Mendham Township Middle School
Grades 5 - 8

Library Media AASL &
Design Thinking Integrated Curriculum
Grade 5 SEL / Grade 6 Media Literacy / Tech Safety

2024 Update / Aligned to NJSLS 2020

Grade Level: 5

Unit Title: Investigating Variables with Pendulums
Duration: 2 Weeks

AASL Integration:

The **Investigating Variables with Pendulums** unit directly aligns with AASL Standards by engaging students in inquiry, collaboration, and reflection throughout their exploration of scientific concepts. Specifically:

1. **AASL I.A.1 & I.B.1:** The unit requires students to "formulate questions about a curricular topic" and "use evidence to investigate questions," as they identify and test variables such as string length or bob mass to determine their effects on a pendulum's motion. These activities build their critical thinking and problem-solving skills.
2. **AASL III.B.2 & III.D.3:** During the team-based design challenge to create a pendulum timer, students "develop new understandings through engagement in a learning group" and "collaboratively identify innovative solutions to a challenge." This aligns with their iterative process of brainstorming, testing, and improving their designs based on peer feedback.
3. **AASL V.B.1 & V.B.2:** The iterative process of testing and refining their pendulum prototypes embodies "problem-solving through cycles of design, implementation, and reflection" and "persisting through self-directed pursuits by tinkering and making." This hands-on, reflective approach encourages innovation and a growth mindset.
4. **AASL V.A.3:** Students "engage in inquiry-based processes for personal growth" as they explore how their pendulum designs meet specified criteria, test their ideas, and reflect on how scientific principles (e.g., gravity and motion) inform real-world problem-solving.

NGSS Standards:

- **5-PS2-1:** Support an argument that the gravitational force exerted by Earth on objects is directed down.
- **3-5-ETS1-1:** Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.

Design Thinking Standards (Integrated):

1. **8.2.5.ED.1:** Explain the functions of a system and its subsystems.
2. **8.2.5.ED.2:** Collaborate with peers to collect information, brainstorm solutions, and evaluate results with models or sketches.
3. **8.2.5.ED.5:** Describe how specifications and limitations impact the engineering design process.
4. **8.2.5.ED.6:** Evaluate and test alternative solutions to a problem.
5. **8.2.5.NT.3:** Redesign an existing product for a different purpose in a collaborative team.
6. **8.2.5.ETW.3:** Explain why human-designed systems need constant monitoring, maintenance, and improvement.

Unit Objectives:

- Understand the concept of variables (independent, dependent, and controlled) through hands-on experimentation with pendulums.
- Develop collaborative problem-solving skills to modify and improve pendulum designs.
- Explore the relationship between gravity and motion.
- Apply the engineering design process to test and refine ideas.

Unit Outline:

Week 1

Day 1: Introduction to Pendulums and Variables

- **Objective:** Define a pendulum system and identify variables.
- **Activity:** Demonstrate a simple pendulum; discuss its parts (string, mass, pivot). Introduce variables and brainstorm examples (e.g., string length, mass of bob).
- **Standards:** 5-PS2-1, 8.2.5.ED.1.

Day 2: Independent Variables

- **Objective:** Investigate how changing the length of the string affects the swing.
- **Activity:** Students experiment with different string lengths, timing swings. Record data in a table.
- **Standards:** 8.2.5.ED.5, 8.2.5.ED.6.

Day 3: Dependent Variables and Graphing

- **Objective:** Measure and graph the effect of string length on pendulum period.
- **Activity:** Teach graphing techniques; students create line graphs from Day 2 data.
- **Standards:** 8.2.5.ED.2, 3-5-ETS1-1.

Day 4: Exploring Other Variables

- **Objective:** Test the effect of the pendulum bob's mass on the period.
- **Activity:** Students use different weights while keeping string length constant. Collect data.
- **Standards:** 8.2.5.ED.5, 8.2.5.ED.6.

Day 5: Analyzing Patterns and Drawing Conclusions

- **Objective:** Discuss findings and evaluate the role of variables.
- **Activity:** Student teams present results and discuss discrepancies or unexpected findings.
- **Standards:** 8.2.5.NT.3.

Week 2

Day 6: Engineering Challenge Introduction

- **Objective:** Introduce a real-world problem-solving challenge using pendulums.
- **Activity:** Teams identify a pendulum timer that accurately measures a 10-second interval.
- **Standards:** 3-5-ETS1-1, 8.2.5.ED.1.

