



VR Quest® STEAM Curriculum Guide 7th Grade Science

Chemical and Physical Changes



Table of Contents

VR Quest® STEAM Curriculum Guide Introduction	3
The Journey Begins	5
The 7 Steps of VR Quest®	6
Establishing an Objective.	6
Brainstorming and Collaborating	8
Research	9
Websites for Student Use.	12
Student Voice and Empowerment	12
Storyboard	13
Storyboard Example.	14
Science Accountable Talk Vocabulary Verbs	15
Build the Interface	16
Pilot Test.	17
Revise	18
Take it Home	19
Curricular Alignment	20

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VR Quest® STEAM Curriculum Guide Introduction

VR Quest® is pleased to introduce its **STEAM** virtual reality platform using the best digital content to create a transdisciplinary education product that emphasizes social emotional learning. Designing games strengthens academic concepts by reinforcing content knowledge and expands skill sets with reliance on logic, probability, geometry and other mathematical principles. VR Quest's STEAM curriculum challenges students to create, innovate, and problem solve all while connecting them to history, science and real-world events and issues that affect their lives. It includes extensive support for teachers such as embedded professional development and instructional resources to support a differentiated learning experience for each student with an emphasis on social emotional learning.

The **Science** component can be best seen through scholars being able to create various physical environments and natural resources that will influence their characters and the game. There are landforms, geographic and climate factors that scholars account for during the game's design.

Technology is evident as VR Quest provides a full virtual reality experience for the user, but also fosters problem solving while building mindset and skills. Additionally, the game creator has the option of focusing on the game design, presentation and story, there are also elements of the programming language, LUA that can differentiate the experience for scholars.

The **Engineering** process is facilitated through the design implementation. Scholars are consistently planning, designing and building their creations. When the design process is completed, the game must be piloted or tested out. By determining if there are glitches or does not run as anticipated, scholars are able to fail, regroup and correct the approach.

Art is the actual creation process and the aesthetics of the game or how one artistically perceives what is being created. The design concepts being facilitated and placement, colors and variety are consistently addressed.

The **Math** component is seen through sizing, scales, ratios, proportions and rotational axis. In the creation process, creators utilize logic, probability, geometry and various other mathematical principles. Scholars will need to visualize and generate geometric shapes. Through the use of visual examples and models, they will demonstrate how formulas work.

Social Emotional Learning is prompted as scholars will be prompted to identify situations where social action is required, as well as possible solutions. Scholars will also reflect on how they can best influence people's rights and freedom through advocacy and connecting with people and/or leaders in positions of power.

Additionally, the VR Quest® STEAM curriculum supports ENL programs as it creates equitable opportunities for scholars to develop social and academic language while improving their performance and constructing meaning. In order to accomplish this goal, scholars engage in all domains of language acquisition (listening, speaking, reading, and writing) while being active participatory learners through inquiry within meaningful contexts and authentic experiences.

Through its multi-ethnic characters, settings and variables, VR Quest® has the ability to showcase different cultures and heritages as valued assets to learning and offer an opportunity for the learning community to expand its understandings of global awareness international mindedness. Regardless of whatever communication level an ENL student is at, he or she can display knowledge and create something special unique while reinforcing written and spoken English.

As a classroom or content teacher:

- Collaborate with other teachers in different disciplines and grades about the most important concepts and skills to be taught and transferred into the game.
- Seek out the school librarian to support the research and to design instructional curriculum maps.
- Implement assessment rubrics with information fluency skills to guide the design process.
- Incorporate students’ knowledge and use of multimedia resources.



The VR Quest design screen



The Journey Begins

Now put on your seatbelts and get ready for a fun filled ride. You are the creator of this journey into the chemical and physical change of matter in all of nature's glory. As you make this game richly unique with content knowledge, the player participants will be focused on accomplishing the games' objective or guided through an experience while being stimulated by audio, images, videos and text.

Prepare to travel through the world of water as it changes from solid to liquid to a gas. You will gain insight into atoms, molecules and the role of kinetic energy as it rolls through and changes matter.

