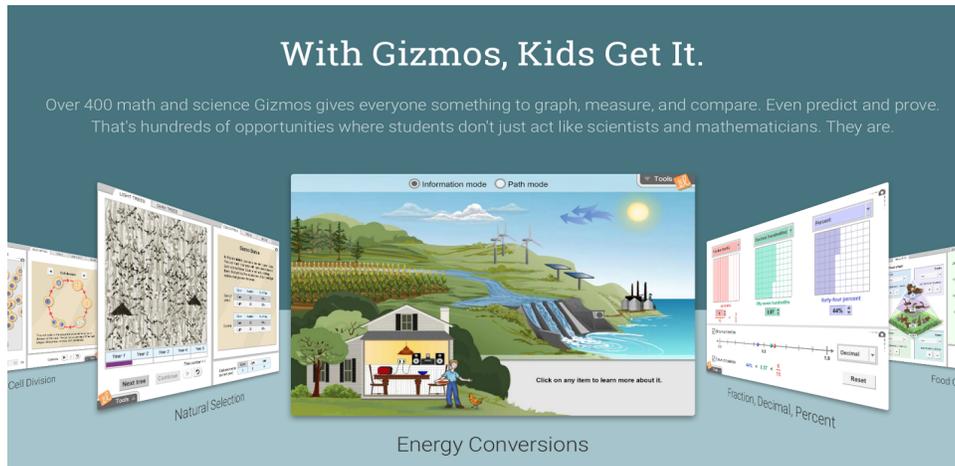


THE GIZMOS OF TOMORROW

“Online simulations that power inquiry and understanding.”

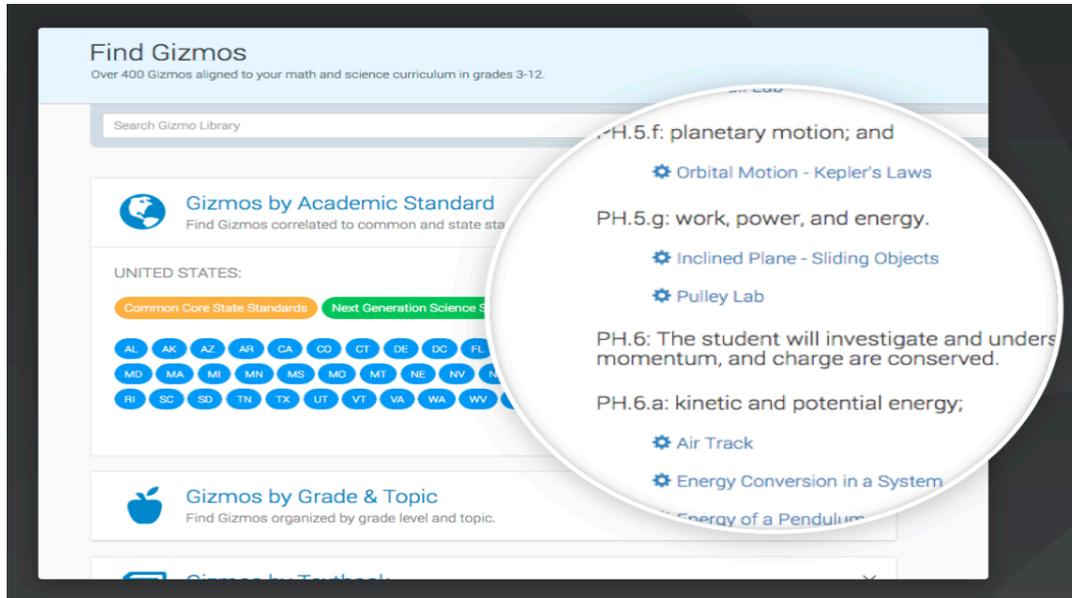
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Introduction

In today's classrooms, all teachers struggle with coming up with engaging lessons that are engaging to all their students. Lessons that form effective and engaging ways to move students to inquiry math. Many teachers fall into the trap of lecturing about a topic and every once in a while, throwing a picture in to serve as a visualization of the problem. When it comes to planning lessons, teachers can spend hours trying to incorporate effective instructional strategies such as Marzano's nine categories of effective instructional strategies, however oftentimes teachers do not succeed in utilizing these strategies properly. With the help of the technology that is available in today's society, teachers can overcome the struggle of creating engaging lessons.