Day 7: Brainstorming and Sketching Designs

- **Objective:** Plan and communicate design ideas.
- **Activity:** Use sketches and models to represent ideas. Consider constraints (e.g., materials, time).
- **Standards:** 8.2.5.ED.2, 8.2.5.ED.5.

Day 8: Prototyping and Testing Designs

- **Objective:** Build and test pendulum.
- **Activity:** Teams construct, test and record outcomes.
- **Standards:** 8.2.5.ED.3, 8.2.5.ED.6.

Day 9: Redesign and Retest

- **Objective:** Predict how variables affect test results.
- **Activity:** Teams refine pendulums and retest. Share data for collaborative feedback.
- **Standards:** 8.2.5.NT.3, 8.2.5.ETW.3.

Day 10: Final Presentations and Reflection

- **Objective:** Present final graphs and reflect on learning.
- **Activity:** Teams showcase their designs, explaining the role of variables and the design process. Reflect on challenges and successes.
- **Standards:** 8.2.5.ETW.3, 8.2.5.ED.6.

Assessment:

- **Formative:** Observation during experiments, peer collaboration, and data accuracy.
- **Summative:** Final pendulum design, presentation, and written reflection on the role of variables and the design process. CER assessment and content in Unit Test.

Grade 5 SEL / 6 Media Literacy / Academic Lab

Unit Title: Middle School Medial Literacy / Technology Safety
Duration: 10 lessons (42 minutes each)

Course Overview

This media literacy course equips Grade 6 students with essential digital skills to navigate the online world responsibly and critically. Aligning with AASL standards, the course emphasizes accessing, analyzing, and creating media while fostering digital citizenship and safety.

Course Goals

By the end of this course, students will:

- Navigate the digital landscape **safely and ethically**.
- Critically analyze media messages for accuracy and bias.
- Create original digital content while respecting copyright laws.
- Engage responsibly in digital communities, fostering collaboration and positive interactions.
- Understand school specific AI safety practices

Pre Lesson: MTMS AI Safety Protocol

1. ***GoGuardian in use.*** Teachers at MTMS will employ GoGuardian to monitor all classroom activities involving the use of OpenAI resources.

2. ***Never share personal information.*** Do not input or share any personal details such as your name, address, school, or other identifying information when using AI tools.

3. ***Report inappropriate content immediately.*** If you encounter any unsafe, inappropriate, or concerning content, stop using the AI immediately and report it to your teacher or a trusted adult.

4. ***Use only in safe, supervised environments.*** Only use AI tools in controlled settings like school computers or supervised home environments. Avoid using them in public spaces or on unsecured networks.

5. ***Be aware of AI limitations.*** Understand that AI can make mistakes or provide inaccurate information and may reflect biases in its responses. Always verify important information from reliable sources.

6. ***Maintain online stranger awareness.*** Remember that AI, like ChatGPT, is not a real person. Do not develop any sense of personal connection or share private information as you might with a friend.

7. ***Respect academic integrity.*** Don't use AI to engage in or promote academic dishonesty. Be honest about AI usage in your work.

If you break these guidelines, it may be considered a violation of the Honor Code and Acceptable Use Policy that all students have signed. Some violations may lead to consequences as described in the MTMS Student Handbook.

Course Outline

Lesson 1: Introduction to Media Literacy

- **Objective:** Define media literacy and understand its importance.
- **Activities:**
    - Discuss real-life examples of media's influence (e.g., advertising, news, social media).
    - Introduce AASL standards for accessing, evaluating, and creating information (e.g., I.A.1, V.A.3).
- **Key Skills:** Recognizing media's impact, understanding the role of media literacy in informed decision-making.

Lesson 2: Accessing Information Effectively

- **Objective:** Learn search strategies and evaluate source credibility.
- Activities:
    - Teach advanced search techniques (e.g., Boolean operators).
    - Evaluate real and fake websites for credibility and accuracy.
    - Introduce AI prompting
- **Key Skills:** Using search tools effectively (I.B.1), identifying credible sources (VI.C.2).

Lesson 3: Evaluating Digital Footprints (Grade 5 SEL)

- **Objective:** Understand how online actions create a permanent record.
- **Activities:**
    - Analyze examples of positive and negative digital footprints.
    - Discuss the implications of shared posts and personal data online.
    - Review ramifications of adding personal information to AI prompts
- **Key Skills:** Reflecting on digital behavior and its consequences (VI.D.2).

Lesson 4: Analyzing Media Messages

- **Objective:** Develop critical thinking skills to identify bias, propaganda, and misinformation.
- **Activities:**
    - Analyze advertisements and news articles for bias and hidden agendas.
    - Discuss techniques used in fake news and how to verify claims.
    - How to fact check AI
- **Key Skills:** Detecting bias and misinformation (V.B.2, VI.A.1).

Lesson 5: Ethical Content Creation

- **Objective:** Explore copyright, fair use, and ethical digital storytelling.
- Activities:
    - Create a digital poster or infographic using copyright-free media.
    - Discuss the importance of citing sources.
- **Key Skills:** Ethical content creation (VI.C.1), understanding copyright laws (VI.B.2).

Lesson 6: Internet and Social Media Safety (Grade 5 SEL)

- **Objective:** Recognize online risks and learn safe practices.
- Activities:
    - Role-play scenarios involving cyberbullying or phishing attempts.
    - Create a personal checklist for online safety.
- **Key Skills:** Identifying risks and practicing safe online behavior (VI.C.3, VI.D.1).

Lesson 7: Digital Citizenship (Grade 5 SEL)

- **Objective:** Promote online etiquette and responsible behavior.
- **Activities:**
    - Discuss examples of respectful online interactions.
    - Create a "digital citizen pledge" outlining responsible online behavior**.**
- **Key Skills:** Building a positive digital presence (III.D.3, VI.C.1).

Lesson 8: Information Evaluation

- **Objective:** Learn fact-checking methods and recognize sponsored content.
- Activities:
    - Compare news stories from credible and non-credible sources.
    - Analyze an article to identify native advertising.
    - Impotence of fact checking AI as a news source
- **Key Skills:** Fact-checking and assessing relevance (I.B.2, VI.A.2).

Lesson 9: Media and Mental Health (Grade 5 SEL)

- **Objective:** Understand social media's impact on self-esteem and well-being.
- **Activities:**
    - Discuss real-life examples of how social media affects mental health.
    - Create a plan for balanced screen time and positive online interactions.
- **Key Skills:** Reflecting on media's impact on mental health (II.B.1, VI.D.3).

Lesson 10: Collaborative Learning and Global Connections (STEM Activity 5-8)

- **Objective:** Leverage digital tools for collaboration and communication.
- **Activities:**
    - Participate in a mock global project (e.g., designing a solution to a global issue).

    - Reflect on cross-cultural communication skills.
    - Use AI to assist in collaboration skills
- **Key Skills:** Collaborative learning (III.B.2), cross-cultural understanding (II.B.2, VI.D.1).

Grade Level: 6

Unit Title: Foundations of Democracy

Duration: 2 Weeks

AASL Integration:

The **Foundations of Democracy** Grade 6 unit aligns closely with AASL Standards by incorporating inquiry, collaboration, and reflection as students explore democratic principles and develop real-world solutions to societal issues. Specifically:

1. **AASL I.A.1 & I.B.1:** Students "formulate questions about a curricular topic" and "use evidence to investigate questions" as they analyze foundational democratic documents (e.g., the U.S. Constitution) and historical examples of civic participation. For example, students examine how social and political systems have influenced democratic decision-making and how they can apply these principles in their design challenge.
2. **AASL III.B.2 & III.D.3:** The collaborative design challenge, where students propose solutions to issues like conflict resolution or civic engagement, supports "developing new understandings through engagement in a learning group" and "collaboratively identifying innovative solutions to a challenge." Teams brainstorm, debate, and build prototypes of tools or systems to enhance democracy.
3. **AASL V.A.3 & V.B.1:** Through the iterative design process, students "engage in inquiry-based processes for personal growth" and "problem-solve through cycles of design, implementation, and reflection." This is exemplified as students test and refine their models, such as apps or campaigns that foster civic participation, and connect their findings to democratic ideals.
4. **AASL VI.C.1 & VI.C.2:** By presenting their “Legal System” to peers and receiving constructive feedback, students "adapt and communicate learning products with others" and "act on feedback to improve" their final designs. These activities emphasize the importance of ethical and effective communication in a democratic society.