As you explore game design, you will discover how excited scientists became when they understood phase changes and points of change. As you begin to develop questions about this topic and see the process and its relationship, you will investigate how plasma is made and its relevance to health, community and art. Learn through the minds of the greatest thinkers in the world, as you explain chronologically how all disciplines are related to each other.

In this quest, you create an edventure in literacy and informational text or a learning walk. The graphic below outlines the basic steps involved in creating your learning quest. Be aware that you may not go in order. While brainstorming, you may start doing the storyboard, then do research. While building the interface, you may have to go back and do more brainstorming. Just like a paper that you edit and revise, you will be revisiting your storyboard and your game several times to fine tune and perfect it.

On the following pages, you can read how these steps apply to designing a sample quest. Though you can design a quest by yourself, you can often generate more ideas and create more in less time if you collaborate and work as a team.

The 7 Steps of VR Quest®



01 Establishing an Objective

An objective guides the player in your game and helps them focus on the task at hand. A good objective is clear, concise and **SMART**.

- S**pecific
- M**easurable
- A**ttainable
- R**ealistic
- T**ime-based

By the end of this quest, players will be able to _____.

Here is a sample **SMART** objective:

Players will be able to:

Here is a sample SMART objective: players will be able to:

- Explain the significance of matter changes because of chemical reactions utilizing real life examples within a 45 minute time frame
- Create a timeline of the formation of a glacier dissolving over a 30 day time period
- Compare and contrast the development of water in various forms like a frozen wasteland to something mobile like a river or ocean over a five day time period

Your objectives will vary depending on the type of quest you design. Your quest may have an objective that requires player participants to acquire artifacts. Or your quest could have an objective that is based on an educational gallery walk. Regardless of which one you select, an objective is necessary to guide the game designing process just as a thesis guides a major research paper. A good objective has no more than five main points.



Brainstorming and Collaborating

The thinking and conceptualization of process is intended to be a free-flowing period to generate as many ideas as possible. Brainstorming is the collection of all ideas. No idea is a bad idea in this stage.

Collect all ideas

Often an idea will lead to a bigger and better idea. Once you get your creative juices flowing, you start to think of other things.

Write ideas on big chart paper

If everyone takes ownership and can easily read the group work, it will generate more ideas.

Utilize pictures, colors and music

Have you ever heard the expression you are the company you keep? Writing in color will help you color code your ideas and adding drawings, photos and sketches will ignite greater creativity. This is a great organizational tool as well.

Play background music

Play some relaxing wordless music. If you have Amazon's Alexa available, she can play beach sounds, pink noise, healing or mediation sounds. You name it, she has it. Studies show that music can make you more productive.

Set a timer

A solid half-hour for brainstorming is usually sufficient time. When you work on a timer, you are focused, clear and productive. Do not allow anything to distract you during this time. Cell phones should be put away and the only task at hand will be brainstorming.

Be comfortable

Make sure you have water to drink, ample room to write and draw and the atmosphere is a pleasant temperature. When you are comfortable, you will get more done.

Now that you have completed formulating and generating ideas, you have officially completed the brainstorming process. Go through all the ideas and separate the great ideas from the rest of them.

Using teamwork, read through the list and discuss what you like and dislike about each. As a group, vote on what works and what doesn't then cross off the not so good ideas. Finally, think about what you can realistically create in the given time period.



03

Research

Use the objectives you wrote in Step One to guide your research answering any questions. Here's some of the research associated with the objectives in our example:

Assess the applications of of the change of matter in our world:

Recovering from the pandemic means rethinking how we live, our surrounding and the world everywhere. Understanding that matter is affected by energy will help you see that atoms and molecule movement play a big role. An increase in kinetic energy can bring together or push apart matter and thus change its' state.

Possessing a thorough knowledge of matter changing foundation fosters a transdisciplinary interaction with the world and helps to contribute to a unique skillset prompting critical thinking and problem solving. These skills will not only make you special by thinking more sharply, but also contribute to your many different sectors and careers. Additionally, understanding and applying these dispositions to your surroundings and everyday life will help you see the world through a different lens.

- Explain the importance of being able to articulate phase change. In what kind of careers would this prove particularly helpful? Why would firefighters need to know about gas under pressures? Where and what kinds of situations could unfold?
- Compare and contrast two different TVs, an LED and a plasma screen.
- Investigate the role that electricity plays in plasma. What observations and assumptions do you make and why?
- Determine everyday implications for a cook. Assess the differences between cold cooking and hot pertaining to aromatic molecules.

Know the significance of art, science and technology throughout the course of history:

The chemical and physical changing state of matter has implications in various fields. For example, consider water and how it is use for art. Physical and chemical changes can inspire many STEM lessons .ike exploring colorful patterns in melting ice, the mixing of ice to liquid slushies and constructing oobleck and determining the fluid behaves like both a liquid and a solid at the same time. Since the beginning of history, harvest water has the ability to change to fog. How has that affected strategic preparation of armies and the winning of battles? Atmospheric pressure changes states of matter and understanding it can better predict weather and prepare for those changes with the knowledge of how temperature affects gases.

Explain how past practices are current and still used today:

Define how past and present chemical and physical changes are intertwined. Determine the change from solid to liquid in the context of polar ice caps. From simple to more complex, consider the advancement in technology of gas to plasma in things like neon signs that have been around for decades to plasma screens, which are more recent. In a timeless real world, matter deintergrates and forms just as fluidly seen in the examples of diamonds.

Taking it to the next level with critical thinking:

The changing state of matter has influenced the environment and human activities throughout history. As people become more globally concerned with sustainable living and the ozone layer, determining unknown variables have taken a greater role in how we think, live and react. By investigating relationships of various systems, concerned citizens are hypothesizing how to best live sustainably, recycle and care for our natural resources.

- Determine and describe how two changing variables can alter the state of matter by applying different chemical equations using a concrete real world scenario.
- Identify cause and effect in order to analysis humans' relationship with their environment.
- Assess data to predict the effects of what Bill Gates proposes doing to alter climate change.
- Explain the change in matter in a simple Amazon cardboard box from creation to recycling.

VR Quest® encourages scholars to practice while they are learning game creation, but do not copy. Be creative, try new things and bring new ideas and aspects into the VR experience with your fresh take and stimulating outlook.

Critical thinking of physical and chemical changes with respect to our environment and provides a wealth of opportunities and challenges to design a quest where players better understand what is happening to nature around us and how these changes apply to various careers or job roles. Some mathematicans and scientists determine changes in matter to create technology like 3D printing that melts plastic filaments to reshape into different creations. Take time and reflect on how innovators take something like changing matter, both physically and chemically, to recreate the world we live in and use it to make new learning opportunities.

- Tell players to utilize various globes, maps and documents to show the location of where past geographic features like many of the glaciers were and the chemical changes they went through. Create a timeline of this and the historical people who were a part of the discovery and documentation of the changes. What affect did their discoveries have immediately and in the future?
- Climate, geographic features and political policies influence what happens in our environment and developments made in science advancement. Illustrate the specific turning points in history with respect to major scientific highlights and discoveries.
- Create a museum gallery walk of important chemical and physical matter changes that are of historical significance.



Websites for Student Use

Here are a few vetted websites to help you conduct research:

[7th grade science physical chemical Flashcards and Study Sets | Quizlet](#)

[Seventh Grade, Measure a Chemical Reaction Science Projects \(sciencebuddies.org\)](#)

[8 Hands-On Experiments to Teach Kids About Chemical Reactions - Owlcation - Education](#)

[Endothermic and Exothermic Reactions Experiment | Science project | Education.com](#)

[\(10\) Physical and Chemical Changes for Kids | Classroom Video - YouTube](#)

[\(10\) Types of Changes |Physical and Chemical Changes | Class 7 - YouTube](#)

[\(10\) Physical and Chemical Changes - YouTube](#)



Student Voice and Empowerment

Educators often feel as if they must know it all before they can teach it. The beauty of game design and integrating technology to support the curriculum is scholars can become the experts. There is nothing scholars love more than to be able to teach their cohorts or even adults how to do something.

