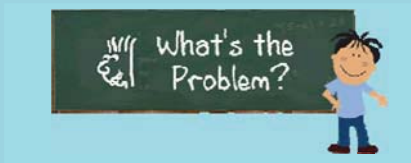
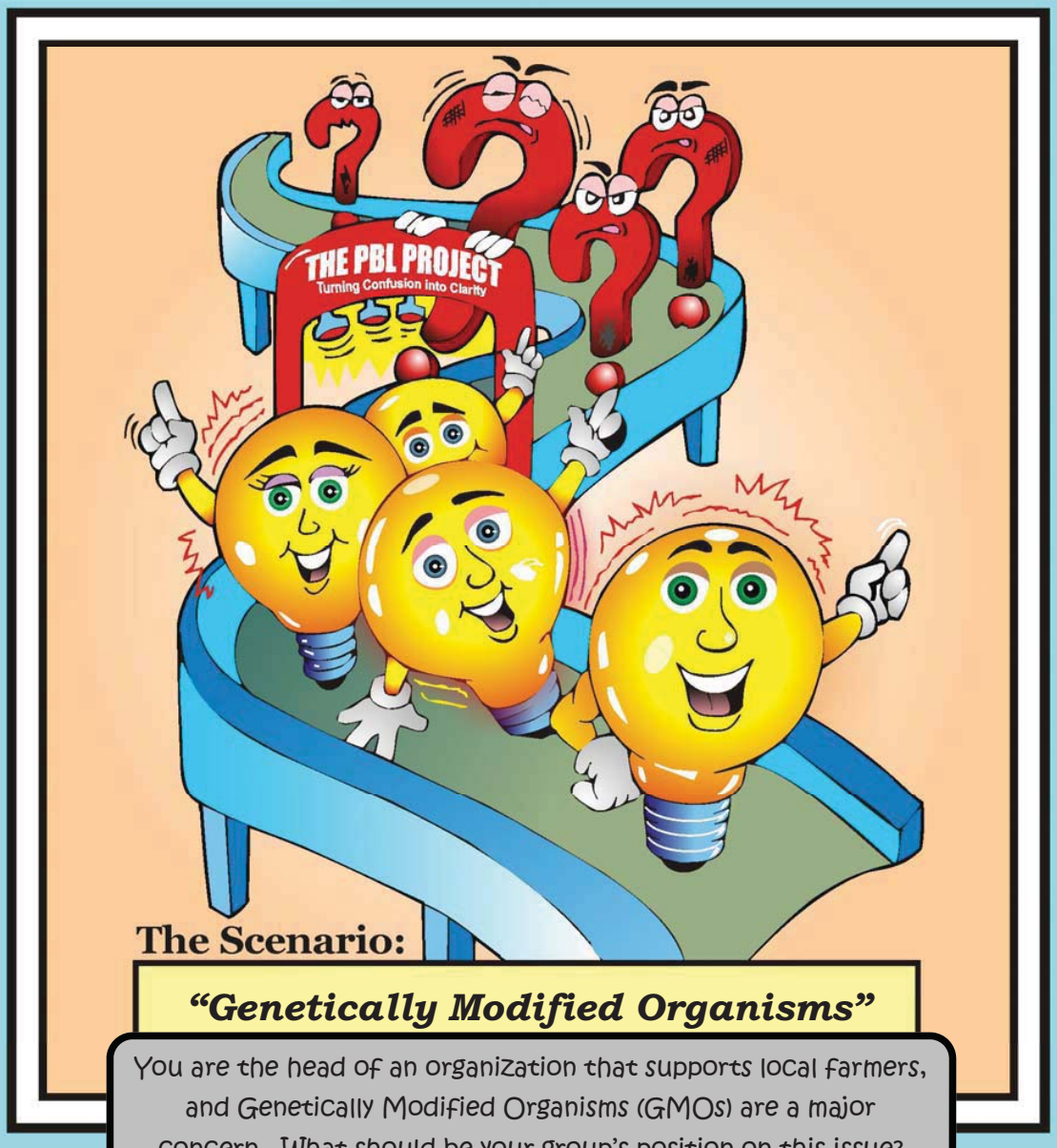
THE PBL PROJECT

Problem-Based Learning. Done Right. Finally.



Integrated Problem Scenarios
Middle School / Secondary



The Scenario:

"Genetically Modified Organisms"

You are the head of an organization that supports local farmers, and Genetically Modified Organisms (GMOs) are a major concern. What should be your group's position on this issue?

*** Features engaging and real-world scenarios**
*** Integrates all core subjects**
*** Includes all teacher and student resources**
*** Provides a full overview of Problem-Based Learning**

Problem-Based Learning. Done Right. Finally.

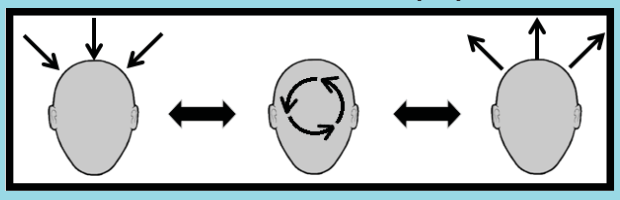
It's an important part of an educator's job to make sure students leave the classroom fully prepared for their lives ahead and equipped with 21st century skills (i.e. skills that focus on communication, organization, technology, and problem-solving). We use these skills every day. Unfortunately, they are often overlooked as students work to absorb names and dates, facts and figures.

That's why **Problem-Based Learning** is so important. It allows students to tackle a scenario that goes beyond a "yes" or "no" answer. In doing so, students will review a variety of resources related to the topic (articles, videos, statistics, infographics, etc.), engage in classroom discussion, and organize their thoughts as they evaluate the information. After all this, they will have a chance to respond to the challenge and defend their approach.

It won't be easy, but it will be very engaging. Best of all, this process will help develop a wide variety of skills that students will use the rest of their lives!

The 1-2-3 of Problem-Based Learning

When faced with any problem, challenge, or situation, students need to be prepared to:



Step 1
Absorb the information

Step 2
Evaluate the information

Step 3
Generate the response

This book will walk teachers and students through the following Problem Scenario:

The Main Problem Scenario:

You are the head of an organization that supports local farmers, and Genetically Modified Organisms (GMOs) are a major concern. What should be your group's position on this issue?

You will approach this Main Problem from several points-of-view

The Math Angle

Is the amount of food being grown enough to feed the population?

The Science Angle

What is the science behind GMOs, and what are the potential results?

The Social Studies Angle

Why are GMOs controversial, and how is the public reacting to scientific changes in agriculture?

In the end, you will take all you've learned and give your final response to the Main Problem.

★ *Language Arts serves as the hub for the entire exercise. It is in ELA that all of the other "subject angles" are evaluated and measured against one another, and a final decision about how to approach the Main Problem is made based on all of the available information.*

www.pblproject.com

Homecourt Publishers

A Note to the Teacher:

If there was something about the cover or title of this book that interested you enough to pick it up and turn to this page, then you probably already know what we are going to say. The truth is that, in today's world, students must leave the classroom equipped with 21st century skills and ready to meet the challenges of real life. One of the best ways to meet these demands is through interdisciplinary **Problem-Based Learning** scenarios. This type of classroom instruction promotes communication, collaboration, curiosity, organization, and problem-solving skills . . . all major components of any reputable set of standards.

The Problem-Based scenarios in this book integrate Language Arts, Math, Social Studies, Science, and other content areas. They offer educators a chance to shift the work of learning from the teacher to the students, where it belongs. If we wish to prepare a generation of students to solve real-world problems, we simply must give them real-world problems to solve… Problem-Based Learning is the way to accomplish this task.

So, let's get ready to begin! Enjoy,

Your Friendly Editors

Table of Contents

What are the key features?

When carri[illegible]rrectly, a classroom that revolves around Problem-Based Learning has [illegible]flow[illegible]d l[illegible] of engagement that is hard to match with any lesson that begins with "[illegible]*t to p[illegible]17[illegible]n your textbook.*" Listed below are characteristics that you'll notice in [illegible]las[illegible]t is workin[illegible] on a Problem-Based Scenario like the one offered in this book:

T[illegible]PBL[illegible]cklist

- ☑ Students focus on con[illegible]nt [illegible]t[illegible][illegible]ant to them in **real-world scenarios**
- ☑ The **teacher serves as the medi[illegible], [illegible]d [illegible]udents are in charge** of managing, planning, and executing t[illegible]ask
- ☑ Students demonstrate **21st Century Skill[illegible]** (collaborating, researching, communicating, etc.)
- ☑ Instead of a single answer, students consider **mu[illegible]e points-of-view**, and search for **evidence to suppor[illegible]eir views**
- ☑ Knowledge, skills, and information **integrates across multiple subjects**
- ☑ **Students respond in a variety of ways**, creating "products" that go beyond writing an answer to a single question

What are misconceptions?

T[illegible] "Problem-Based Learning" (along with any of the related ones on page 6) is o[illegible]n [illegible] ou[illegible] context or with no clear idea in mind. As a result, both critics and su[illegible]cte[illegible] the[illegible] trategy commonly identify PBL with characteristics that simply aren't true. Here[illegible] some common misconceptions we've run across:

M[illegible]ic[illegible]tions of Problem-Based Learning

The misconcept[illegible]: "T[illegible]s[illegible] no wrong answer."

