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Activities for Challenging Gifted Learners by Increasing Complexity in the Common Core

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Abstract

Gifted learners need opportunities for critical and creative thinking to stretch their minds and imaginations. Strategies for increasing complexity in the four core areas of language arts, mathematics, science, and social studies were addressed using the Common Core and Iowa Core Standards through several methods. Descriptive adjective object boxes were created, based on the themes of bees, surface area and volume, cultural beliefs and mummies, and bee colony collapse disorder. The sets of materials were used in various ways to increase the complexity of instruction in the core subject areas of literacy, mathematics, social studies, and science. The descriptive adjective boxes consisted of several small objects related to a theme with corresponding cards. This card set provided activities to increase the complexity of the topics. This document provides the content presented at the Iowa Talented and Gifted Association's (ITAG) Annual Conference.

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Introduction

Too often, gifted students are overlooked in classrooms, even by well-intentioned teachers. Many teachers believe the myth that gifted students will reach their potentials on their own; or, teachers lack the time and skills needed to appropriately challenge the gifted. The No Child Left Behind (NCLB) Act did not include legislation for the gifted. The educational initiative of Response to Intervention (RTI) is designed to remediate learning and behavior for learners who struggle. The current surge of interest in the common core may further harm the gifted because the standards are locked into grade level content (Schroeder-Davis, 2014). A mother of a gifted child shared her seven year old's thoughts about teachers (Kottmeyer, C., 1997-2015, p. 1), "The teachers are really nice people, all of them. And I understand about other kids needing to learn. But sometimes I wonder – what about me, in terms of learning?"

Most educators complete their college years with little to no instruction on effective teaching of gifted students. However, at the Midwestern university of the authors of this document, middle level education majors complete an online, week-long unit of instruction focused on gifted students. They learn about the characteristics of the gifted, begin to comprehend the diversity of this group of students, and complete activities designed to provide them tools for teaching gifted students. They learn how to compact curriculum so that learners skip parts of the curriculum they have already mastered to spend time on new learning instead. These preservice teachers also learn how to increase the complexity of lessons to meet the needs of high-achieving students. For the presentation at the Iowa Talented and Gifted Association (ITAG) conference on which this document focuses, five middle level education students used descriptive adjective object boxes that one of the professors had made and created several new sets of materials themselves. They added ideas of their own to increase complexity for elementary or middle level gifted learners.

This document describes the contents of these effective learning materials, offers activities to enhance student understanding of the topics, and provides suggestions to increase the complexity to challenge high-performing students.

Literacy: Increasing Vocabulary

The materials described here assist students in increasing their descriptive vocabularies. After working with teacher-made materials, students could each be given a theme, and they could each assemble their own set of items related to the theme. Then, students would generate

adjectives for each object, printing four unique adjectives that refer to one object in the box on each of the cards. Gifted students might also make these materials as a service project for younger students.

Lessons involving
Descriptive Adjective Object Boxes

Common Core Literacy Standards (2010a) Addressed: Language; