tailored to data science roles, focusing on analytical and technical abilities.

B. **The student demonstrates the skills for Machine Learning and Data Science. The student is expected to:**
   1. Apply deep learning techniques, including neural networks (CNNs and RNNs), for tasks such as image and text classification.
   2. Utilize NLP techniques for text processing tasks, such as sentiment analysis and topic modeling.
   3. Implement clustering algorithms like K-means for unsupervised learning projects and analyze results for real-world applications.

C. **The student demonstrates the skills for Portfolio Development. The student is expected to:**
   1. Document machine learning project workflows, including data preprocessing, model development, and evaluation phases.

2. Develop a professional portfolio demonstrating problem-solving and technical skills applied to real-world data science projects.

D. **The student develops environmental sustainability with architecture of hardware and software. The student is expected to:**
   1. Data Analysis for Environmental Impact: Use data science tools to analyze environmental data, such as emissions, energy usage, and resource consumption, interpreting trends to communicate environmental impact effectively.
   2. Predictive Modeling for Conservation: Develop machine learning models to predict the impact of environmental changes, like climate shifts or deforestation, and explore applications in renewable energy forecasting.
   3. Sustainable Data Practices: Understand the energy consumption of data storage and processing and learn techniques for optimizing code and using efficient algorithms to reduce the environmental footprint of data science projects.

E. **The student develops financial literacy with project based learning. The student is expected to:**
   1. Data Science for Personal Finance: Apply data science techniques to analyze personal financial data, including savings, investments, and expenses, developing skills in budgeting and financial forecasting.
   2. Machine Learning in Investment Analysis: Utilize machine learning models to analyze stock market data, forecast trends, and assess investment risks, including building simple recommendation systems for diversified portfolios.
   3. Financial Data Ethics: Explore ethical considerations in financial data handling, such as data privacy, security, and responsible use, assessing the implications of algorithms used in personal finance and investment platforms.

F. **The student develops civic engagement with project based learning. The student is expected to:**
   1. Data-Driven Decision Making in Civic Issues: Analyze datasets related to social issues (e.g., education, healthcare, housing) to address community needs and propose data-driven improvements for local communities.
   2. Social Impact Measurement: Use data science methods to assess the effectiveness of civic programs or public policies, such as public health initiatives, by applying machine learning for classification or clustering.

Course Standards: Career Connected Learning I and II

Career connected learning is an educational approach that integrates classroom instruction with real-world experiences, enabling high school students to explore potential careers and develop relevant skills before graduation. By participating in work-based learning opportunities—such as apprenticeships, internships, capstone projects, and school-based enterprises—students apply academic concepts in authentic settings, gain practical industry knowledge, and build professional networks. This hands-on engagement helps students connect their studies to future career paths, strengthens their problem-solving and communication skills, and supports a smoother transition into college, vocational programs, or the workforce.

All Career and Technical Education Programs of Study include aspects of work-based learning, and almost all of the programs include two Career Connected Learning (CCL) courses. Below are the course descriptions for CCL I and CCL II. The CCL standards can be found via this link: