TABLE OF CONTENTS

I. Mission & Introduction
II. STEAM at ASE
III. Project Based Learning Initiative
IV. STEAM Professional Development
V. ASE Project Based Learning Model
VI. STEAM School Culture

- STEAM Approach
  a. School-wide STEAM “STEAM for Everyone.”
  b. Share and Shine
  c. Technology integration
    i. Online student portfolio

- STEAM Integrated into Curriculum
  a. Project Based Learning (PBL) integration to Curriculum

    b. STEAM Pathways
      a. Summer Camps

- STEAM Partnerships and Outreach
  c. STEAM as Part of GT/Honor Program

- Campus-wide STEAM Events
  b. STEAM festival
  c. Campus-wide STEAM competitions
  d. Clubs and after-school STEAM-day celebrations
  e. STEAM
Mission Statement

Mission of the Albuquerque School of Excellence (ASE) is to provide a safe and collaborative environment which will cultivate the academic and social development for all students regardless of their socio-economic status by emphasizing math, science, and technology for the purpose of students setting and meeting higher education goals.

STEAM at ASE

ASE’s instructional approach strives for equity by providing a rigorous, challenging STEAM curriculum to serve all students, a focus on formative assessment, and a culture of high expectations and support. ASE’s STEAM curriculum is student-centered and inquiry-based and matches the focus of the NGSS and College Ready Standards on rigor, depth, and higher-order skills such as conceptual understanding and application. In addition, we emphasize mastery of 21st century skills that all students will need to be successful in college and career.

Project Based Learning (PBL)

ASE’s unique approach to implement Project Based Learning (PBL) is a nationally recognized model adopted from Harmony Public Schools. The ASE approach is to maintain the focus on standards-based and student-centered teaching while enriching and extending the learning of students through PBL projects. The goal is to promote not only collaborative skills and student ownership of learning but also to promote student success in state and national standards.
STEAM Professional Development

Teacher quality is a key determinant of student achievement and strong content knowledge is crucial to effective teaching. Professional development is a key strategy for upgrading the skills of the existing teachers, particularly for teachers who are not highly qualified.

To date, efforts to improve the content knowledge and instructional practices of mathematics and science teachers have been limited in scope but very well received by teachers in the United States. ASE believes that professional development is a critical instrument to ensure the quality of teaching science and mathematics.

Our STEAM training model has two major components; the mastery of content knowledge and effective use of instructional practices. Firstly, we target to enhance the content knowledge of teachers before we work on improving their instructional practices.

STEAM School Culture

ASE STEAM program also provides strategies and resources for schools to build STEAM culture preparing students for college and career readiness. STEAM culture creates a variety of opportunities for students to take STEAM education “beyond the classroom” and see how today’s instruction connects to career and lifelong learning. Examples include campus-wide STEAM festivals, science fairs, STEAM Expo exhibitions, STEAM related competitions, online student portfolio, internships, and career fairs.
Program Overview

The Project Based Learning initiative, first launched during the 2013-2014 school year by Harmony Public Schools, addresses the increased need for students to acquire 21st century skills. Through Project Based Learning (PBL), students are exposed to deep learning experiences that are inquiry based, student-centered, and integrated to the curriculum. The ASE approach is to maintain the focus on standards-based and student-centered teaching while enriching and extending the learning of students through PBL projects. The goal is to promote not only collaborative skills and student ownership of learning but also to promote student success in state and national standards.

What is Project-Based Learning?

Project Based Learning is an instructional approach that emphasizes collaboration and personalized learning. In project-based learning, student groups engage in meaningful inquiry that are of personal interest to them. These problems are real-life oriented, curriculum-based, and often interdisciplinary. Learners decide how to approach a problem and what activities or processes they will perform. They collect information from a variety of sources, analyze, synthesize and derive understanding from it. The real-world focus of PBL activities is central to the process because it motivates students and adds value to their work. Their learning is connected to something real and involves life skills such as collaboration and reflection. Technology enables students and teachers in various phases of the PBL process. At the end of the PBL, students demonstrate their newly acquired knowledge and are evaluated by how much they have learned and how well they communicate it. Students also conduct self-evaluation to
assess their own growth and learning. Throughout this process, the teacher's role is to guide and advise students, rather than to direct and manage student work.

**What are the components of Project-Based Learning?**

According to the Buck Institute for Education there are eight essential components of meaningful PBL experiences. These essentials are summarized below.

1. **Significant content:** The project focuses on important knowledge and concepts derived from the standards and targets essential understanding in the course. Students should find the content to be significant in terms of their own lives and interests. A well designed PBL is an effective vehicle for understanding content more deeply than by traditional methods such as lectures and textbooks.

2. **A Need to Know:** Teachers powerfully activate students’ need to know content by launching a project with an “entry event” that engages student interest and initiates questioning. The entry event can be anything that sparks student inquiry such as a video, a discussion, a guest speaker, a field trip, a laboratory experience, etc. In contrast, announcing a project with a packet of papers will likely not create excitement and an atmosphere of active learning. Simply telling students that they should learn something because they will need it later does not motivate them. With a compelling student project, the reason for learning relevant material becomes personal and purposeful to the student.

3. **A Driving Question:** After the discussion and brainstorming, students create a Driving Question to focus their efforts. A good Driving Question captures the heart of the project in clear, compelling language. The Question should be provocative, open-ended, complex, and
linked to the core of what we want students to learn. It could be abstract, concrete, or focused on solving a problem. The Driving Question allows students to understand why they are undertaking a project as well as the sequence of activities that ensues from their personal challenge.