Social Studies Standards:

- **6.1.8.CivicsPI.3.a:** Explain how and why individuals and groups, including racial, ethnic, religious, and gender groups, have worked to expand or limit rights in democracy.
- **6.1.8.CivicsDP.3.b:** Evaluate the impact of a constitution on defining the principles of democracy.
- **6.3.8.CivicsPR.4:** Use evidence and reasoning to support or oppose a public policy decision in a democratic society.

Design Thinking Standards (Integrated):

1. **8.2.8.ED.1:** Evaluate the function, value, and aesthetics of a system from different perspectives.
2. **8.2.8.ED.3:** Develop a proposal for a solution to a real-world problem using models.
3. **8.2.8.ED.6:** Analyze how trade-offs impact the design of a product or system.
4. **8.2.8.NT.1:** Examine a malfunctioning system and propose solutions.
5. **8.2.8.ITH.1:** Explain how technology influences political, economic, and cultural issues.

Unit Objectives:

- Understand the core principles of democracy, including equity, representation, and participation.
- Analyze challenges to democracy and propose solutions to strengthen democratic systems.
- Use design thinking to create tools or systems that enhance democratic engagement.
- Evaluate historical and contemporary examples of how democracy functions in different societies.

Unit Outline:

Week 1

Day 1: Introduction to Democracy

- **Objective:** Define democracy and explore its principles.
- **Activity:** Students brainstorm what they know about democracy. Teacher-led discussion on core principles (e.g., rule of law, equality, freedom).
- **Standards:** 6.1.8.CivicsDP.3.b, 8.2.8.ED.1.

Day 2: Historical Context

- **Objective:** Examine how democratic systems evolved over time.
- **Activity:** Research different democratic systems (e.g., Ancient Greece, the U.S. Constitution). Compare their principles.
- **Standards:** 6.1.8.CivicsPI.3.a, 8.2.8.ITH.1.

Day 3: Democracy in Action

- **Objective:** Explore how citizens participate in democracy.
- **Activity:** Role-play a town hall meeting where students represent various groups advocating for public policy.
- **Standards:** 6.3.8.CivicsPR.4, 8.2.8.ED.3.

Day 4: Challenges to Democracy

- **Objective:** Identify and analyze barriers to equitable representation (e.g., voter suppression, misinformation).
- **Activity:** Explore direct vs representative democracy. Small groups brainstorm ways to address these issues.
- **Standards:** 6.1.8.CivicsPI.3.a, 8.2.8.NT.1.

Day 5: Reflect and Plan

- **Objective:** Synthesize understanding of democracy and prepare for a design challenge.
- **Activity:** Teams draft initial ideas for a system or tool to enhance our legal system
- **Standards:** 8.2.8.ED.6, 8.2.8.ITH.4.

Week 2

Day 6: The Design Process - Research

- **Objective:** Explore current solutions that promote civic participation.
- **Activity:** Students analyze tools like voting systems, advocacy platforms, and government apps.
- **Standards:** 8.2.8.ITH.4, 8.2.8.ED.1.

Day 7: The Design Process - Prototyping

- **Objective:** Develop a presentation that enhances our legal system.
- **Activity:** Teams create G-slides presentations to support the legal system they created.
- **Standards:** 8.2.8.ED.3, 8.2.8.NT.1.

Day 8: Testing and Feedback

- **Objective:** Test student-made legal systems and evaluate their effectiveness.
- **Activity:** Teams present prototypes to classmates for feedback. Discuss strengths and areas for improvement.
- **Standards:** 8.2.8.ED.6, 8.2.8.ITH.1.

Day 9: Iteration and Redesign

- **Objective:** Refine presentations based on feedback.
- **Activity:** Teams make improvements to their presentations / systems and document trade-offs made during the process.
- **Standards:** 8.2.8.ED.7, 8.2.8.NT.1.

Day 10: Final Presentations and Reflection

- **Objective:** Present solutions and reflect on learning.
- **Activity:** Teams showcase their final designs, explaining how their new system addresses challenges to democracy. Individual reflections on the importance of civic engagement.
- **Standards:** 6.3.8.CivicsPR.4, 8.2.8.ED.6.

Assessment:

- **Formative:** Observations during role-plays, group discussions, and prototype development.
- **Summative:** Final G-slides presentation, written analysis of challenges to democracy, and individual reflection on the overall process.

Grade Level: 7

Unit Title: Exploring Themes of Identity, Community, and Conflict in *The Outsiders*
Duration: 2 Weeks

AASL Integration:

The **Exploring Themes of Identity, Community, and Conflict in *The Outsiders*** Grade 7 unit aligns seamlessly with AASL Standards by engaging students in inquiry, collaboration, and creative reflection as they analyze literary themes and design innovative solutions to real-world issues. Specifically:

1. **AASL I.A.1 & I.B.1:** Students "formulate questions about a curricular topic" and "use evidence to investigate questions" as they analyze *The Outsiders*, identifying themes such as social division, identity, and belonging. For example, students explore how these themes are reflected in the text and modern societal challenges, using textual evidence to support their analysis.
2. **AASL III.B.2 & III.D.3:** During group discussions and the design challenge to propose solutions for resolving conflict or building community, students "develop new understandings through engagement in a learning group" and "collaboratively identify innovative solutions to a challenge." Teams brainstorm and refine ideas for products such as apps or initiatives that promote inclusion and empathy.
3. **AASL V.A.3 & V.B.1:** The iterative process of designing and testing their prototypes embodies "engaging in inquiry-based processes for personal growth" and "problem-solving through cycles of design, implementation, and reflection." Students apply lessons from the novel to address real-world challenges related to social division and conflict resolution.
4. **AASL VI.C.1 & VI.C.2:** By presenting their G-slide presentation to peers, receiving feedback, and refining their designs, students "adapt and communicate learning products with others" and "act on feedback to improve." This collaboration fosters an understanding of how effective communication and feedback are integral to addressing social issues.
5. **AASL II.B.1 & II.D.2:** As students reflect on the experiences of the Socs and Greasers and compare them to contemporary societal divisions, they "articulate an awareness of the contributions of a range of learners" and "demonstrate interest in other perspectives during learning activities." This builds empathy and cultural relevancy in their analysis.

ELA Standards (NJSLS):

- **RL.7.1:** Cite textual evidence to support analysis of what the text says explicitly as well as inferences drawn from the text.
- **RL.7.2:** Determine a theme or central idea of a text and analyze its development over the course of the text; provide an objective summary.
- **RL.7.3:** Analyze how particular elements of a story or drama interact (e.g., how setting shapes the characters or plot).
- **W.7.1:** Write arguments to support claims with clear reasons and relevant evidence.
- **SL.7.1:** Engage effectively in a range of collaborative discussions, building on others' ideas and expressing their own clearly.

- **L.7.5:** Demonstrate understanding of figurative language, word relationships, and nuances in word meanings.

Design Thinking Standards (Integrated):

1. **8.2.8.ED.1:** Evaluate the function, value, and aesthetics of a system or product from different perspectives.
2. **8.2.8.ED.3:** Develop a proposal for a solution to a real-world problem.
3. **8.2.8.ITH.1:** Explain how technology influences political, economic, social, and cultural issues.
4. **8.2.8.NT.3:** Examine a system, consider how parts relate, and redesign it for another purpose.

Unit Objectives:

- Deepen understanding of the themes of *The Outsiders* (identity, community, and conflict).
- Explore the relationships between social divisions and technology's role in shaping culture.
- Use design thinking to create a project that addresses themes of conflict resolution or community building.
- Strengthen skills in textual analysis, collaborative discussions, and persuasive writing

Unit Outline:

Week 1

Day 1: Introducing *The Outsiders*

- **Objective:** Introduce key themes and the concept of identity and social divisions.
- **Activity:** Students complete a pre-reading activity exploring personal identity and stereotypes. Discuss the social groups (Socs vs. Greasers) in the novel.
- **Standards:** RL.7.3, SL.7.1, 8.2.8.ED.1.

Day 2: Analyzing Conflict

- **Objective:** Identify and analyze the central conflicts in *The Outsiders*.
- **Activity:** Read selected chapters, focusing on conflicts between characters and groups. Students map conflicts (character vs. character, society, self) using a graphic organizer.
- **Standards:** RL.7.1, RL.7.3, 8.2.8.ITH.1.

Day 3: Theme Development

- **Objective:** Explore how themes of identity and belonging develop throughout the novel.
- **Activity:** Analyze key passages where Ponyboy reflects on his identity. Write a response discussing how these themes are relevant today.
- **Standards:** RL.7.2, W.7.1, 8.2.8.ITH.2.