Studies show that scaffolding learning helps to not only reinforce new knowledge, but to also foster and promote a growth mindset, as well as build confidence, empower scholars and reinforce a strong sense of voice.

04



Storyboard

In order to have your game make sense to the player participants, you must create your storyboard. A storyboard is a physical layout or a sequence of directions, illustrations and dialogue of the order of your story. A good storyboard depicts significant action and changes.

Think about the last good book you read. The author sat down to think about exactly what would happen when. One of the best ways to do this is to create a series of panels that almost look like a comic book.

Going through the process of planning and creating this will help you to envision both the actions that the player will be experiences, and the environments in which they'll be doing it.

Every story will have the following main components:

Introduction

Here, the player is introduced to the characters, environment and objective of the quest. You will also establish the player as the 'main character' of the story, and let them know what is expected of them.

Body

The body is where all the action takes place! Your player will face challenges, solve puzzles, meet other characters, and build toward the climax.

Climax

A climax is the ultimate challenge, where the main character uses everything they've learned during the course of the quest to achieve their final objective.

Summary

The summary congratulates the player for a successful quest and reminds them of all the amazing things they did to get here.

In order to create a good story, you will need to define the challenges that the main character will face on their journey. Ideally, all of these will build upon one another getting harder and harder as the player moves forward.

As you devise your story, be sure that the problems the main character needs to solve are not too easy, but also not too hard. If they need knowledge to answer questions, be sure to embed the answers somewhere or explain clearly where they can be found.

On the following page is a sample storyboard for a quest.

Sample Storyboard for VR Quest[®]

<p>Introduction Panels 1 and 2</p>		<p>Body Panels 3-10</p>
1.	2.	3.
4. P	5.	6.
7.	8.	9.
10.	<p>Climax</p>	<p>Summary</p>



Science Accountable Talk Vocabulary Verbs

Analyze	Apply	Calculate	Classify	Compare	Compose	Convert
Decompose	Demonstrate	Derive	Describe	Determine	Develop	Differentiate
Distinguish	Evaluate	Explain	Explore	Express	Fluent	Generate
Identify	Interpret	Justify	Know	Make	Prove	Recognize
Reference	Represent	Solve	Specify	State	Understand	Use
Verify	Written Method/ Representation					

05



Build the Interface

Now that you've decided your story line and main scenes, it's time to build it using the VR Quest[®] software. Use the tables included with 'Learning the VR Quest System' to help you remember how to use the commands to build your quest.

Depending on what's available and how much time you have, you may need to go back to Steps 2 - 4. Maybe you don't have time to fill rooms with all the right equipment or build a complex series of underground tunnels. Perhaps you're not exactly sure what equipment would be found in a space lab and need to do more research. The story might benefit from a bit more brainstorming.

How could you include different artifacts relevant to the historical period your game is describing? Would it be a series of different artifacts that will help the player participants learn more or would it be one artifact that is continually acquired?



06



Pilot Test

After you've finished building your first draft of the quest, you'll need to give it to people outside your team to solve. It helps to have a fresh set of eyes evaluating and making suggestions on what you need to do to improve it. This will help you to identify any problems that need fixing.

Ask the following questions of the people who try it out:

1. Did you know what you were supposed to accomplish to win the game?
2. Did everything work (switches, videos, doors, etc.)?
3. Did we provide everything you needed to succeed in this quest?
4. Was this exciting? Were you completely engaged? What do you think could make the quest better?

Professional game designers go through many pilot tests because there are almost always things that don't work the way they intend them to. Just like good writers edit and revise, as a game designer you must also seek ways to improve your game. It often helps to step away from your project and return with a fresh outlook. You may want to do several test runs.

07



Revise

The pilot test will give you lots of information. Maybe players didn't understand what they needed to succeed. Perhaps they were unable to move items or open doors to move forward. Or critical information that they needed to solve the quest wasn't available.