4. **Student Choice and Voice:** Students’ interest is captured by a challenging question that is selected and crafted by the students. This provides the student Choice to the project. The requirements of the projects such as project report, digital and oral presentations, visual demonstrations etc. provide Student Voice to the project. The Student Choice and Voice makes the project meaningful to the students. The more Voice and Choice for the student, the greater the ownership of the learning will be. However, projects should be designed with the extent of student choice that best fits each student. On the limited-choice end of the scale, learners can select what topic to study or choose how to design, create, and present products. As a middle ground, teachers might provide a limited menu of options to prevent students from becoming overwhelmed by choices. On the “the more the better” end of the scale, students can decide what product they will create, what resources they will use, how they will structure their time or even their topic and Driving Question.

5. **21st Century Skills:** Collaboration is central to the PBL learning experience. A project should give students opportunities to build valuable 21st century skills such as collaboration, communication, critical thinking, and the use of technology, which will serve them well in the workplace and in life. Once students have decided on the Driving Question, they form teams of three or four and begin planning how they would work together. Each team regularly pauses to review their progress. Teachers can help grow these collaboration skills by using team building
techniques and time/task organizers. Teachers in a Project Based Learning environment also assess these skills and provide frequent opportunities for students to assess themselves.

6. Inquiry and Innovation: Brainstorming sessions as a class helps students generate new ideas and questions. Student team discussion allows opportunities to fine-tune their own Driving Questions and to discuss resources and procedures. Students find project work to be more meaningful if they conduct real inquiry that begins with their own questions, leads to a search for resources and the discovery of answers, and which ultimately leads to generating new questions, testing ideas, and drawing their own conclusions. With real inquiry comes innovation – a new answer to a Driving Question, a new product, a new solution to a problem. Students are not expected to simply reproduce provided information in a pretty format. The teacher’s task is to create the context for real inquiry in the classroom and to guide students through the process.

7. Feedback and Revision: As students develop their ideas and products, student teams use rubrics and exemplars to review and critique one another’s work. The teacher checks research notes, reviews rough drafts and plans, and meets with teams to monitor their progress. The mentoring process of monitoring and feedback is formalized and structured so all student teams have guidance from their teacher throughout the duration of the project. Students learn through this mentoring that first attempts do not always result in high quality and that revisions are a frequent feature of real-world work. In addition to providing direct feedback, a teacher coaches students in using rubrics or other sets of criteria to critique one another’s work. Teachers can
arrange for experts or adult mentors to provide feedback, which is especially meaningful to students because of the source.

8. Publicly Presented Product: Student teams present their findings, conclusions, and solutions to audiences such as peers, parents, representatives of community, business, government organizations and professionals from various industries. Students answer questions and reflect on how they completed the project, next steps they might take, and what they gained in terms of knowledge and skills and pride. When they present their work to a real audience, they connect to real life through their PBL projects. These projects become authentic when the process replicates real-life tasks and students are no longer observers but participants in real life experiences.

What is Standards-Focused PBL?

There is no one accepted definition of PBL. However, BIE defines standards-focused PBL as a systematically teaching method that engages students in learning knowledge and skills through an extended inquiry process structured around complex, authentic questions and carefully designed products and tasks. This definition encompasses a spectrum ranging from brief projects of one to two weeks based on a single subject in one classroom to year long, interdisciplinary projects that involve community participation and adults outside the school. More important than the definition itself are the attributes of effective projects. You will find that the BIE planning model is based on a number of criteria that distinguish carefully planned projects from other extended activities in the classroom.
Outstanding projects…

- Recognize students’ inherent *drive to learn*, their capability to do important work, and their need to be taken seriously by putting them at the center of the learning process.

- Engage students in the central concepts and principles of a discipline. The project work is *central* rather than peripheral to the curriculum.

- Highlight provocative issues or questions that lead students to *in-depth exploration of authentic and important topics*.

- Require the use of essential *tools and skills*, including technology, for learning, self-management, and project management.

- Specify *products* that solve problems, explain dilemmas, or present information generated through investigation, research, or reasoning.

- Include *multiple products* that permit frequent feedback and consistent opportunities for student to learn from experience.

- Use *performance-based assessments* that communicate high expectations, present rigorous challenges, and require a range of skills and knowledge.

- Encourage *collaboration* in some form, either through small groups, student-led presentation, or whole-class evaluations of project results.

The BIE model for PBL also addresses a singular need in the field of PBL: to create *standards-focused* projects that fit well with the era of accountability and performance. Often projects have been used as fun or change-of-pace events completed after students have been pushed through homework assignments, lectures, and tests.
**In standards-based PBL, students are pulled through the curriculum by a Driving Question or authentic problem that creates a need to know the material.** The Driving Question is tied to content standards in the curriculum, and assessment is explicitly designed to evaluate the students’ knowledge of the content.

Similarly, Project Based Learning is sometimes equated with inquiry-based or experiential learning. Though PBL shares some overlapping characteristics with these two terms, standards-focused PBL is designed to acknowledge the importance of standards and evaluation of student learning. In an era of accountability, with testing and performance uppermost in the minds of parents and educators, it is imperative that all instructional methods incorporate high standards, rigorous challenges, and valid assessment methods.

**References**


**ASE Project Based Learning Model**

The Project Based Learning initiative launched during the 2013-2014 school year by ASE Public Schools, addresses the increased need for students to acquire critical-thinking, problem-solving, collaboration and communication skills, otherwise known as 21st century skills. Albuquerque School of Excellence has service contract with ASE and following ASE education model and will be implementing ASE PBL program this year. Through Project Based Learning (PBL), students are exposed to deep learning experiences that are inquiry based, student-centered, and integrated to the curriculum. The ASE approach is to maintain the focus on standards-based and student-centered teaching while enriching and extending the learning of students through PBL work. The goal is to promote not only collaborative skills and student ownership of learning but also to promote student success in state and national standards.

ASE implements the PBL program in grades 6th through 12th in 2015-2016. There are 3 different levels of PBL program, Level I,II & III

In Middle School, ASE will implement Level I & II and in High School Level I,II & III.