Day 4: Collaborative Discussions

- **Objective:** Discuss the impact of setting on character behavior and societal divisions.
- **Activity:** In small groups, students discuss how the setting (1960s Tulsa) influences the story. Groups create a Venn diagram comparing 1960s technology/culture with today.
- **Standards:** SL.7.1, RL.7.3, 8.2.8.ITH.2.
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Day 5: Design Thinking Challenge – Introduction

- **Objective:** Define a real-world problem inspired by themes in *The Outsiders* (e.g., bullying, conflict resolution).
- **Activity:** Brainstorm challenges faced by the characters. Students work in teams to select a problem and develop a design proposal.
- **Standards:** 8.2.8.ED.3, SL.7.1.

Week 2

Day 6: Prototyping Solutions

- **Objective:** Develop and model solutions to promote community and reduce conflict.
- **Activity:** Teams create prototypes for their solutions (e.g., an app for conflict resolution, a community-building activity).
- **Standards:** 8.2.8.ED.3, 8.2.8.NT.3.

Day 8: Evaluating Trade-offs

- **Objective:** Evaluate trade-offs and refine prototypes based on feedback.
- **Activity:** Peer review session where teams present G-slides. Feedback focuses on trade-offs between effectiveness, practicality, and aesthetics.
- **Standards:** 8.2.8.ED.6, SL.7.1.

Day 9: Final Presentations

- **Objective:** Present final projects and analyze their relevance to *The Outsiders* themes.
- **Activity:** Teams present their refined G-slides and connect them to the novel's themes.
- **Standards:** W.7.1, SL.7.1, 8.2.8.ED.3.

Day 10: Reflection and Writing

- **Objective:** Reflect on lessons from the novel and the design process.
- **Activity:** Students write an essay explaining how their design addresses a modern-day issue connected to *The Outsiders* and its themes.
- **Standards:** W.7.1, L.7.5, 8.2.8.ITH.1.

Assessment:

- **Formative:** Participation in discussions, graphic organizers, and presentations.
- **Summative:** Final presentation, reflective essay, and theme analysis writing assignment.
- **Potential Essay Revision and Rewrite**

Grade Level: 8
Unit Title: Exploring Acceleration: Forces and Motion in Action
Duration: 2 Weeks

AASL Integration:

The **Exploring Acceleration: Forces and Motion in Action** Grade 8 science unit connects strongly with AASL Standards by emphasizing inquiry, collaboration, and critical thinking as students investigate acceleration and apply design thinking to real-world physics challenges. Specifically:

1. **AASL I.A.1 & I.B.1:** Students "formulate questions about a curricular topic" and "use evidence to investigate questions" as they conduct experiments to explore the effects of forces and mass on acceleration. For example, students analyze data collected from their experiments with ramps, carts, and weights to build a deeper understanding of Newton's laws of motion.
2. **AASL III.B.2 & III.D.3:** During the collaborative design challenge to create a vehicle that demonstrates acceleration, students "develop new understandings through engagement in a learning group" and "collaboratively identify innovative solutions to a challenge." Teams brainstorm, prototype, and iterate designs while sharing and integrating diverse perspectives.
3. **AASL V.A.3 & V.B.1:** The iterative design process requires students to "engage in inquiry-based processes for personal growth" and "problem-solve through cycles of design, implementation, and reflection." By repeatedly testing and refining their vehicles, students develop resilience and a growth mindset while applying scientific principles to improve their designs.
4. **AASL VI.C.1 & VI.C.2:** During presentations, students "adapt and communicate learning products with others" and "act on feedback to improve" their final vehicle prototypes. This emphasizes the importance of effectively sharing their findings and integrating constructive criticism to enhance their solutions.
5. **AASL I.D.4 & I.C.1:** As students explore the broader implications of acceleration and Newton's laws in real-world contexts (e.g., transportation, space exploration), they "use reflection to guide informed decisions" and "determine the need to gather information" to enhance their understanding of physics and its applications.
6. **AASL II.B.2 & II.D.2:** By analyzing how their findings apply to broader societal needs, such as sustainable transportation or efficient engineering solutions, students "evaluate a variety of perspectives during learning activities" and "demonstrate interest in other perspectives during learning activities," fostering a sense of relevance.

NGSS Standards:

- **MS-PS2-2:** Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object.
- **MS-PS2-3:** Ask questions about data to determine the factors that affect the strength of electric and magnetic forces.