Following are a few of the things you may need to revise:

Factual Content:

- Did players understand the quest?
- Was all the information needed available to players?
- Did the story make sense?
- Were there things that misled players because they were unclear or inaccurate?

Interface:

- Did all of the interactive features work?
- Could the players navigate the landscape?
- Was the setting attractive, and in line with the theme of the quest?
- Did things like maps or guides properly match the 3-D landscape?

Overall Experience:

- Was the quest at an appropriate level of difficulty?
- Did players stay interested in the quest?
- Were players able to complete the quest in a reasonable amount of time?
- Did players have an overall positive reaction to the quest?

In revising, it is likely that you will repeat some of Steps 2 - 6. If you have a chance to pilot test a second time, hopefully you will see how much better your quest is after incorporating feedback.



Take it Home

One of the best things about VR Quest® is you can take your project home!

When you've finished, you will be able to save your file in a format that can play on any home computer. Your friends and family will be amazed that you've created your very own computerized VR Quest® and will enjoy playing it long after you've gone home.

In the future, we hope you'll be able to join us in designing a wide variety of quests, sparked by your creativity and imagination and share them with scholars across the United States!

Curricular Alignment

DOK Tags	Next Generation	IFC Standards	AASL	ISTE
Author's Perspective	MS-PS1-1. Develop models to describe the atomic composition of simple molecules and extended structures.	Predicts answers to inquiry questions based on background knowledge and beginning observation or experience.	I.A1	3d
Domain Specific Vocabulary		Distinguishes between fact and opinion.	V.A2	1b
Explanatory Texts	MS-PS1-3. Gather and make sense of information to describe that synthetic materials come from natural resources and impact society.	Identifies facts and details that support main ideas. Follows a model or template provided to complete inquiry project and follows a timeline. Asks questions to clarify topics or details.	I.D1	3d
Facts		Generates a list of key words for a research-based project with guidance. Uses selected search engines to find appropriate information.	I.B1	5c
Illustrations		Uses pre-selected Web resources to locate information.	IV.C1	3c
Informational Texts	MS-PS1-4. Develop a model that predicts and describes changes in particle motion, temperature, and phase (state) of a substance when thermal energy is added or removed.	Selects and uses multiple appropriate print, nonprint, electronic and human sources to answer questions.	V.A1	2b
Key Details		Uses various note-taking strategies.	III.B1	3d
Narrative	MS-PS1-7. Use evidence to illustrate that density is a property that can be used to identify samples of matter.	Uses common organizational patterns to organize information.	IV.D1	6a
Opinion		Uses pre-writing to brainstorm ideas for most effective way to present conclusions.	II.D2	1b
Organization		Identifies and evaluates the important features for a good product.	I.B2	1b
Point of View	MS-PS1-8. Plan and conduct an investigation to demonstrate that mixtures are combinations of substances.	Recognizes the right to express own opinion in an appropriate manner, even when the opinion differs from the ideas of others.	I.A2	3c
Quotations		Restates ideas of others accurately and adds own perspective.	VI.A2	3c

DOK Tags	Next Generation	IFC Standards	AASL	ISTE
Reasoning	MS-PS1-2. Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.	Paraphrases and summarizes information that answers research questions.		
Sequence of Events		Uses common organizational patterns to organize information. Understands the concept of "audience;" determines audience before creating product.		
Audience	MS-PS1-5. Develop and use a model to describe how the total number of atoms does not change in a chemical reaction and thus mass is conserved.	Understands the basic concept of plagiarism as copying the work of others. Drafts the presentation / product. Assesses and revises own work with guidance	III.C2	6d
		Asks questions to clarify topics or details.		
		Understands the concept of "audience;" determines audience before creating product.		
Organization	MS-PS1-6. Undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy during a chemical and/or physical process.	Recognizes the right to express own opinion in an appropriate manner, even when the opinion differs from the ideas of others.	VI.C2	7b
		Restates ideas of others accurately and adds own perspective.		
Purpose		Identifies and evaluates the important features for a good product.		
		Understands the basic concept of plagiarism as copying the work of others.		
		Identifies facts and details that support main ideas.		