**Middle School**: Students will prepare level I projects as a small group in following subjects; English, Social Studies, Art, Math & Science. All students in middle school will prepare level II projects in Math and/or Science throughout the year.
**High School:** Students will prepare level I projects as a small group in following subjects; English, Social Studies, Art. All students in high school will prepare level II/III projects in Math and/or Science throughout the year.

**Level I:** Level I is a short term project that targets 21st century skills within the context of the curriculum. Middle school ELA/S.Studies/Art teachers will have students complete at least one PBL project in class each semester. Some of the major features of the Level I PBL projects are outlined below:

- The projects are based on the standards covered within the context of the curriculum as described by the scope and sequence of the course.
- The projects are conducted as in-class group projects. Student groups of 3-4 students are recommended.
- The time required for completion of projects should be no more than one week.
- PBL teacher guides and training for effective planning and integration of the PBL projects into the curriculum will be provided at the start of the school year.
- The teachers will provide relevant information, timelines, documents, assessment rubrics and guidance for the successful completion of projects to their students in a timely manner.
- Upon completion of project, students are expected to produce a three dimensional display as well as a digital presentation of their work.
Level II & III: Students will complete one interdisciplinary PBL project during the academic year. Upon completion of the PBL project, students will be required to produce:

- a digital story complete with pictures, video, sound and narration.
- a google site explaining their projects
- a brochure for their project including QR codes for movie and website link.
- Students will post their movie presentation to their YouTube Channel.
- Both movie and handout will be inserted in student’s Google Site.
- There is a Technology Rubric for the evaluation of PBL digital stories at this level.
- WeVideo will be recommended as the software tool for creating PBL digital stories at this level. However, students will have a choice to select from other digital storytelling software such as Photostory 3, iMovie, Animoto, and Windows Live Movie Maker.
- Training materials including video tutorials are prepared for students and teachers at this level. The training materials will be on how to use WeVideo and other popular software for creating digital stories. The video tutorials will be hosted through www.nmsteam.org website.
- ASE Students’ PBL digital stories will be sent to the Digital Storytelling Contest (DISTCO) automatically.
- DISTCO system will host students’ PBL digital stories for future review and access.

ASE-PBL program customizes and individualizes the PBL experience for its students while incorporating the research from successful PBL programs into the design and structure. Technology is integrated into every phase to enable students to progress and complete PBL projects successfully while learning life skills. The STEAM focus of the ASE-PBL program
Albuquerque School of Excellence

allows the growth and acquisition of 21st Century skills. A framework of the ASE-PBL program for middle and high school is shown below.

### PBL Framework

#### Middle School

<table>
<thead>
<tr>
<th>Levels</th>
<th>Content/Courses</th>
<th># of Projects</th>
<th>Allotted Time</th>
<th>Structure</th>
<th>Technology Integration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level I</td>
<td>English</td>
<td>1 Project each Semester</td>
<td>4 weeks</td>
<td>Group work (3-4 students per group)</td>
<td>1 Digital Photo Gallery Presentation per semester</td>
</tr>
<tr>
<td>Level I</td>
<td>Math</td>
<td>1 Project each Semester</td>
<td>4 weeks</td>
<td>Group work (3-4 students per group)</td>
<td>1 Digital Photo Gallery Presentation per semester</td>
</tr>
<tr>
<td>Level I</td>
<td>Social Studies</td>
<td>1 Project each Semester</td>
<td>4 weeks</td>
<td>Group work (3-4 students per group)</td>
<td>1 Digital Photo Gallery Presentation per semester</td>
</tr>
<tr>
<td>Level I</td>
<td>Art</td>
<td>1 Project each Semester</td>
<td>4 weeks</td>
<td>Group work (3-4 students per group)</td>
<td>1 Digital Photo Gallery Presentation per semester</td>
</tr>
<tr>
<td>Level I</td>
<td>Science</td>
<td>1 Project each Semester</td>
<td>4 weeks</td>
<td>Group work (3-4 students per group)</td>
<td>1 Digital Photo Gallery Presentation per semester</td>
</tr>
<tr>
<td>Level II</td>
<td>Math/Science with integrated ELA, Social Studies, &amp; Technology</td>
<td>1 Inter-disciplinary Project each Year</td>
<td>1st Semester</td>
<td>Individual</td>
<td>Presentation through video, website and brochure + (DISTCO Contest)</td>
</tr>
</tbody>
</table>
## High School

<table>
<thead>
<tr>
<th>Levels</th>
<th>Content/Courses</th>
<th># of Projects</th>
<th>Allotted Time</th>
<th>Structure</th>
<th>Tech. Integration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level I</td>
<td>English</td>
<td>1 Project each Semester</td>
<td>4 weeks</td>
<td>Group work (3-4 students per group)</td>
<td>1 Digital Photo Gallery Presentation per semester</td>
</tr>
<tr>
<td>Level I</td>
<td>Math</td>
<td>1 Project each Semester</td>
<td>4 weeks</td>
<td>Group work (3-4 students per group)</td>
<td>1 Digital Photo Gallery Presentation per semester</td>
</tr>
<tr>
<td>Level I</td>
<td>Social Studies</td>
<td>1 Project each Semester</td>
<td>4 weeks</td>
<td>Group work (3-4 students per group)</td>
<td>1 Digital Photo Gallery Presentation per semester</td>
</tr>
<tr>
<td>Level I</td>
<td>Art</td>
<td>1 Project each Semester</td>
<td>4 weeks</td>
<td>Group work (3-4 students per group)</td>
<td>1 Digital Photo Gallery Presentation per semester</td>
</tr>
<tr>
<td>Level I</td>
<td>Science</td>
<td>1 Project each Semester</td>
<td>4 weeks</td>
<td>Group work (3-4 students per group)</td>
<td>1 Digital Photo Gallery Presentation per semester</td>
</tr>
<tr>
<td>Level II</td>
<td>Math/Science with integrated ELA, Social Studies, &amp; Technology</td>
<td>1 Inter-disciplinary Project each Year</td>
<td>1st Semester</td>
<td>Individual</td>
<td>Presentation through video, website and brochure + (DISTCO Contest)</td>
</tr>
</tbody>
</table>
MIDDLE SCHOOL

Language Arts / Social Studies/Art

Level I

Level I is a short term project that targets 21st century skills within the context of the curriculum.