An interactive application that helps teachers to create engaging lessons as well as providing engaging activities for students, is Gizmos. Gizmos is an interactive math tool for students in grades 3rd – 12th. The application provides appropriate grade level content math problems, in real world contexts. Gizmos brings content to life for students to interact and engage with by exploring. Gizmos is easily accessed through any device and is very user friendly. The website provides tutorials for its users and provides lesson plans that work amazingly with any of the Gizmos provided in their library. Even though there is a cost to be able to access Gizmos, the cost is minimal and best of all, all the material on the website is aligned to common core state standards



Exploring Learning

Within the website of Gizmos, there is a library of interactive math and science simulations targeted to engage students by allowing students to interact with the content. The goal of the website is to create project based learning among all lesson plans. Each simulation targets math and/or science concepts through inquiry and exploration. Within each lesson the targets are problem-solving and critical thinking. All you need to do is choose your grade level, the subject, and content you wish to teach. You can even choose a specific Common Core State Standard that you wish to teach and multiple lessons will come up. In every activity or lesson that you chose, it is almost guaranteed that students will be able to discover concepts through experimentation. Students will also have the opportunity to analyze data by being able to visualize problems and utilize hand graphing tools to help them compare results. Let's not forget about allowing students to have some fun while learning. Interactive, self-correcting math and science games are

also included in Gizmos; through these games students are able to explore concepts while having fun.

When it comes to why Gizmos works, research supports the effective instructional techniques offered in the simulations. Simulations can be found that represent new knowledge in graphic/nonlinguistic formats, which is important because research in cognitive psychology indicates that our brains store knowledge using both words and images. Instruction that targets and engages both of these systems of representation has been shown to significantly increase students' comprehension and retention. Or simulations that use manipulatives to explore new knowledge and practice applying the new knowledge. Manipulatives are powerful instructional aids because they enable active, hands-on exploration of abstract concepts. Simulations provided by Gizmos allow students to generate and test hypotheses about new knowledge. A typical simulation starts with students engaging in a set of exercises where they perform

specific actions and record the results. Then, they are prompted to make predictions about new situations, after which they verify their answers using the Gizmo.

How Do Students Benefit

Students benefit from using Gizmos because this program’s philosophy is to “Make connections and draw conclusions” (explorelearning.com). Gizmos has three components to their philosophy: to discover concepts, analyze data, and go deeper. It focuses on providing students with opportunities to discover mathematical concepts via manipulation of variables and asking themselves the questions such as “why” and “what-if” during experiments to discover the concepts. It also provides multiple visual representations and graphing tools to help students analyze their results from their activities and experiments. Gizmos also provides in-depth activities there students are provided with more opportunities to discover and apply new mathematical concepts.

As in any classroom, there will be a diverse group of students with varying levels of need. When planning lessons we must take into account the specific needs of each of our students and differentiate within our lessons to accommodate them. Gizmos is a perfect application for meeting the needs of all of our students. Many of the activities within Gizmos that students can do are self-correcting activities. They explain to the students why their answers may be incorrect and help to guide them to the

correct answer. It is also easy to accommodate students when they are participating in the lesson plans or activities by providing them with calculators, manipulatives, measuring tools etc. Using manipulatives is actually very useful because the majority of the lessons and activities are real world scenarios.

Math Activity

One of the many activities Gizmos provides is “Compound Interest” based of the Common Core State Standard Algebra 1.7.A: *Sketch the graph for an exponential function of the form $y = abn$ where n is an integer, describe the effects that changes in the parameters a and b have on the graph, and answer questions that arise in situations modeled by exponential functions.* This activity allows for students to play with the value of each variable within the exponential function and to see the changes the various values make to the graph. This activity can be use as a mastery lesson where students piece together what they have learn about exponential functions and interest.

The screenshot shows the Gizmos search interface. At the top, there is a search bar with the text "Find Gizmos" and a "Learn More" link. Below the search bar, the results for "Exponential Functions" are displayed. The first result is "A1.7: Additional Key Content" with a sub-result "A1.7.A: Sketch the graph for an exponential function of the form $y = abn$ where n is an integer, describe the effects that changes in the parameters a and b have on the graph, and answer questions that arise in situations modeled by exponential functions." Below this, there are two links: "Simple and Compound Interest" and "Exponential Functions".

When the activity is selected it will give a preview of the Gizmo along with the option to launch it or view the lesson information.



A1.7: Additional Key Content

A1.7.A: Sketch the graph for an exponential function and describe the effects that changes in the parameters have on the graph modeled by exponential functions.

[Simple and Compound Interest](#)

A1.7.B: Find and approximate solutions to exponential equations.

[Exponential Functions](#)

A1.7.C: Express arithmetic and geometric sequences in both explicit and recursive forms, translate between the two forms, explain how rate of change is represented in each form, and use the forms to find specific terms in the sequence.

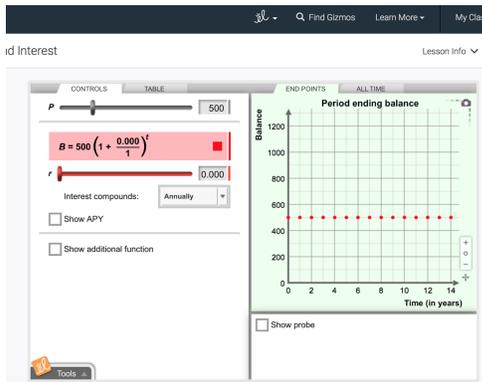
Compound Interest

Explore compound interest in-depth, from compounded annually to compounded continuously. In addition, compare the END POINTS graph, with dots that fit an exponential curve, to the ALL TIME graph, which has a more step-like appearance.