The truth: ***A Problem-[illegible]ed [illegible]enari[illegible]ill not have a single, "correct" answer. However, a[illegible] sp[illegible]e[illegible] [illegible] logical and where no effort has been made to suppo[illegible]a "[illegible]g" answer.***

The misconception: "Problem-[illegible]ed [illegible]ng is just the hot topic that is currently gaining mom[illegible]m (i.e. it's a fad)."

The truth: ***Problem-Based Learning has been ar[illegible]or generations, and will be around for many more. It is becomi[illegible]ore essential in a world where facts are instant and effortless, mak[illegible]"thinking" a [illegible]werful skill.***

The misconception: "Problem-Based Learning isn[illegible]out 'facts'."

The truth: ***You always have to have the facts right. However, [illegible]today's world, finding facts on any topic is usually just a click away. It's what you do with those facts that matters—that's Problem-Based Learning.***

The misconception: "The learning really begins when students are given a problem they've never considered before."

The truth: ***There are few things in life that aren't a "problem" (What should I buy at the store? Where should we go on vacation? What can we do this weekend?). The skills of Problem-Based Learning can be developed with all of these.***

The Main Problem:

Here is the Problem-Based Learning scenario that is the focus of this guide:

You are the head of a professional organization that supports local farmers. You are aware that Genetically Modified Organisms (GMOs) are a heavily debated topic within agriculture and throughout your community. You want to do what is best for the farmers you represent and for the public in general. What are the issues involved with GMOs, and what is the best position for your organization?

Of course, every significant challenge in life needs to be looked at from several points-of-view. For the Problem-Based Scenario in this book, the different "points-of-view" have been divided into a math angle, a science angle, and a social studies angle. Then, in Language Arts, all points-of-view are evaluated in an integrative approach.

Obviously, life isn't so cleanly divided into subject areas. Remember the visual that you saw on page 12:

School

Life

It's certainly a challenge—impossible, actually— to have "real life" teaching to a box that fits the academic schedule. Still, having students review a problem from several angles (even if they are neatly divided along subject lines) helps them understand that problems are multi-dimensional, made up of pieces so complex that they must be evaluated on their own. Only after all of the pieces have been individually examined can the problem be properly approached as a whole.

So, each "subject angle" is one piece of the puzzle. That's not to say they aren't plenty challenging in their own right. In fact, they are wonderful exercises for math, or science, or social studies class, even if you never have a chance to get into the other subject points-of-view.

Now we're ready to begin. The page to the right outlines the "subject angles" that we've created for the Problem-Based Scenario in this book.

The “Subject Angles”:

In order to properly respond to the Main Problem, it is important to consider multiple points-of [illegible] Below are several angles from which to approach the problem.

The Math Angle:

Is the amount of food being grown enough to feed the population?

Students will review data about [illegible] and food distribution, and decide on the issue of food scarcity from a mathematical perspective.

The Science Angle:

What is the science behind GMOs, and what are the potential results?

Students will review the science behind Genetically Modified Organisms, and decide on the potential (both good and bad) of this new innovation.

The Social Studies Angle:

Why are GMOs controversial, and how is the public reacting to scientific changes in agriculture?

Students will review the debate over Genetically Modified Organisms and determine what is fueling the controversy and which arguments are the most sound.

★ **Language Arts** serves as the hub for the entire exercise. It is in ELA that all of the other “subject angles” are evaluated and measured against one another, and a final decision about how to approach the Main Problem Scenario is made based on all of the available information.

Math Standards

As students work through this section of our Problem-Based Scenario, they'll be focusing on several mathematical content areas. This includes:

Student Handout

- **Data Analysis**
- **The Number System**

In addition—and perhaps more importantly—students will need to take on a mathematical frame of mind (in grades 3-5, this is referred to as the "Standards for Mathematical Practice"), which they'll benefit from in Problem-Based Learning. This means that students will need to:

- **Make sense of problems and persevere in solving them.**
- **Reason abstractly and quantitatively.**
- **Construct viable arguments and critique the reasoning of others.**

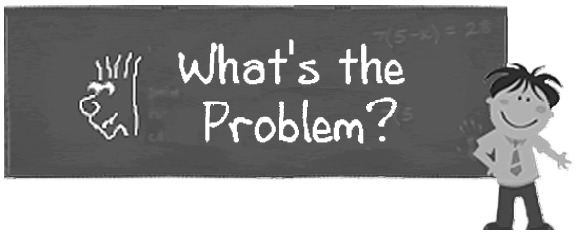
You may want to share the goals listed above with your students prior to beginning the exercise, but the best part is that they'll be developing these skills whether they realize it or not!

The most important thing to remember when introducing the Problem-Based Scenario is to grab student interest right away. It is a fun and challenging exercise, and you certainly want students to approach it that way.

To make this easy for you, we have created a handout to introduce the "math angle" to your students for this Problem-Based Scenario. This will help them see that they will be looking at the Main Problem Scenario from a specific point-of-view, in this case with a mathematical focus.

Make photocopies of the next page to introduce the "Math Angle" of this Problem-Scenario to your students

The MATH ANGLE



Are you ready to tackle the problem?

The Scenario:

You are the head of a professional organization that supports local farmers. You are aware that Genetically Modified Organisms (GMOs) are a heavily debated topic within agriculture and throughout your community. You want to do what is best for the farmers you represent and for the public in general. What are the issues involved with GMOs, and what is the best decision for your organization?

In order to properly respond to a complicated problem like the one above, you must view it from different points-of-view. In this case, we will consider the following:

Something to think about:

Is the amount of food being grown enough to feed the population?

Prior to giving your response, you will review multiple resources, engage in classroom discussion, and take time to organize your thoughts.

In this exercise, you will review data about hunger and food distribution, and decide on the issue of food scarcity from a "numbers" perspective.

★ *As you work on this exercise, remember that this is primarily a **mathematics question**. This means that numbers, statistics, and calculations will be needed to support your ideas!*

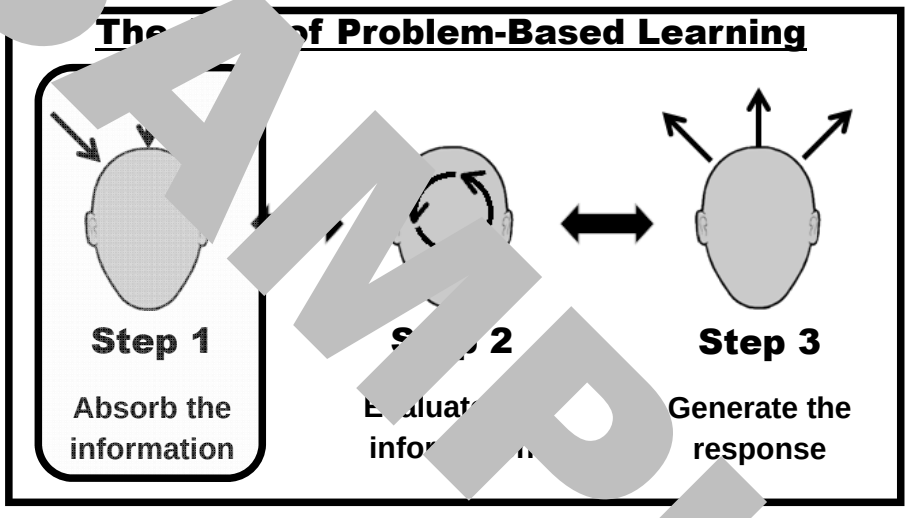
Teacher Instruction Sheet

Problem-Based Scenario

- **Section 1** - Stimulus Review
- **Section 2** - Classroom Discussion
- **Section 3** - Student Response
- **Section 4** - Grading & Analysis

Stimulus Review

The Stimulus Review is ***Section 1*** *on your* ***Teacher Instruction Sheet.***



The MATH ANGLE

It's a fancy term, but the "Stimulus Review" is simply t step in Problem-Based Learning where students review a variety of information ounding th specific problem or challenge.

In our Problem Scenario, all of the Stimulus Items have been pro for y We have intentionally gathered a variety of different types and sources. Th important in today's modern world where information comes from all directio and also sets the stage for Step 2 (Evaluating the Information).

A few examples of the types of Stimulus Items you might see in a Problem-Based Scenario include:

- **Articles**
- **Videos**
- **Infographics**
- **Blogs**
- **Statistics**
- **Lists**
- **Websites**
- **Editorials**
- **Audio Recordings**
- **Cartoons**
- **Primary Sources**
- **Advertisements**

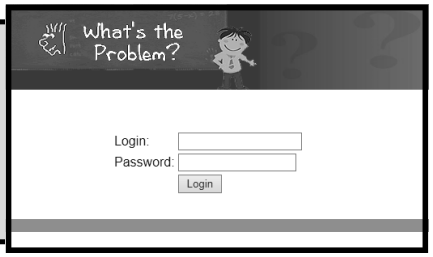
...and much more!

For your convenience, we've placed all of the Stimulus Items for this Problem-Based Scenario on a special website where **both you and your students** can have full access to them. To access these resources, you will go to:

http://w[illegible]oblproject.com/students

Login: [illegible]

Passwo[illegible]



The Stimul[illegible]you[illegible]ee for this section of the exercise include:

Stimulus Ite[illegible]#1

— "A Look at H[illegible]" [illegible]graphic)

Stimulus Item #2

— "Hunger Stats" (statistics)

Stimulus Item #3

— "The Power of GMOs" (article)

A Few Notes:

There are a few things we'd like to highlight as your students get ready to dive into the Stimulus Items. First, these are actual sources that have been gathered for the topic at hand, even if they have been edited or adapted at times due to length, format, or readability. That means that they don't necessarily reflect our personal opinions, and we certainly don't want to take credit for the hard work of others (all source information will be provided). It does, however, provide a nice mix for your students.

Next, the Stimulus Items should give your students the background information they need to generate their responses to the Problem-Based Scenario. There is no need for you to seek out other resources or for students to do their own research.

With that said, it is always great if there is an opportunity for students to get on a computer or head to the library to find their own background information. Being able to conduct your own research is a vital skill to have, and it is referenced throughout Language Arts standards.

Again, this extra step is not necessary to successfully go through the exercise (we know you're already crunched for time!), but we figured it was worth mentioning!

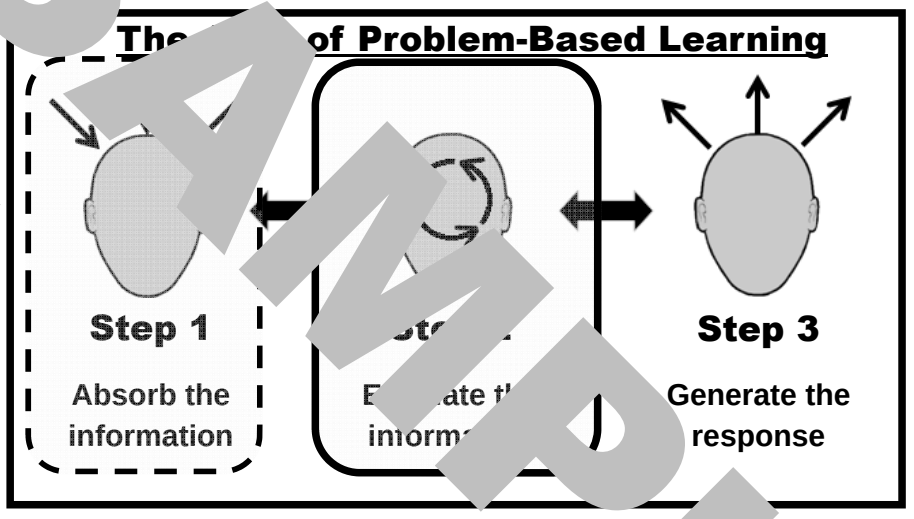
Teacher Instruction Sheet

Problem-Based Scenario	
Section ① -	Stimulus Review
Section ② -	Classroom Discussion
Section ③ -	Student Response
Section ④ -	Grading & Analysis

Classroom Discussion

The Classroom Discussion is **Section 2** *on your* ***Teacher Instruction Sheet.***

Teacher "Quick Sheet"

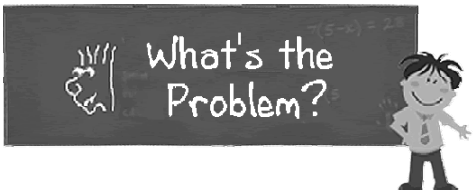


The MATH ANGLE

Now that your students have reviewed the Stimulus Iten a fitting time to have a **class discussion** about the Problem-Based Scenario (sp fically, the "st ct angle" that you're working with).

At this stage, there will be a limited amount of new information b t to table (Step 1), although you might want to introduce ideas not covered in th imuli, and perhaps students will share original thoughts and experiences. For the mo rt, though, the classroom discussion is where you want students to evaluate the information (Step 2) to which they've been exposed. It is now that they will begin to organize it all and decide how it will fit together in their response.

The key to a classroom discussion, of course, is keeping everything focused and moving it in the direction you want, and at the same time creating a free environment for students to share and build on ideas. This is certainly where teachers earn their pay! One way we've tried to help (a little bit, at least) is to provide you with the talking points that work well for this scenario. The bold questions are what you will ask your students, and each has bullet points that you can use to guide the discussion.



Leading Questions for Classroom Discussion

Genetically Modified Organisms (math angle)

How can simple math and statistics be used to demonstrate how widespread the problem of hunger is?

- Consider data that is important and easy to measure, such as the amount of the hungry people in an area and the supply of food that is available
- Consider other data that is relevant, such as how much food may be wasted or improperly stored or the amount of farmland that is not being utilized to its full potential
- Consider that some important data may be very difficult to measure, such as the number of people who have food insecurity for a short time because they are temporarily out of work, the number of people who rely on their church for help

How is the use of actual numbers and mathematical facts an effective way to convince others of the problem of hunger?

- Consider how calculations about how much food is available compared to the number of hungry people must be made to determine how widespread the problem really is
- Consider that "hard data" (i.e. actual numbers) can be more convincing and support an argument more than just stories and anecdotes that don't have statistical evidence
- Consider how some data can be "more important" to your cause than other data, so it is important to choose the statistics that best represent your argument and will be most useful in convincing others to take action

What other methods—aside from simple math—can be used to capture people's attention about the problem of hunger?

- Consider that sometimes a personal story—or even a picture—can be more effective than statistics in capturing people's emotions and getting them to take action
- Consider that slogans and catchy posters or flyers can catch a person's eye and raise awareness about a subject
- Consider that the combination of statistics and "hard math" with imagery and stories is the most effective way to garner attention and convince people to take action on a certain cause

Teacher Instruction Sheet

Problem-Based Scenario

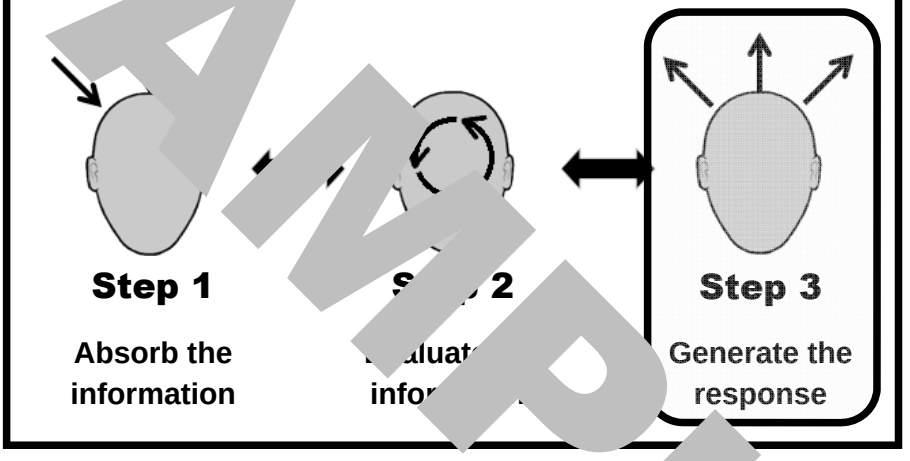
- **Section 1** - Stimulus Review
- **Section 2** - Classroom Discussion
- **Section 3** - Student Response
- **Section 4** - Grading & Analysis

Student Responses
(Extended Response)

The Student Responses are **Section 3** *on your* ***Teacher Instruction Sheet.***

Student Handout

The [illegible] of Problem-Based Learning



The MATH ANGLE

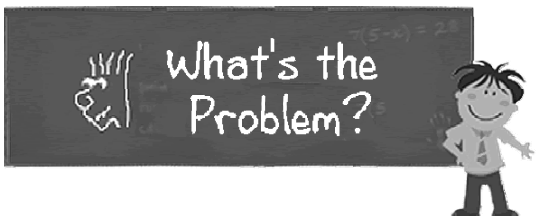
On your Teacher Instruction sheet, you'll see that each scenario provides two types of response options for your students—Extended Response and the Product Option. Let's look at the **"Extended Responses"** first.

As you would expect, the Extended Responses are simply questions relating around the Problem-Based Scenario that the students answer through their writing.

Most likely, the Extended Responses are similar to what you might see during a Performance Task of a comprehensive assessment (where students are given a range of information to review, and then must give their conclusions based on the evidence). The "test prep" benefits alone make it worthwhile for students to complete the Extended Responses, but the broader benefit is their ability to take the information they've been exposed to and generate a logical response to a problem scenario.

The rubric and process for grading Extended Responses is on the following pages. Also, we will leave it up to you whether you want to allow students to use notes they have taken throughout (we think it's fine for them to do so), and also how strict you want to be with time limits (a half hour or so should be fine).

Here are the Extended Response questions for this scenario.



What do you think?

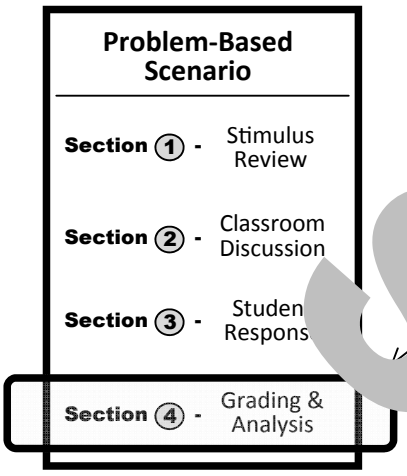
The questions below are centered around the Problem-Based Scenario you've been reviewing. Please answer the questions on separate sheets of paper.

1) **How can simple math and statistics be used to highlight the problem of hunger in America? What other methods can be used to grab people's attention?**

2) **Based on the "numbers", how much of a problem is hunger and food insecurity in the United States? Should GMOs be used if they can increase the amount of food that is grown? Would other strategies work better?**

★ *Remember to support your answers with evidence that you've gathered from what you've read and discussed in class!*

Teacher Instruction Sheet



Grading Rubric
(Extended Responses)

The Grading Rubric is **Section 3** *on your* ***Teacher Instruction Sheet.***

Student Handout

The MATH ANGLE

One thing that your st nts r d erstand about these Problem-Based Scenarios is that the answer is ne y es " n stead, students must think their way through the muddy waters of diffe ar and challenges, while you guide them along the journey.

Of course, the end result needs to be more t o back—and that's why proper grading is so important. While stude may t gr des exist only to cause stress and fill the blank spaces on a report card, the broader t is that when students are graded in a clear and fair way, it enables them to dually improve their approach and response.

The Extended Responses for this scenario can be graded us the to t right. It is divided into four sections:

1) **Math Content** (*What do you want students to bring to the table based on previous ons?)*
2) **Writing Focus** *(Was it clear what point the students were trying to make?)*
3) **Use of Evidence** *(Did the students back up their position with evidence, quotes, statistics, and facts?)*
4) **Language & Conventions** (*Did students limit mistakes and respond in a thorough and professional manner?)*

Here is a copy of the rubric for your students to review.

What's the Problem?

How do I get an A?

Listed below are the four different areas that will be evaluated as your responses are graded. Be sure to consider each area as you write.

Rubric Section #1: **Math Content** – you must show a high level of background knowledge and general understanding of the topic
****in other words:** *What are you bringing to the table based on previous lessons?*

4	3	2	1	NS
You prove[illegible] your response to have a high level of backgro[illegible] knowledge of the subject.	You sho[illegible] r[illegible] und[illegible]ledge [illegible]gh m[illegible] your res[illegible]	You showed a limited level of background knowledge, and only in certain parts of your response.	You showed barely any background knowledge of the subject throughout your response.	Your response was incoherent, off-topic, or unable to be read.

Rubric Section #2: **Production & Distribution of Writing** – you must organize and sustain your writing based on a defined purpose
****in other words:** *Was it clear wha[illegible] trying to make, and did you focus on that point?*

4	3	2	1	NS
Your response had a defined purpose, and it was organized with a clear focus on that purpose.	Your response had a defined purpose, although it lacked organization and a clear focus on that purpose.	[illegible] purpo[illegible] respons[illegible] vague, [illegible]ere v[illegible] limited organization a[illegible] focus.	[illegible] was no defined [illegible]se or organization [illegible]ur response.	Your response was incoherent, off-topic, or unable to be read.

Rubric Section #3: **Integration of Knowledge & Ideas (use of "evidence")** – you must support your arguments and positions with ou[illegible] informati[illegible] "stimulus items")
****in other words:** *Did you back up your position with evidence, qu[illegible]stati[illegible]d [illegible]?*

4	3	2	1	NS
You provided convincing support/evidence for your main idea and included appropriate sources, facts, & details.	You provided adequate support/evidence for your main idea and only limited sources, facts, & details.	You provided only modest support/ evidence for your main idea and it was not strengthened by sources, facts, & details.	You provided a[illegible] support/evidence [illegible] your main idea.	You[illegible] response was incoherent, off-topic, or unable to be read.

Rubric Section #4: **Language & Conventions** – you must use proper grammar, spelling, vocabulary, and other conventions of the English language
****in other words:** *Did you limit mistakes and respond in a thorough and professional manner?*

4	3	2	1	NS
Your response was professional and you demonstrated a command of language conventions.	Your response was mostly professional with limited errors related to language conventions.	Your response was rather sloppy with multiple errors related to language conventions.	Your response was completely sloppy and showed no effort to follow language conventions.	Your response was incoherent, off-topic, or unable to be read.

Science Standards

As students work through this section of our Problem-Based Scenario, they'll be focusing on several science content areas. This includes:

Student Handout

- **Genetics and variations**
- **Science, Engineering & Society**

In addition—and perhaps more importantly—students will need to take on a scientific frame of mind (in academic circles, these are referred to as the "Science and Engineering Practices"), which is a key element of Problem-Based Learning. This means that students will be:

- **Asking questions and defining problems.**
- **Constructing explanations and designing solutions**
- **Engaging in argument from evidence.**
- **Obtaining, evaluating, and communicating information**

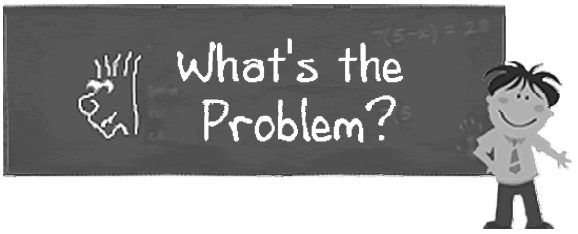
You may want to share the goals listed above with your students prior to beginning the exercise, but the best part is that they'll be developing these skills whether they realize it or not!

The most important thing to remember when introducing the Problem-Based Scenario is to grab student interest right away. It is a fun and challenging exercise, and you certainly want students to approach it that way.

To make this easy for you, we have created a handout to introduce the "science angle" to your students for this Problem-Based Scenario. This will help them see that they will be looking at the Main Problem Scenario from a specific point-of-view, in this case with a scientific focus.

Make photocopies of the next page to introduce the "Science Angle" of this Problem-Scenario to your students

The SCIENCE ANGLE



Are you ready to tackle the problem?

The Scenario:

You are the head of a professional organization that supports local farmers. You are aware that Genetically Modified Organisms (GMOs) are a heavily debated topic within agriculture and throughout your community. You want to do what is best for the farmers you represent and for the public in general. What are the issues involved with GMOs, and what is the best decision for your organization?

In order to properly respond to a complicated problem like the one above, you must view it from different points-of-view. In this case, we will consider the following:

Something to think about:

What is the science behind GMOs and what are the potential risks?

Prior to giving your response, you will review multiple resources, engage in classroom discussion, and take time to organize your thoughts.

In this exercise, you will review the science behind Genetically Modified Organisms, and decide on the potential (both good and bad) of this new innovation.

★ *As you work on this exercise, remember that this is primarily a **science question**. This means that scientific facts will be needed to support your ideas, and you'll also want to maintain a healthy skepticism throughout the exercise!*

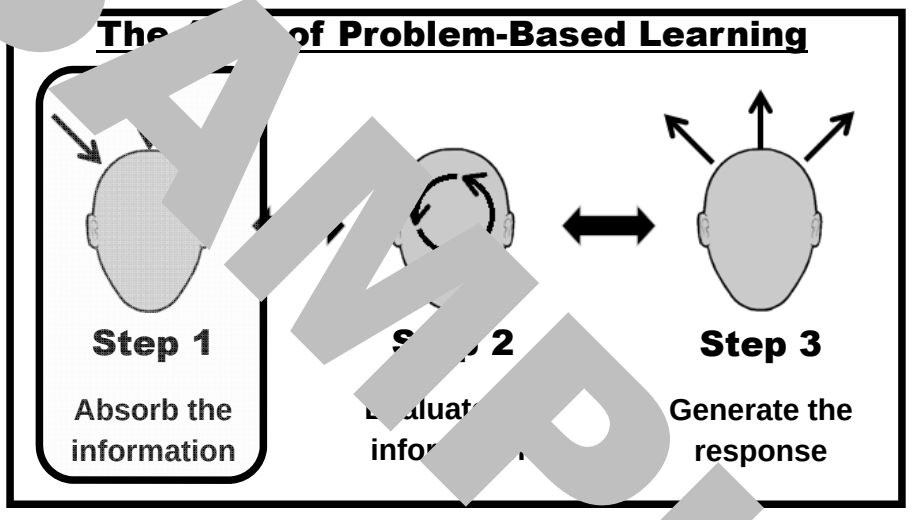
Teacher Instruction Sheet

Problem-Based Scenario

- **Section 1** - Stimulus Review
- **Section 2** - Classroom Discussion
- **Section 3** - Student Response
- **Section 4** - Grading & Analysis

Stimulus Review

The Stimulus Review is ***Section 1*** *on your* ***Teacher Instruction Sheet.***



The SCIENCE ANGLE

It's a fancy term, but the "Stimulus Review" is simply the first step in Problem-Based Learning where students review a variety of information surrounding the specific problem or challenge.

In our Problem Scenario, all of the Stimulus Items have been provided for you. We have intentionally gathered a variety of different types and sources. This is important in today's modern world where information comes from all directions and also sets the stage for Step 2 (Evaluating the Information).

A few examples of the types of Stimulus Items you might see in a Problem-Based Scenario include:

- **Articles**
- **Videos**
- **Infographics**
- **Blogs**
- **Statistics**
- **Lists**
- **Websites**
- **Editorials**
- **Audio Recordings**
- **Cartoons**
- **Primary Sources**
- **Advertisements**

...and much more!

For your convenience, we've placed all of the Stimulus Items for this Problem-Based Scenario on a special website where **both you and your students** can have full access to them. To access these resources, you will go to:

http://[illegible].pblproject.com/students

Login: [illegible]
Password: [illegible]

The Stimulus Items you will see for this section of the exercise include:

Stimulus Item #1
— "GMOs & [illegible]" (article)

Stimulus Item #2
— "GMO Basics" (bullet-point list)

Stimulus Item #3
— "A Scientist's Take on GMOs" (editorial)

A Few Notes:

There are a few things we'd like to highlight as your students get ready to dive into the Stimulus Items. First, these are actual sources that have been gathered for the topic at hand, even if they have been edited or adapted at times due to length, format, or readability. That means that they don't necessarily reflect our personal opinions, and we certainly don't want to take credit for the hard work of others (all source information will be provided). It does, however, provide a nice mix for your students.

Next, the Stimulus Items should give your students the background information they need to generate their responses to the Problem-Based Scenario. There is no need for you to seek out other resources or for students to do their own research.

With that said, it is always great if there is an opportunity for students to get on a computer or head to the library to find their own background information. Being able to conduct your own research is a vital skill to have, and it is referenced throughout Language Arts standards.

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Teacher Instruction Sheet

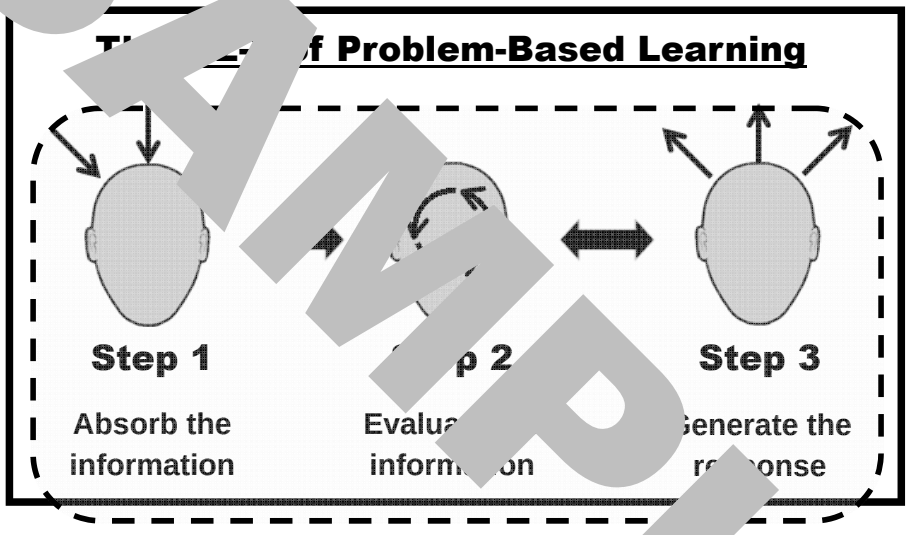
Problem-Based Scenario

- Section ① - Stimulus Review
- Section ② - Classroom Discussion
- Section ③ - Student Response
- Section ④ - Grading & Analysis

"Thought-Gathering" Sheet

The "Thought-Gathering" Sheet is an interim step prior to the student responses.

Student Handout



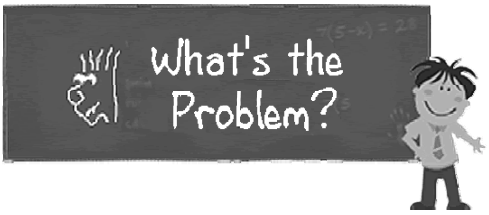
The SCIENCE ANGLE

So, by this point, you've had students review Stimulus I elated to the Problem Scenario. That led to a stimulating (we hope) classroom ssion on t ic.

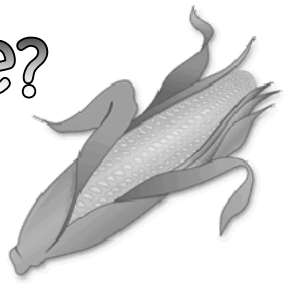
Often times, there is a feeling of "information overload" at this sta de have enough information to generate their constructed responses and/or fu their product options (we'll talk about these on the upcoming pages), but their thou may be all over the place. They may still have to pick their position, refine their arguments, focus their proposal, perfect their design… and so on.

That's where the **"Thought-Gathering" Sheet** comes in. This isn't to be confused with any "note-taking sheets" your students may have written while they were looking through the Stimulus Items or listening to the discussion. Rather, this is a final stage where they sort everything (including their own notes) to prepare for their response. It is a chance to tie together Step 1, Step 2, and Step 3 (shown above).

We have provided a "Thought-Gathering" sheet that works with this exercise and is a good chance for students to organize their ideas prior to creating their responses.



GMOs
Friend or Foe?



"Thought-Gathering" Sheet

What are GMOs?

Your Thoughts

Examples of GMOs:	How GMOs can be used:

Why GMOs are controversial:

Teacher Instruction Sheet

Problem-Based Scenario

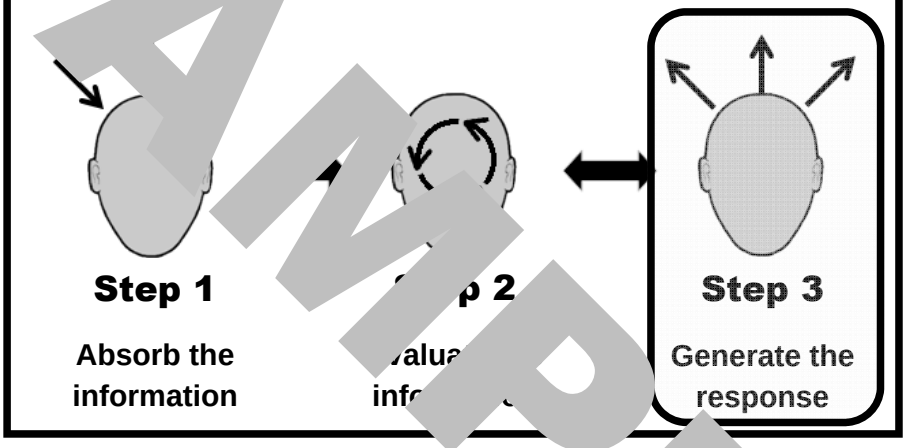
- **Section 1** - Stimulus Review
- **Section 2** - Classroom Discussion
- **Section 3** - Stude… Respon…
- **Section 4** - Grading & Analysis

Student Responses
("Product Option")

The Student Responses are **Section 3** *on your* ***Teacher Instruction Sheet.***

Student Handout

Th… of Problem-Based Learning



It all leads up to this—*"The Product Option."* It is here that …nts will have the "thinking muscle" truly stretched and those 21st Century Skills …oration, communication, technology, and so on) will be finely tuned.

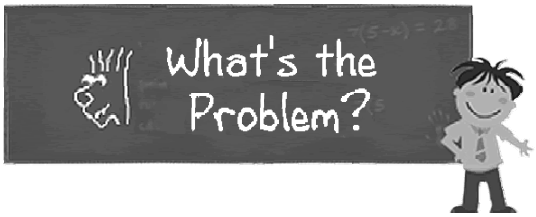
Let's start with a very simple definition:

The Product Option – where students are asked to "produ… so…hing

Yes, this is very broad, and could include any of the following (and so much m…):

Bulletin Board	Advertisement	Chart	Role Play	Tips / Suggestions
Letter	Cartoon	Pop-up / Child Book	Commercial	Slogan / Motto
Comic Strip	Play	Collage	Riddles / Jokes	Marketing Plan
Movie Trailer	Poster / Artwork	Timeline	Graphic Organizer	Jingle
Demonstration	Political Cartoon	Prototype	Brochure	Campaign Platform
Diary Entry	Costume	Crossword Puzzle	Poem	Experiment
Editorial Essay	Newspaper Article	Database / Spreadsheet	Rap Song	Mosaic
Map	Diorama	Oral Report	Webpage	Argument
Lesson Plan	Display	Rebus Story	Instruction Manual	Proposal
Fiction Story	Mock Interview	Slide Show	Petition	Illustrated Story
Interview	Survey	Recipe / Instructions	Game	Radio show

After you divide your students into teams, photocopy the next page to outline the Product Option for this scenario.



The task at hand...

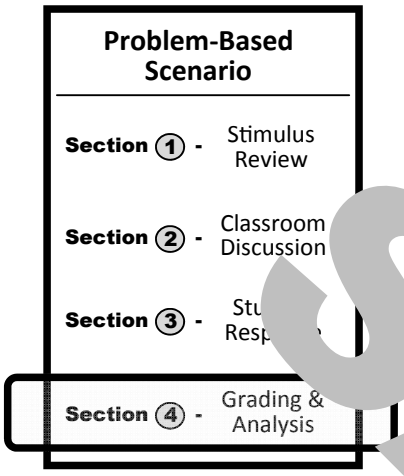
Working together to solve something as a team can help you gain a better understanding of the problem-scenario. Please work together on the exercise below.

Your group is a team of **web developers**. Your task is to **design a website** that is intended to provide information about "Genetically Modified Organisms" (GMOs).

The website design can be drawn on paper in a way that a developer would be able to take it and post it on the internet. The homepage should show the links that will be included on the website, with a brief explanation as to what information will be provided when viewers click on each link.

Remember that the goal is simply to provide information about GMOs to the general public, including what they are and how they can be used. There may also be a link on the controversy surrounding them. You will share your designs with the class and vote on the best website design.

Teacher Instruction Sheet



Grading Rubric
(Product Option)

The Grading Rubric is **Section 3** *on your* ***Teacher Instruction Sheet.***

Student Handout

The SCIENCE ANGLE

We mention this time an e aga gh this book, and it's worth saying another time:

It's al bo s.

The purpose of these exercises is to stud o thi through problems and situations, and it's the teacher's role t ue the the journey.

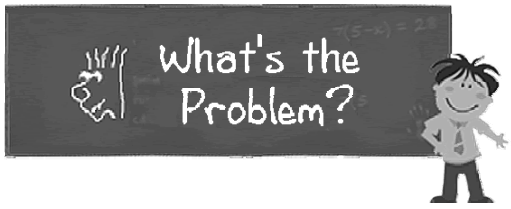
Without a doubt, your students will remind tha about the process" when they try to convince you to be gentle during the grading proce er all, they've been brought up to bubble in the correct circle with a #2 pencil, s ng asked to "produce" something from a variety of information can be tri t they'll do just fine.

As students work through the process, they will learn subje cifi ar cover a few important standards. Yet they'll also be developing those 21 kills and lifelong traits that we mention throughout this book (a few are listed y).

- **Critical Thinking**
- **Researching**
- **Creativity**
- **Planning**
- **Communication**
- **Collaboration**
- **Leadership**
- **Technological Ability**
- **Social Awareness**
- **Scientific Literacy**
- **Entrepreneurialism**
- **Self-Direction**
- **Internet / Media Literacy**
- **Data Analysis**
- **Personal Expression**
- **Patience / Pe erance**
- **Listening**
- **Healthy Skepticism**
- **Imagination**
- **Flexibility / Adaptability**

It's difficult to put a hard grade on any of those, and it isn't the final goal. If you live by the mantra, *"It's all about the process,"* these skills will indeed be developed. With that said, you do want to provide worthwhile feedback to your students. We use a simple—but sound—rubric to help students "ace the **TEST**" (a clever acronym to help them remember the key steps). The rubric is provided to the right for your convenience.

Photocopy this scoring sheet for your students to review.



How do I get an A?

As you work in teams on this exercise, you will be evaluated to see if you ace the **TEST:**

Thoroughness
Evidence
Strategy
Teamwork

Thoroughnes

_____ **The group con ted of uired tasks** (15 points)

_____ **Everyone followed tio roug ut the process** (15 points)

Evidence

_____ **The group's final product was logical and e defended** (15 points)

_____ **A variety of evidence was provided to ort the produ** (10 points)

Strategy

_____ **The group kept its focus on the requirements of the duct** (15 points)

_____ **The group used a sound approach in completing the exercise** (10 points)

Teamwork

_____ **Everyone in the group participated and played a key role** (10 points)

_____ **All members of the group worked well together** (10 points)

Shown above are general areas that your teacher will be evaluating as he or she scores the products you create with your team. You may be provided more details about what it takes to receive the full value in any one of these areas.

Social Studies Standards

Student Handout

As studen wo hrc this section of our Problem-Based Scenario, they'll be focusing on se al s st dies content areas. This includes:

- **Society & Technology**
- **Economics (supply ema**

In addition—and perhaps m impo students will need to understand basic principles of social studies, nich s enefit of Problem-Based Learning. This means that in addition to the ba isci nar dards, students will become familiar with the broader themes of so ial mple:

- **Culture and Cultural Diversity**
- **Time, Continuity, and Change ***
- **People, Places, and Environments**
- **Individual Development and Identity**
- **Individuals, Groups, and Institutions**
- **er, A y d Governance**
- **Produ istri on, and Consumption ***
- **Scie ec and Society ***
- **Global Connections**
- **Civic Ideals and Prac**

**an asterisk has been placed beside each theme that is a major part of this PBL ex*

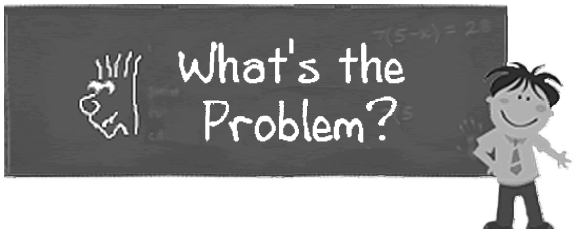
You may want to share the themes listed above with your st ts prior to beginning the exercise, but the best part is that they'll be developing bro understanding whether they realize it or not!

The most important thing to remember when introducing the Problem ed Scenario is to grab student interest right away. It is a fun and challenging exe and you certainly want students to approach it that way.

To make this easy for you, we have created a handout to introduce the "social studies angle" to your students for this Problem-Based Scenario. This will help them see that they will be looking at the Main Problem Scenario from a specific point-of-view, in this case with a focus on society and historical trends.

Make photocopies of the next page to introduce the "Social Studies Angle" of this Problem-Scenario to your students

The SOCIAL STUDIES ANGLE



Are you ready to tackle the problem?

The S[illegible]ario:

You are the head of a professional organization that supports local farmers. You are aware that Genetically Modified Organisms (GMOs) are a heavily debated issue within agriculture and throughout your community. You want to do what is best for the farmers you represent and for the public in general. What are the issues involving GMOs, and what is the best position for your organization?

In order to properly respond to a complicated problem like the one above, you must view it from different perspectives. For example, we will consider the following:

Something to think about:

Why are GMOs controversial, and how is the public reacting to scientific changes in agriculture?

Prior to giving your response, you will review multiple resources, engage in classroom discussion, and take time to organize your thoughts.

In this exercise, you will review the debate over Genetically Modified Organisms and determine what is fueling the controversy and which arguments are the most sound.

★ *As you work on this exercise, remember that this is primarily a* ***social studies question****. This means that you must consider historical and current trends in our society, along with other political and economic factors, when providing your response.*

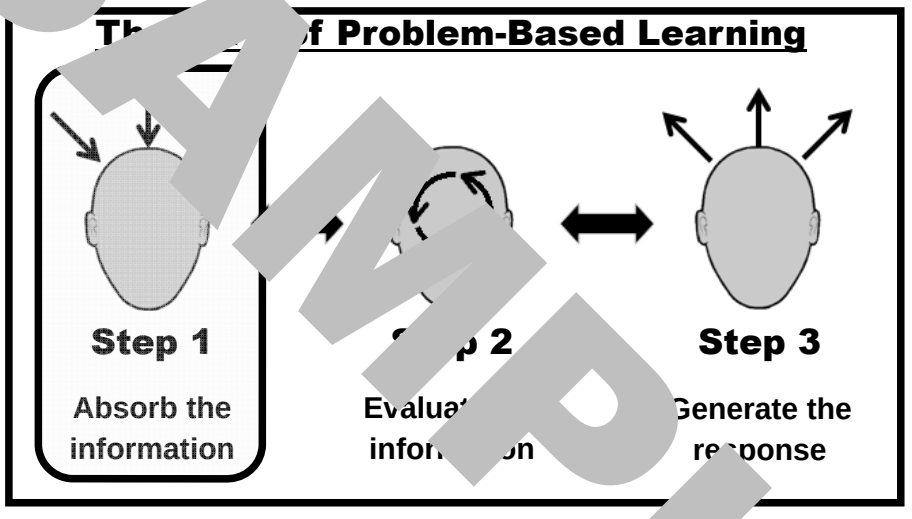
Teacher Instruction Sheet

Problem-Based Scenario

- **Section 1** - Stimulus Review
- **Section 2** - Classroom Discussion
- **Section 3** - Student Response
- **Section 4** - Grading & Analysis

Stimulus Review

The Stimulus Review is **Section 1** *on your* ***Teacher Instruction Sheet.***



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In our Problem Scenario, all of the Stimulus Items have been provi for y We have intentionally gathered a variety of different types and sources. This important in today's modern world where information comes from all direction and also sets the stage for Step 2 (Evaluating the Information).

A few examples of the types of Stimulus Items you might see in a Problem-Based Scenario include:

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...and much more!

For your convenience, we've placed all of the Stimulus Items for this Problem-Based Scenario on a special website where **both you and your students** can have full access to them. To access these resources, you will go to:

http://[illegible].pblproject.com/students

Login: [illegible]
Password: [illegible]

The Stimulus Items you will see for this section of the exercise include:

Stimulus Item #1

— "Welcome to [illegible]d..." (article)

Stimulus Item #2

— Searching for 'GMO' (search engine results)

Stimulus Item #3

— "Should we allow GMOs?" (online discussion)

A Few Notes:

There are a few things we'd like to highlight as your students get ready to dive into the Stimulus Items. First, these are actual sources that have been gathered for the topic at hand, even if they have been edited or adapted at times due to length, format, or readability. That means that they don't necessarily reflect our personal opinions, and we certainly don't want to take credit for the hard work of others (all source information will be provided). It does, however, provide a nice mix for your students.