Middle school ELA/S.Studies students will complete at least one PBL project in class each semester. Some of the major features of the Level I PBL projects are outlined below:

- The projects are based on the standards covered within the context of the curriculum as described by the scope and sequence of the course.
- The projects are conducted as in-class group projects. Student groups of 3-4 students are recommended.
- The time required for completion of projects should be no more than four week.
- PBL teacher guides and training for effective planning and integration of the PBL projects into the curriculum will be provided at the start of the school year.
- The teachers will provide relevant information, timelines, documents, assessment rubrics and guidance for the successful completion of projects to their students in a timely manner.
- Upon completion of project, students are expected to produce a three dimensional display as well as a digital presentation of their work.
- The respective teachers using provided rubrics will complete project assessment in each of the core content areas.

Mathematics

Level I

Level I Mathematics PBLs are embedded into the math curriculum as an introduction or enrichment activity. The activities require group work and teachers’ special attention when monitoring students. Once students finish working in groups, teachers should pick different solution and organizing methods of students and let them to present in the class. The utmost goal of the teacher is to relate different solution methods and tie all the work done to the objectives of that curriculum unit. All of the projects are aligned with Common core and they are implemented in the class. With these activities, students improve their group work skills and their ability to explain and justify their solutions.
Science

Level I
Level I investigations are curriculum based learning experiences that are essential activities in the course. These activities are part of the lesson; usually the “Elaborate” phase of a lesson designed according to the 5E Instructional model. Within the context of Level I, the students learn how to plan an investigation, implement it, analyze data and report/present their findings and conclusions. Additionally, students learn how to collaborate, engage in self-evaluation and work as responsible citizens in the classroom.

No additional work is required of the teacher other than to monitor and guide students towards successful learning outcomes.

These activities will be completed in class during the school year according to the scope and sequence of the course. Since these activities are meant to serve as a spark to student inquiry, student presentations and discussion of conclusions on real life applications must be an integral part of classroom instruction.

Math & Science

Level II
These are semester-long projects that students begin during the first quarter of the course and complete by the end of the first semester. The projects conform to all attributes of Project Based Learning described in the information section earlier. Students will complete the Level II project in addition to the curriculum based Level I investigations. Level II projects should provide opportunities for the students to engage in meaningful inquiry of personal interest at greater depth.

Students who have a difficult time coming up with project ideas and driving questions on their own, may receive help from the teacher with such ideas. The classroom “explore” and “engineering connections” activities, as well as the Level I projects, scaffold students into the first phase of a project. They provide a choice of thought provoking activities that will allow the students to generate driving questions which they can investigate on their own. However, with Level II, students will be asked to create and develop their project from start to finish on their own, or with a partner, and with some support from the teacher.
In Level I, the teacher provides the time, space, and supervision for the student to complete the laboratory activities. In level II, the teacher will provide structure via checkpoint deadlines for work increments. In both Levels I and II, the teacher guides and mentors the students in a timely manner through various phases of the project. The timeline will aid the student as well as the teacher in keeping track of time and will allow for efficient completion without unnecessary stress at the end of the year.

Level II PBLs in middle school are Math/Science projects with integrated English, Social Studies components.

**ELA Connection:** Students will select one of the following options (journal, argumentative essay, narrative essay, newspaper, or interview) to complete during the process of developing their Level II project, or will obtain ELA teacher permission to pursue a different option. This ELA piece will be assessed with a common rubric. Specific deadlines will be determined by the ELA teacher.

**Social Studies Connection:** Students in grades 6-8 will be asked to choose a driving question from their Math or Science course. It is then up to the student to investigate the connections the project has to social studies issues. The selection of a driving question and the social studies connections should be determined by the conclusion of the first quarter. Below are 6 ways a student can find the social studies connections to their level II and III PBLs.

1. **Historical Connection:** Students should be encouraged to examine the historical connections to a math or science problem. They can do this by exploring an event in the past that might be related to the discovery, or an effect of the discovery on an event that had happened as a result. For example, if a student is investigating air pressure, they can include how air pressure is related to the discovery of flight. (From the discovery of hot air balloons in the 18th century, all the way through space travel).

2. **Economic Influence:** Students can connect a scientific discovery with its economic impact. For example they can explain the discovery of radio waves, and the impact
that has had on business and trade. Or explain how a new product has revolutionized an industry (GM Foods) or has caused the destruction of an existing economy.

3. **Political influence:** Students could investigate the role politics plays in their topic of choice. They can trace the influence governments have on funding particular research programs or how much funding is directed towards developing new scientists. Conversely, students could explore how science influences politics, such as the discovery of “greenhouse gases”.

4. **Geographical influence:** Students can look at how their topic can be observed in the natural world, and investigate if geography is an influence. As volcanos, geysers and hurricanes all have geographical influences students can make these connections and explain how these forces can affect all of us.

5. **Effect of change on Society:** Students can show how the topic of their project has influenced the way we live. Students investigating the development of computers, and show how this technology has revolutionized our whole world. Or how discoveries in the medical fields have changed the life expectancy, and what impact this has on culture.

6. **Legal impact:** Students can also look at how scientific and mathematical discoveries have impacted our legal sySTEAM. The discovery of Steam power directly led to the Gibbons Vs. Ogden Supreme court case which decided several aspects of federal power in the United States.