- **MS-ETS1-1:** Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution.
- **MS-ETS1-2:** Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

Design Thinking Standards (Integrated):

1. **8.2.8.ED.1:** Evaluate the function, value, and aesthetics of a system from the perspective of the user and the producer.
2. **8.2.8.ED.3:** Develop a proposal for a solution to a real-world problem that includes a model.
3. **8.2.8.ED.6:** Analyze how trade-offs can impact the design of a product.
4. **8.2.8.NT.1:** Examine a malfunctioning system and propose solutions.
5. **8.2.8.NT.3:** Examine a system, consider how parts relate to each other, and redesign it for another purpose.
6. **8.2.8.ITH.1:** Explain how technology influences political, economic, social, and cultural issues.

Unit Objectives:

- Understand the concepts of speed, velocity, and acceleration and how they are related to forces.
- Apply Newton’s laws of motion to real-world scenarios.
- Use design thinking to build and test a model that demonstrates acceleration.
- Analyze data to identify patterns and refine solutions.

Unit Outline:

Week 1

Day 1: Introduction to Motion and Acceleration

- **Objective:** Understand the basics of speed, velocity, and acceleration.
- **Activity:** Conduct a mini-lab where students roll a ball down a ramp, measuring speed and calculating acceleration.
- **Standards:** MS-PS2-2, 8.2.8.ED.1.

Day 2: Newton's Laws of Motion

- **Objective:** Explore how forces affect motion and acceleration.
- **Activity:** Demonstrate Newton's laws with hands-on activities (e.g., tug-of-war, pushing carts with different weights).
- **Standards:** MS-PS2-2, 8.2.8.ITH.1.

Day 3: Variables in Acceleration

- **Objective:** Investigate how mass and force influence acceleration.
- **Activity:** Students design an experiment using ramps, carts, and weights to test how mass impacts acceleration. Record and analyze data.
- **Standards:** MS-PS2-2, 8.2.8.ED.3.

Day 4: Introducing the Physics Project

- **Objective:** Define the design challenge: Build a model that demonstrates acceleration effectively.
- **Activity:** Introduce the project criteria: Teams must create a vehicle that accelerates under various forces (e.g., gravity, elastic energy).
- **Standards:** MS-ETS1-1, 8.2.8.ED.6.

Day 5: Brainstorming and Sketching Designs

- **Objective:** Plan vehicle designs and identify potential challenges.
- **Activity:** Teams brainstorm designs, sketch models, and list materials needed. Discuss trade-offs in their designs.
- **Standards:** MS-ETS1-2, 8.2.8.ED.6.

Week 2

Day 6: Building the Model

- **Objective:** Construct a prototype vehicle based on team designs.
- **Activity:** Teams use materials like cardboard, rubber bands, and weights to build their vehicles.
- **Standards:** 8.2.8.ED.3, 8.2.8.NT.1.

Day 7: Testing and Data Collection

- **Objective:** Test prototypes and collect data on acceleration under different conditions.
- **Activity:** Students measure acceleration by adjusting variables such as ramp height and applied force. Record observations in a table.
- **Standards:** MS-PS2-2, MS-ETS1-2, 8.2.8.NT.1.

Day 8: Evaluating and Iterating Designs

- **Objective:** Refine prototypes to improve acceleration.
- **Activity:** Analyze test data to identify strengths and weaknesses in designs. Teams modify their vehicles to optimize acceleration.
- **Standards:** 8.2.8.ED.6, 8.2.8.NT.3.

Day 9: Final Demonstrations and Presentations

- **Objective:** Present final vehicles and explain the physics behind their performance.
- **Activity:** Teams demonstrate their vehicles and give a short presentation discussing how they applied Newton's laws and design trade-offs.
- **Standards:** MS-ETS1-1, 8.2.8.ED.1.

Day 10: Reflection and Connection to Real-World Applications

- **Objective:** Reflect on the unit and connect concepts to real-world scenarios (e.g., transportation, space exploration).
- **Activity:** Students write a reflection on what they learned about acceleration and the design process. Discuss how these concepts apply to engineering in daily life.
- **Standards:** MS-ETS1-2, 8.2.8.ITH.1.

Assessment:

- **Formative:** Data from ramp experiments, participation in discussions, and initial prototype designs.
- **Summative:** Final vehicle presentation, written reflection, and analysis of design trade-offs and acceleration concepts.