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With that said, it is always great if there is an opportunity for students to get on a computer or head to the library to find their own background information. Being able to conduct your own research is a vital skill to have, and it is referenced throughout Language Arts standards.

Again, this extra step is not necessary to successfully go through the exercise (we know you're already crunched for time!), but we figured it was worth mentioning!

Teacher Instruction Sheet

Problem-Based Scenario

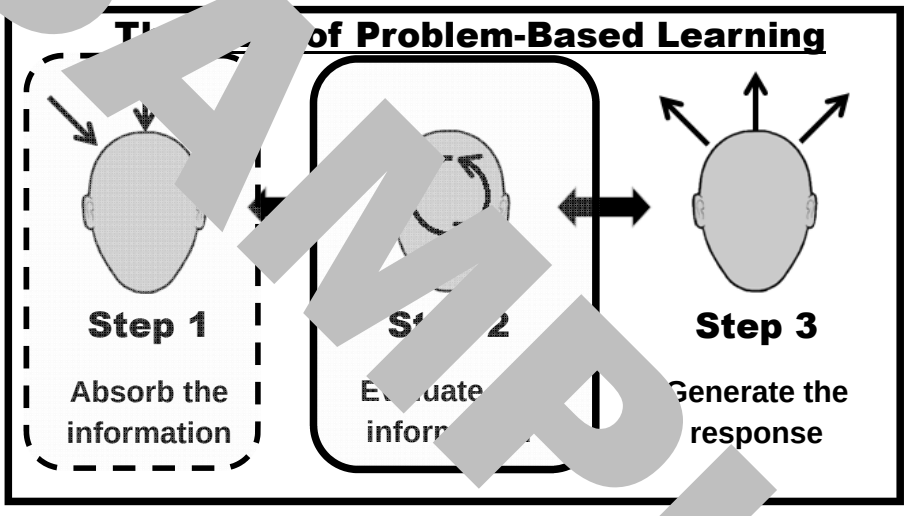
- **Section 1** - Stimulus Review
- **Section 2** - Classroom Discussion
- **Section 3** - Student Response
- **Section 4** - Grading & Analysis

Classroom Discussion

The Classroom Discussion is **Section 2** *on your* ***Teacher Instruction Sheet.***

Teacher "Quick Sheet"

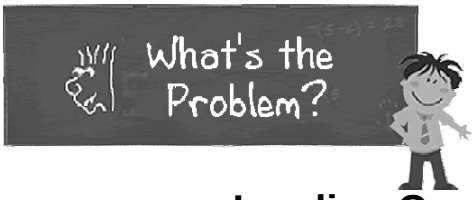
The SOCIAL STUDIES ANGLE



Now that your students have reviewed the Stimulus Ite[illegible]s a fitting time to have a **class discussion** about the Problem-Based Scenario (sp[illegible]ally, the "[illegible] angle" that you're working with).

At this stage, there will be a limited amount of new information br[illegible]t to t[illegible] table (Step 1), although you might want to introduce ideas not covered in the [illegible]ulus, and perhaps students will share original thoughts and experiences. For the mos[illegible]art, though, the classroom discussion is where you want students to evaluate the information (Step 2) to which they've been exposed. It is now that they will begin to organize it all and decide how it will fit together in their response.

The key to a classroom discussion, of course, is keeping everything focused and moving it in the direction you want, and at the same time creating a free environment for students to share and build on ideas. This is certainly where teachers earn their pay! One way we've tried to help (a little bit, at least) is to provide you with the talking points that work well for this scenario. The bold questions are what you will ask your students, and each has bullet points that you can use to guide the discussion.



Leading Questions for Classroom Discussion
Genetically Modified Organisms (social studies angle)

What is the public sentiment towards GMOs?

- Consider that genetically modified foods are very common in grocery stores, and the majority of people do not protest the practice… however, there is a large group of critics and they often have the strongest (and loudest) opinions
- Consider that, by definition, "Genetically Modified Organisms" have been modified from their natural state by human engineering… many critics compare this to "playing God" and have a problem with the practice
- Consider that many people claim that there are health risks to eating food that has been genetically modified… even if science doesn't support this to a large degree, it is impossible to completely rule out… public opinion is difficult to change

How much should public opinion be considered when making policies regarding the use of GMOs?

- Consider that GMOs are used to increase the availability and durability of food… obviously, the amount of food available will play a large role in determining any laws or restrictions concerning GMOs
- Consider that the use of GMOs is as much an economic issue as a social one… if consumers are willing to buy genetically modified foods, farmers will supply them
- Consider that in a democratic system, public opinion always matters a great deal… if people feel strongly enough to elect representatives who are willing to make strict laws concerning GMOs, then there will be changes

What can be done to satisfy both the critics and supporters of GMOs?

- Consider how clear labeling of food packages can make it easy for critics of GMOs to know they are purchasing natural foods (and they can encourage others to do so, too)
- Consider that proper research on GMOs can help consumers form more educated opinions about the practice as opposed to "listening to the hype"
- Consider that elected officials always have the power to make laws regarding GMOs, but it is best if these laws are made based on scientific evidence rather than irrational fears

Teacher Instruction Sheet

Problem-Based Scenario

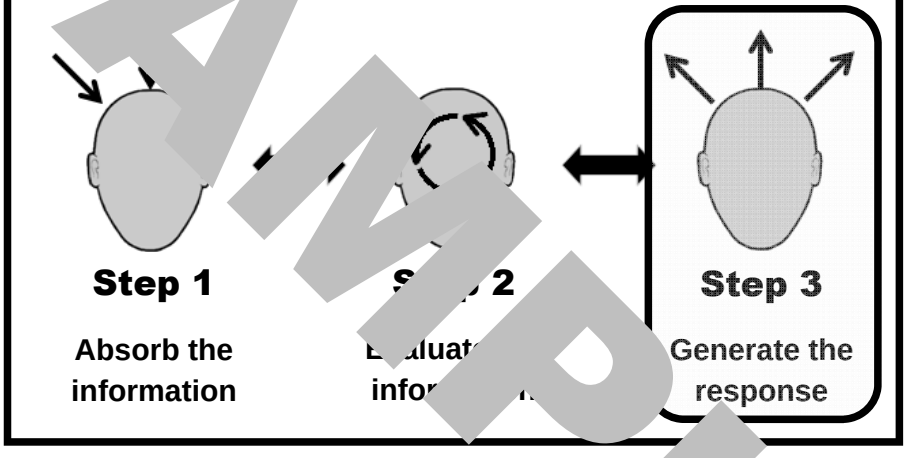
- **Section 1** - Stimulus Review
- **Section 2** - Classroom Discussion
- **Section 3** - Student Response
- **Section 4** - Grading & Analysis

Student Responses
(Extended Response)

The Student Responses are **Section 3** *on your* ***Teacher Instruction Sheet.***

Student Handout

The [illegible] of Problem-Based Learning



The SOCIAL STUDIES ANGLE

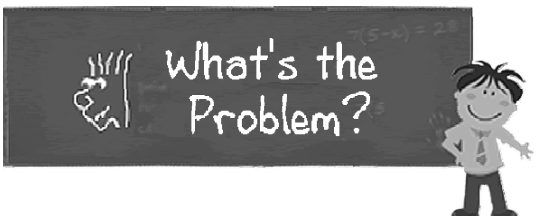
On your Teacher Instruction sheet, you'll see that each sce[illegible] provides two types of response options for your students—Extended Respo[illegible]nd the Product Option. Let's look at the **"Extended Responses"** first.

As you would expect, the Extended Responses are simply que[illegible]ng around the Problem-Based Scenario that the students answer through ti[illegible]ritin

Most likely, the Extended Responses are similar to what you might see[illegible]ing a Performance Task of a comprehensive assessment (where students are given a range of information to review, and then must give their conclusions based on the evidence). The "test prep" benefits alone make it worthwhile for students to complete the Extended Responses, but the broader benefit is their ability to take the information they've been exposed to and generate a logical response to a problem scenario.

The rubric and process for grading Extended Responses is on the following pages. Also, we will leave it up to you whether you want to allow students to use notes they have taken throughout (we think it's fine for them to do so), and also how strict you want to be with time limits (a half hour or so should be fine).

Here are the Extended Response questions for this scenario.



What do you think?

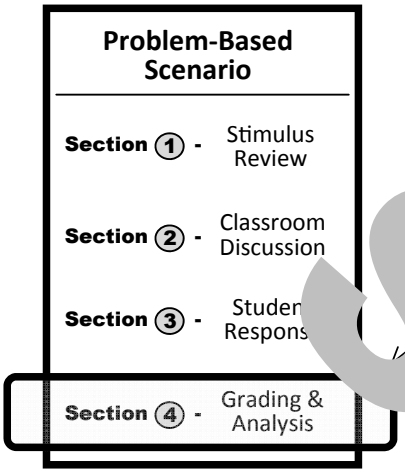
The que[illegible]low are centered around the Problem-Based Scenario you've bee[illegible]rev[illegible]ng[illegible]lease answer the questions on separate sheets of paper.