**HIGH SCHOOL**

**Chemistry**

**Level I**
Chemistry Level I investigations are curriculum based learning experiences that are essential activities in the course. These activities may be part of the lesson; usually the “Elaborate” phase of a lesson designed according to the 5E Instructional model. Within the context of Level I, the students learn how to plan an investigation, implement it, analyze data and report/present their findings and conclusions. Additionally, the students learn how to collaborate, engage in self-evaluation and to work as responsible citizens in the classroom. These investigations may serve as an “entry event” for a student to design a long-term Level III project.
No additional work is required of the teacher other than to monitor and guide students towards successful learning outcomes. These activities will be completed in class during the school year according to the scope and sequence of the course. The essential activities identified for the chemistry course are –

- Thickness of an oil film
- Percent of salt in sea sand
  1. Empirical formula
  2. Percent yield of a chemical reaction
  3. Heat of reaction
  4. Acid rain

Since these activities may serve as a spark to student inquiry, student presentations and discussion of real life applications must be an integral part of classroom instruction.

**Level II & Level III**

These are semester-long projects that students begin during the first quarter of the course and complete by the end of the first semester. The projects conform to all attributes of Project Based Learning described in the information section earlier. Students will complete either a Level II or Level III project in addition to the curriculum based Level I investigations. Level II and Level III projects provide opportunities for the students to engage in meaningful inquiry of personal interest at greater depth.

Level II is intended for students who have a difficult time coming up with project ideas and driving questions on their own. Level II scaffolds students into the first phase of the project by providing a choice of thought provoking activities that will allow the students to generate driving questions that they can investigate on their own. Level III applies to students who create and develop their project from start to finish on their own with little support from the teacher.

In Level II, the teacher provides the list of “Study” activities for student selection and also provides the time, space, and supervision for the student to complete the laboratory activities. In both Levels II and III, the teacher guides and mentors the students in a timely manner through various phases of the project. The timeline will aid the student as well as
the teacher in keeping track of time and allows for efficient completion without unnecessary stress at the end of the year.

**Biology**

**Level I**
Biology Level I projects are aligned with the Next Generation State Standards and follows the STEAM SCOPES. Students will complete four level I PBL projects in class through each 9 weeks period. Following PBL investigations will be done in class:

- Lactase Enzyme
- Diffusion and Osmosis
- Blood Typing and Genetics
- Antibiotic Sensitivity Test

**Level II & III**
Biology Level II and Level III are semester-long individual projects that students begin during the first quarter of the course and complete by the end of the first semester. The projects conform to all attributes of Project Based Learning described in the information section earlier. Students will complete either a Level II or Level III project in addition to the curriculum based Level I investigations. Level II and Level III projects provide opportunities for the students to engage in meaningful inquiry of personal interest at greater depth. Level II is intended for students who have a difficult time coming up with project ideas and driving questions on their own. Level II scaffolds students into the first phase of the project by providing a choice of thought provoking activities that will allow the students to generate driving questions that they can investigate on their own. Following categories are available for Level II Biology projects.

- Biomolecules and food
- Biotechnology
- Cell Respiration
- Cells
- Classification
- Diffusion
- DNA
- Enzymes
- Genetics
- Heart
- Homeostasis
- Lungs
- Mitosis
- Meiosis
- Osmosis
- Photosynthesis
- Pill Bug Behavior
- Proteins
- Starch Reserve
- Viruses

In Level II, the teacher provides the list of “Study” activities for student selection and also provides the time, space, and supervision for the student to complete the laboratory
activities. In both Levels II and III, the teacher guides and mentors the students in a timely manner through various phases of the project. The timeline will aid the student as well as the teacher in keeping track of time and allows for efficient completion without unnecessary stress at the end of the semester.

Level III applies to students who create and develop their project from start to finish on their own with little support from the teacher. In this level, students are responsible for finding their own project ideas. For example, they might work on a research project by collaborating with a university professor or other outside mentors. Level III will be very similar to Science Fair Project.

**Physics**

**Level I**

Physics Level I investigations are curriculum based learning experiences that are essential activities in the course. These activities may be part of the lesson; usually the “Elaborate” phase of a lesson designed according to the 5E Instructional model. Within the context of Level I, the students learn how to plan an investigation, implement it, analyze data and report/present their findings and conclusions. Additionally, the students learn how to collaborate, engage in self-evaluation and to work as responsible citizens in the classroom. These investigations may serve as an “entry event” for a student to design a long-term Level III project.

No additional work is required of the teacher other than to monitor and guide students towards successful learning outcomes. These activities will be completed in class during the school year according to the scope and sequence of the course. The essential activities identified for the physics course in each quarter;

1. **Distance vs. Displacement with Graph matching extended activity.**
2. **Impulse Momentum relation in a an elastic collision of PAScars**
3. **Ohms law in serial and parallel DC circuits**
4. **Calculating the index of refraction by Snell’s Law**

Since these activities may serve as a spark to student inquiry, student presentations and discussion of real life applications must be an integral part of classroom instruction.
**Level II & III**

Level II and Level III are semester-long individual projects that students begin during the first quarter of the course and complete by the end of the semester. The projects conform to all attributes of Project Based Learning described in the information section earlier. Students will complete either a Level II or Level III project in addition to the curriculum based Level I investigations. Level II and Level III projects provide opportunities for the students to engage in meaningful inquiry of personal interest at greater depth.

Level II is intended for students who have a difficult time coming up with project ideas and driving questions on their own. Level II scaffolds students into the first phase of the project by providing a choice of thought provoking activities that will allow the students to generate driving questions that they can investigate on their own. Level III applies to students who create and develop their project from start to finish on their own with little support from the teacher.

In Level II, the teacher provides the list of “Study” activities for student selection and also provides the time, space, and supervision for the student to complete the laboratory activities. In both Levels II and III, the teacher guides and mentors the students in a timely manner through various phases of the project. The timeline will aid the student as well as the teacher in keeping track of time and allows for efficient completion without unnecessary stress at the end of the semester.