Lesson Info
Launch Gizmo
Add to Class

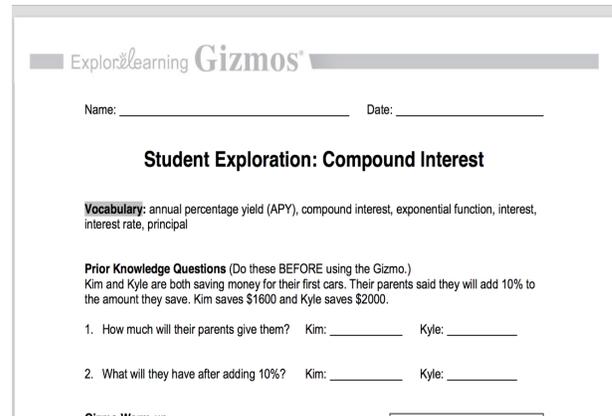
larger, describe the effects that arise in situations

Once the Gizmo is launched, at the top right corner there is a tap for “lesson info.” By clicking there a teacher has the opportunity to look at the vocabulary that will be used, an activity sheet that aligns with the Gizmo and CCSS, and an answer key for the worksheet.



This activity is a great opportunity for students to have a faster way of visualizing what occurs to the exponential graph when the value of its variables changes. Students can also add graphs/functions to the Gizmo to make comparisons.

One of the first things that the activity sheet asks for is students’ previous knowledge of the material.



Once this section is completed students are then to begin the “Warm-up” exercise to help them navigate and become familiar with the Gizmo. Students are then prompt to start the activity by answering questions using the various tools the Gizmo has. These questions does not only ask for “what is the value of...” but rather asks for explanations of the behavior of the graphs; thus engaging in critical thinking. This allows for students to get a better understanding of how exponential graphs work and how they can be use in a real-life problem.

In addition, the Gizmo provides students with a table of values that can be used to numerically analyse data. The Gizmo allows for the table to be edited to show

certain values and exported to be printed or copy as an image (which is great if the Gizmo is used for a project).

Gizmo Warm-up

Kim and Kyle's parents paid them a little extra on top of the amount they saved. This is essentially an **interest** payment, at an **interest rate**, r , of 10%.

Often, though, interest is recurring. When it is paid multiple times, and calculated on the current amount (including previous interest), it is called **compound interest**. In the *Compound Interest Gizmo™*, you can explore the effects of different compounding periods, and different interest rates.

- The **P** slider shows the **principal**, or the initial amount of money. Drag the **P** slider, and watch the graph.

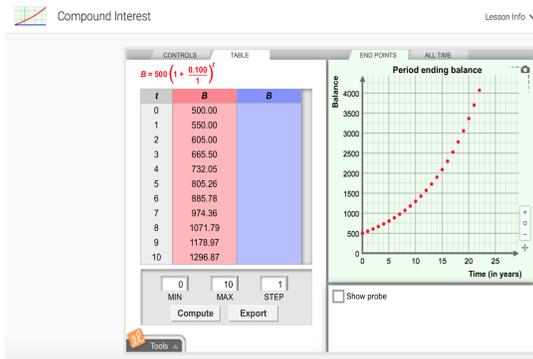
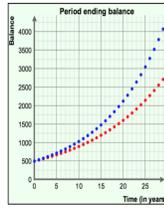
A. How does the graph change? _____

B. Explain why this happens. _____

- Drag the **r** slider (which shows the interest rate), and watch the graph.

A. How does the graph change? _____

B. Explain why this happens. _____



Barriers to Implementation

With all things there are pros and cons. One con to Gizmos is that it does cost money to utilize, however it is a very affordable price for schools and it provides so many ideas, activities, and lessons for teachers and students to use in the classroom. Another barrier to implementation is that because it is an application, the school would need computers or tablets for students to use the application which can be another expense for the school.

Conclusion

In a world full of technology, Gizmos has successfully found a way to use manipulatives to increase students learning. Gizmos has over 400 interactive activities that not only keeps students engaged, but also helps them discover concepts that align with Common Core, gives visual representation of concepts that aids students to analyze data and it provides activity sheets that expands the students' critical thinking. This is essential for students learning since their brains best store knowledge using both words and images, as a result increasing the students' comprehension and retention of the concepts.

For Gizmos, the pros outdo the cons, with more schools wanting to focus on technology usage. The small fee, will bring many interactive activities with real life scenarios (part of the common core), activity sheets to expand students' mathematical reasoning, and many "ah-ha" moments that teachers know is a sign of discovery and understanding in a student's life.

References

- Cholmsky, P. (2003, December). Why Gizmos Work: Empirical Evidence for the Instructional ... Retrieved October 6, 2016, from <https://www.explorelearning.com/View/downloads/WhyGizmosWork.pdf>
- ExploreLearning Gizmos: Math and Science Simulations That Power Inquiry and Understanding. Retrieved October 08, 2016, from <https://www.explorelearning.com/>