1) **Wh[illegible]t is t[illegible]ublic sentiment towards Gene[illegible]ll[illegible]Modified Organisms (GMOs)? If most s[illegible]en[illegible]s agree that the practice is safe, will th[illegible]e be critics among the general pub[illegible]?**

2) **To what degree should p[illegible]blic o[illegible]ion be considered when formin[illegible]olicies and laws about GMOs? What [illegible]e factors that are important regardless of what the public thinks?**

★ *Remember to support your answers with evidence that you've gathered from what you've read and discussed in class!*

Teacher Instruction Sheet



Grading Rubric
(Extended Responses)

The Grading Rubric is **Section 3** *on your* ***Teacher Instruction Sheet.***

Student Handout

The SOCIAL STUDIES ANGLE

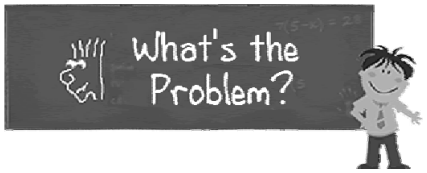
One thing that your st nts r derstand about these Problem-Based Scenarios is that the answer is ne yes "n stead, students must think their way through the muddy waters of diff at and challenges, while you guide them along the journey.

Of course, the end result needs to be more at o back—and that's why proper grading is so important. While stud may at gr des exist only to cause stress and fill the blank spaces on a report card, the broader is that when students are graded in a clear and fair way, it enables them to ually improve their approach and response.

The Extended Responses for this scenario can be graded us the to right. It is divided into four sections:

1) **Social Studies Content** (*What do you want students to bring to the table bas previous lessons?)*
2) **Writing Focus** *(Was it clear what point the students were trying to make?)*
3) **Use of Evidence** *(Did the students back up their position with evidence, quotes, statistics, and facts?)*
4) **Language & Conventions** (*Did students limit mistakes and respond in a thorough and professional manner?)*

Here is a copy of the rubric for your students to review.



How do I get an A?

Listed below are the four different areas that will be evaluated as your responses are graded. Be sure to consider each area as you write.

Rubric Section #1: **Social Studies Content** – you must show a high level of background knowledge and general understanding of the topic

in other words: *What are you bringing to the table based on previous lessons?*

4	3	2	1	NS
You proved in your response to have a high level of background knowledge of the subject.	You showed a high level of background knowledge through most of your response.	You showed a limited level of background knowledge, and only in certain parts of your response.	You showed barely any background knowledge of the subject throughout your response.	Your response was incoherent, off-topic, or unable to be read.

Rubric Section #2: **Production & Distribution of Writing** – you must organize and sustain your writing based on a defined purpose

in other words: *Was it clear what you were trying to make, and did you focus on that point?*

4	3	2	1	NS
Your response had a defined purpose, and it was organized with a clear focus on that purpose.	Your response had a defined purpose, although it lacked organization and a clear focus on that purpose.	Your purpose was vague, and there was limited organization and focus.	There was no defined purpose or organization in your response.	Your response was incoherent, off-topic, or unable to be read.

Rubric Section #3: **Integration of Knowledge & Ideas (use of "evidence")** – you must support your arguments and positions with outside information ("stimulus items")

in other words: *Did you back up your position with evidence, quotations and facts?*

4	3	2	1	NS
You provided convincing support/evidence for your main idea and included appropriate sources, facts, & details.	You provided adequate support/evidence for your main idea and only limited sources, facts, & details.	You provided only modest support/ evidence for your main idea and it was not strengthened by sources, facts, & details.	You provided almost no support/evidence for your main idea.	Your response was incoherent, off-topic, or unable to be read.

Rubric Section #4: **Language & Conventions** – you must use proper grammar, spelling, vocabulary, and other conventions of the English language

in other words: *Did you limit mistakes and respond in a thorough and professional manner?*

4	3	2	1	NS
Your response was professional and you demonstrated a command of language conventions.	Your response was mostly professional with limited errors related to language conventions.	Your response was rather sloppy with multiple errors related to language conventions.	Your response was completely sloppy and showed no effort to follow language conventions.	Your response was incoherent, off-topic, or unable to be read.

Student Responses

Language Arts

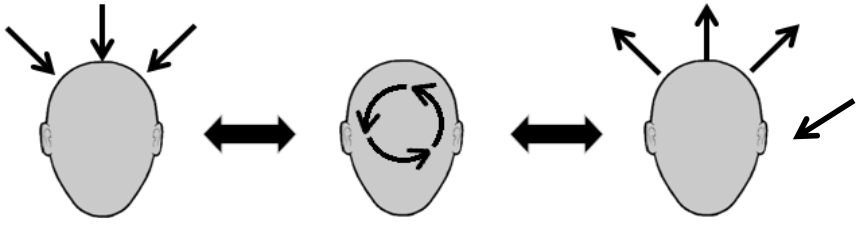
In previous sections of this book, students have only concentrated on one piece of the puzzle. Now they will look at the Main Problem Scenario as a whole, incorporating everything that has been researched and discussed along the way.

To respond to the Main Problem, a prompt has been provided (shown to the right). Your students' written and perhaps oral presentations—will need to meet several expectations from a Language Arts perspective. Students must:

- **Show the ability to comprehend and inform ve texts and resources**
- **Explain their position and ove as ng**
- **Support their positions with evide from esearch**
- **Articulate clear opinions *(stressed at t er y level)***
- **Form compelling arguments *(stressed at the middle ol level)***
- **Demonstrate speaking and listening skills**

The skills above will only be demonstrated if students are to absorb Stimulus Items, organize their thoughts, and approach the Problem Scenari logical way. If they fail in these tasks before a single word is written on , they will never be able "write their way out of it" at this stage of the game. To put it another way:

The 1-2-3 of Problem-Based Learning



Step 1 — **Absorb the information**

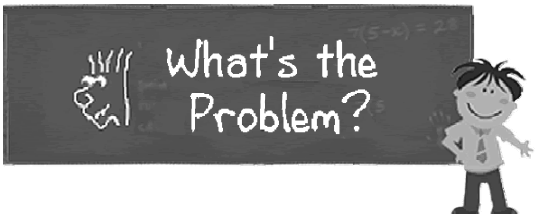
Step 2 — **Evaluate the information**

Step 3 — **Generate the response**

This is not merely a writing exercise! Student responses will never satisfy all of the requirements listed above if Steps 1 and Steps 2 are incomplete.

The LANGUAGE ARTS ANGLE

Here is the Language Arts prompt for this Problem Scenario.



What do you think?

The prom[illegible]ow is centered around the Problem Scenario you've been reviewin[illegible]Plea[illegible]provide your response on a separate sheet of paper.

Using th[illegible]vi[illegible]ence you've gathered about Genetically [illegible]odifi[illegible]d Organisms (GMOs), **write an editorial for** [illegible] school newspaper.

Your editorial shou[illegible]d o[illegible]ne your position on the subject and gi[illegible]e re[illegible]ons why you feel the use of GMOs should [illegible]e encouraged or discouraged.

Share your editorial with your clas[illegible]mates to make sure they are clear about your position and reasoning, and see if they are convinced by your arguments.

How long will it take?

Student Handout

Without a d[illegible] most common question we are asked is:

"H[illegible] long is this going to take?"

Our answer is, *It's u[illegible]* (which could be seen as dodging the question). The truth is that it's all [illegible]ptio[illegible]nd flexibility. Obviously, the time will greatly vary if you just do a "subject-[illegible] problem" (i.e. one section of this book) or do the entire integrated Problem Scena[illegible] (i.e. th[illegible]book). Consider these guidelines:

1 or 2 periods/ blocks

[illegible]oo[illegible]e w[illegible]

2 weeks or more

A specific "subject angle", focusing only on the stimulus review and classroom discussion

All steps of a single "subject angle", with students answering the "Extended Response" questions

[illegible]n enti[illegible] PBL Integrated Sc[illegible], with students [illegible]ng the Product [illegible]ions, collaborating in [illegible]roups, and [illegible] [illegible]esen[illegible]s

If you're crunched for time, you may concentrate on one section of this book (the "subject angle"), and probably won't be able to dive into the Product Option. Still, this will be a great introduction into Problem-Based Learning for your students.

It will certainly [illegible]ee[illegible]ore to[illegible] through this wh[illegible]k, inclu[illegible]he Product Options and[illegible]ntations for each subject angle (i.e. every[illegible]n this book)

In the end, if you can take a Problem Scenario all of the way from beginning to end, including each "subject angle", as well as the products, group work, and presentations that go with each one, your students will have accomplished quite a bit. For that reason, we have included a **"Certificate of Accomplishment"** that you may want to provide to show students that their efforts are appreciated. Remember, you want them to enjoy the whole experience!

Photocopy this certificate to give to your students.

Certificate

of

ACHIEVEMENT

Awarded to

_____

for completion of the following:

Problem-Based Scenario — *"Genetically Modified Organisms"*

By completing this entire scenario, you have demonstrated that you have the ability to approach a real-world problem about [illegible] a variety of different sources, evaluate all of the information and provide a clear and logical response to the challenge.

Given this day _____ *in the year* _____

Signed _____

Great Job!