There is no certain list or handouts for level III. The teacher may prepare a set of project ideas for you to choose, or the students may come with their PBL project idea and driven question which covers the subjects you will learn from math or science classes. It can be:

- in an investigation format
- in a science research project format
- in an engineering or technology project format

Participating in an academic science contest (Robotics, Science Olympiad, etc) may be counted as PBL Level-3 project.
Mathematics

Level I
Level I Mathematics PBLs are embedded into the math curriculum as an introduction or enrichment activity. The activities require group work and teachers’ special attention when monitoring students. Once students finish working in groups, teachers should pick different solution and organizing methods of students and let them to present in the class. The utmost goal of the teacher is to relate different solution methods and tie all the work done to the objectives of that curriculum unit. With this activities, students improve their group work skills and their ability to explain and justify their solutions.

Level II & III
Level II Mathematics PBLs are semester-long projects. Students will pick the topic from a given list of the projects along with the instruction, helpful sites and reflection questions. Students will begin the project at the beginning of the academic year and submit it at the end. Teacher will support the student during the year. Teacher will ask each student to submit a timeline to finish the project, therefore students do not have to rush at the end. Teachers will check students’ progress and give feedback throughout the year. These projects require construction, data collection and analyses, presentation of the findings and reflection on the project. Each project comes with the reflection questions that students have to answer once they finish their projects. Students have to submit the answers of the reflection questions along with the product they have worked on (poster, research report, construction of an objects etc.). The projects are directly intended to apply mathematics in real life. Therefore, students will recognize the use of mathematics upon the completion of their projects.

There is no certain list or handouts for level III. The teacher may prepare a set of project ideas for you to choose, or the students may come with their PBL project idea and driven question which covers the subjects you will learn from math or science classes.

English/Language Arts

Level I
The instructional model at ASE is guided through the lens of Project Based Learning (PBL). Instruction has moved from short term knowledge retention to long term retention by
Albuquerque School of Excellence

integrating 21st Century learning experiences and embedding state standards such as listening, speaking, reading, and writing as well as citizenship. These real life experiences will prepare ASE students for future expectations of our society and workforce. The goal is to promote not only collaboration skills and student ownership of learning but also to promote student success in state and national standards.

**Level II & III**

Level II projects are the year-long individual math or science projects that students begin during the first quarter of the course and complete by the end of the course. Students will complete the Level II project, including its cross-curricular requirements, in addition to the curriculum based Level I investigations.

Level II projects should provide opportunities for the students to engage in meaningful inquiry of personal interest at greater depth by creating and developing their own driving questions and projects, with some support from the teacher.

Students will select one of the following options (journal, argumentative essay, narrative essay, newspaper, or interview) to complete during the process of developing their Level II project, or will obtain ELA teacher-permission to pursue a different option. This ELA piece will be assessed with a common rubric. Specific deadlines will be determined by the ELA teacher.

**Social Studies**

At the High School level, students will have two PBL projects to complete each year (One per Semester) at level 1, as well as several Social Studies components to be include in the level II and III PBL projects.

Some examples of the driving questions at this level are:

World Geography: "compare life in a variety of urban and rural areas in the world to evaluate political, economic, social and environmental changes”

**Driving Question**: What distinctions can be drawn between Brazil and Houston on changes to the urban environment?

World History: "identify major causes and describe the major effects of important turning points in world history from 1750-1914...the Scientific Revolution** Driving Question**: What were some effects of the Scientific Revolution in the 16th century on Western Culture?
U.S. History/11: “analyze social issues affecting women, minorities, children, immigrants, urbanization, the Social Gospel, and philanthropy of industrialists” (1877-1898)

**Driving Question:** Were industrial philanthropists of the late 1800s robber barons or generous benefactors?

**Level II & III**
Level II & III PBLs in high school are Math/Science projects with integrated English and Social studies components. Students in grades 9 – 12 will be asked to choose a driving question from their Math or Science course. It is then up to the student to investigate the connections the project has to social studies issues. The selection of a driving question and the social studies connections should be determined by the conclusion of the first quarter. Below are 6 ways a student can find the social studies connections to their level II and III PBLs.

1. **Historical Connection:** Students should be encouraged to examine the historical connections to a math or science problem. They can do this by exploring an event in the past that might be related to the discovery, or an effect of the discovery on an event that had happened as a result. For example, if a student is investigating air pressure, they can include how air pressure is related to the discovery of flight. (From the discovery of hot air balloons in the 18th century, all the way through space travel).

2. **Economic Influence:** Students can connect a scientific discovery with its economic impact. For example they can explain the discovery of radio waves, and the impact that has had on business and trade. Or explain how a new product has revolutionized an industry (GM Foods) or has caused the destruction of an existing economy.

3. **Political Influence:** Students could investigate the role politics plays in there topic of choice. They can trace the influence governments have on funding particular research programs or how much funding is directed towards developing new scientists. Conversely, students could explore how science influences politics, such as the discovery of “greenhouse gases”.

4. **Geographical Influence:** Students can look at how their topic can be observed in the natural world, and investigate if geography is an influence. As volcanos, geysers and
hurricanes all have geographical influences students can make these connections and explain how these forces can affect all of us.

5. Effect of change on Society: Students can show how the topic of their project has influenced the way we live. Students investigating the development of computers, and show how this technology has revolutionized our whole world. Or how discoveries in the medical fields have changed the life expectancy, and what impact this has on culture.

6. Legal impact: Students can also look at how scientific and mathematical discoveries have impacted our legal system. The discovery of Steam power directly led to the Gibbons Vs. Ogden Supreme court case which decided several aspects of federal power in the United States.

STEAM Culture

- STEAM Approach

ASE STEAM has a comprehensive approach to STEAM education. This approach can be found in the everyday school culture, integrated into curriculum, and highlighted during campus-wide STEAM events. ASE communicates its STEAM efforts to its stakeholders and plans partnerships and outreach activities. ASE’s flagship events I-SWEEEP and STEAM Education Week represent the celebration and culmination of ASE STEAM.

ASE’s beliefs on STEAM education are as follows:

a. School-wide STEAM - “STEAM for everyone.”

ASE targets the entire student body for STEAM education and embraces a school-wide STEAM approach. STEAM is not only for those who have an interest or skill to pursue STEAM majors. The “Every ASE student is a STEAM advocate” approach allows students to, regardless of their ability and major interest, engage and experience success with STEAM, increase their STEAM awareness and become STEAM advocates.
b. Share and Shine

ASE STEAM believes that students become actively engaged in STEAM, share their work in collaborative and social settings, and shine through presentations, displays, and competitions. The ASE STEAM Share and Shine approach makes STEAM engagement socially desirable for students.

c. Technology Integration

ASE STEAM employs technology integration to comply with the 21st century standards. ASE STEAM acknowledges the role of technology literacy in mastery of content knowledge, development of scientific inquiry and mathematical processes, and interdisciplinary projects. Students use technology as they conduct their research, communicate and collaborate with others, and present their final products, e.g. video clip, online student portfolio, etc.

- STEAM Integrated into Curriculum

ASE students are exposed to deep learning experiences through various STEAM programs that are integrated to the curriculum such as Project Based Learning (PBL) initiative, a large spectrum of science, engineering, math, and technology course offerings and opportunities for research and competition.

i. Science Research and Participation in Regional/State Fairs

ASE Science curriculum incorporates project-based learning at multiple levels. It requires students to perform self-initiated research using scientific inquiry and experimentation.

In middle school, all students complete research projects as a part of PBL Level-2. Successful projects are selected through campus-wide science fairs for students to continue their research by participating at regional, state, national, and international levels to compete with other projects. To produce more advanced projects, the ASE helps potential middle school students to get connected to research groups at local universities and labs.

In high school, students experience scientific research as part of Scientific Research and Design curriculum. Students taking this course are connected to higher education institutions and submit a paper at the end of the year to receive credit. Successful students conducting
PBL Level-3 projects may continue their research by competing at science fairs. The ASE connects these students with professors and researchers at local universities for more in-depth research.

ASE students participate in the following science research competitions:

- INTEL ISEF Affiliated Regional and State Science Fairs
- International I-SWEEEP Science Project Olympiad organized by ASE Public Schools in Houston, TX (www.isweeep.org)
- Intel International Science and Engineering Fair organized by Society for Science and the Public (www.societyforscience.org/isef/)
- Google Science Fair (www.googlesciencefair.com)

**ii. Robotics Program/ Robotics Competitions**

The objective of the Robotics program is to foster interest and competence in science, mathematics, and computers, while developing problem-solving skills, enabling creative thinking and design, and providing a domain for the application of scientific concepts. Students learn and apply the scientific, mathematical, and technological fundamentals behind the construction of robots and the design of control algorithms. They also develop some daily life skills as they build robotic creations such as visual reasoning, problem solving, teamwork, cooperation, and self-discipline.

Technology teachers and qualified parents serve as mentors during the robotics events at the schools. Technology teachers receive intensive summer training to develop robotics teams on their campuses

**Robotics Kits**

- LEGO Mindstorms Education Base Set
- LEGO Education Resource Set
- TETRIX® Set by Pitsco
- VEX Robotics Sets

**Robot Programming Software**

- NXT-G – graphical programming
- ROBOTC
- EasyC
- LabVIEW
Participation in Robotics Events
Robotics teams engage in various in-house (organized by ASE Public Schools) and external Robotics events. Students compete in various contests and participate in STEAM exhibitions and conferences to demonstrate and present their work.

External Events:

FLL, FTC, FRC
www.usfirst.org

Best
http://www.bestinc.org

Vex
http://www.vexrobotics.com/

Ecobot
http://www.ecobotchallenge.com
http://robotevents.com

Robo Rave
http://roboquerque.org/

iii. MathCounts

MATHCOUNTS is a national enrichment, club, and competition program that promotes middle school mathematics achievement through grassroots involvement in every U.S. state and territory. MATHCOUNTS is one of the country’s largest and most successful education partnerships involving volunteers, educators, industry sponsors and students.

ASE Public Schools participate in the MATHCOUNTS program at regional and state levels and prepare students for these competitions through MathCounts Clubs as part of the Gifted and Talented Program. ASE students generally outperform at regional and state. The schools utilize pull-out schedules and after school programs to operate the MATHCOUNTS Clubs. ASE Math department provides resources and training for teachers who coach the clubs.
• Campus-wide STEAM Events

  a. STEAM Festivals

The goal of STEAM festivals is to stimulate the interest of our students, parents, and public in STEAM by organizing fascinating, exciting, educational, and entertaining activities in our schools. Each year, all ASE high school campuses organize a STEAM festival to showcase students’ various STEAM products. Local influential people, parents, and public are invited to STEAM festivals as we celebrate the success and hard work of our students.

Students present a variety of STEAM projects in these festivals some of which include:

  o Year-long PBL projects
  o Science Research and Engineering Projects
  o Exciting STEAM demonstrations, hands-on activities, and experiments
  o Robotics shows
  o Arts Show

  b. Campus-wide STEAM Competitions

i. School-wide Science Fair

Each year, All ASE middle school campuses organize a campus-wide science and engineering fair in which students display their year-long science research projects and compete against their peers. Local influential people, parents, and public are invited to visit the fair. Schools also invite engineers, doctors, educators, and other professionals to judge the students’ projects.

ASE Academic Department provides necessary guidelines, training, resources and support to the schools for a successful event organization.
ii. **STEAM Activity competitions**

In addition to STEAM festival and science fair organization, interested students participate in various STEAM competitions throughout the school year. These events take place as part of the after-school program. Students join the contests in teams or as an individual. Some of the competitions are listed below:

- Spaghetti Bridge
- Popsicle Stick Bridge
- Mousetrap Car Race
- Water Rocket
- Tower Building
- Water Rocket Car
- Motor Man
- Scientific T-Shirt Design
- Science Photo Contest
- Hatching Egg Activity
- Insect Collection Activity
- ...etc.

iii. **Online Technology contests** (Web site design, movie contest, science photo contest)

- **Website design contest**: As the high school students work on their PBL projects, they develop a website about their projects. Upon the completion of their website, their teachers can submit these website designs to the ASE website contest that includes different categories like science, math, engineering, and technology.

- **Video Production Competition**: Each middle and high school student prepares their digital presentation in video format. Upon the completion of their product, students can participate in ASE video production contest. There are also campus-wide video production competitions during the year.

- **Science/math photo contests** are held in some of the campuses. Winners also participate in nationwide photo contests like [AAPT High School Physics Photo Contest](#).
c. Clubs and After-School STEAM-day Celebrations

- **STEAM Clubs**: After school clubs provide students with opportunities to improve their STEAM projects with extensions, present their PBL projects in school days, and prepare journals, photo albums, posters, and movies of STEAM activities in the school.

- **STEAM-day Celebrations**: These are subject-specific, week-long events such as Mole Day, Pi ($\pi$) Day, Physics Week, and Biology Week. During those days, each department organizes different activities and competitions on campus. They can also be considered as STEAM-day celebrations or preparation times for STEAM festivals.

d. STEAM summer camps

STEAM summer camps are held as part of leadership camps during the summer. Several fun and hands-on activities are planned for students to engage them in STEAM.

STEAM web site

Although, it is considered challenging to reach all stakeholders at once with equal strength, a comprehensive STEAM website is used as a tool to disseminate the STEAM message publicly. It is important that STEAM website have features to be updated regularly. A comprehensive STEAM website contains most of the following menu items if not all.

i. **About**: Introductory statement of the organization including mission, vision, and STEAM efforts is shared publicly at this section that serves as a reference point.

ii. **STEAM Programs**: The STEAM curriculum documents including guides, scope and sequence, unit plans, sample lesson plans, and additional resources are uploaded at the STEAM website for easy access by all stakeholders at all levels. ASE Public School use the STEAM websites as a STEAM library to maximize the benefit from curriculum resources and documents.

iii. **STEAM Activities**: ASE believes in the necessity of “share and shine” approach in promoting the STEAM education. STEAM activities of any kind are promoted on this section publicly. STEAM stories, STEAM field trips, STEAM speakers, STEAM programs, and STEAM classroom activities are shared under this section.
iv. **STEAM Partnerships:** Collaboration and partnerships are key elements in sustaining and promoting STEAM education. This section serves as a tool for building and improving the STEAM network for the organization. We partnership with business community, governmental agencies, local educational agencies, higher education institutes, and industrial companies for STEAM education.

v. **STEAM Resources:** Resources for teachers, parents, and students are shared publicly in order to support STEAM education. This section is open to any type of resources including video libraries, and links to other STEAM resources. Parents, students, and faculty are directed to information on STEAM-related websites, resources, careers, college programs, community partnerships, STEAM projects, and scholarship opportunities.

vi. **STEAM Showcase:** The ASE “share and shine” approach requires a showcase for STEAM activities and STEAM efforts. Best practices are shared in various formats including videos, picture presentations, or featured articles. Because this section is considered a very dynamic part of the website, the showcase needs to be updated with new material at least weekly if not daily.

vii. **STEAM Research:** It is critical to support STEAM education with the latest research. Reports, newspaper articles, or journal articles related to STEAM are shared under this tab in accordance with the relevancy of the research.

viii. **STEAM Competitions:** Participation in STEAM competitions is encouraged due to ASE’ strong emphasis on hands-on and inquiry-based learning activities. ASE encourages students to participate in local, regional, and national STEAM competitions such as science fair, mathcounts, science olympiad, robotics, etc. Brief information regarding STEAM competitions along with links of additional information serves as a guide to increase participation in STEAM competitions. These STEAM competitions are advertised to encourage participation and involvement by sharing previous experiences in STEAM-related competitions.

x. **Contact:** Contact information for STEAM personnel is shared for easier and better communication.
b. Social network, e.g. Facebook, Twitter, YouTube channel, etc.

Social media is used effectively and heavily to keep the STEAM communication exciting. Different types of news regarding high quality STEAM education is shared daily with the audience. Innovations, advancements in technology, local and regional STEAM events, and announcements are considered part of daily social media materials. These tools integrate younger generations with STEAM education as they are more technology savvy than adults. ASE uses Twitter, Facebook, YouTube channel, and blogs to spread the word out.

a. STEAM Presentations to School Visitors

ASE utilizes STEAM presentations to school visitors to establish a network of supporters and advocates for STEAM education through outreach activities. ASE establishes VIP teams at campus level formed by students who display their STEAM skills through demonstrations, experiments, projects, and activities to school visitors. These presentations could take place in science labs or robotics labs. It is very important to link classes of today with careers of tomorrow during these presentations.

• STEAM Partnerships and Outreach

ASE STEAM emphasizes the role of partnerships and outreach activities in the development of STEAM culture. The following programs have their unique contributions to foster STEAM culture in our schools.

ASE STEAM partners with T-STEAM centers, colleges, and universities in the areas of mentoring, research, professional development, and dual credit courses. Industry and community partners provide internship, service learning opportunities, and support for other projects.

STEAM Expo and presentations in major events such as conferences, legislative sessions, etc.

ASE STEAM seizes every opportunity for its students to showcase their work and provide STEAM outreach and advocacy to their peers, educators, and legislators. Students interact with community in STEAM context through STEAM Expo events, exhibits, and presentations.

Robotics Competition, over a hundred astonishing science demonstrations and activities, and amazing chemistry shows.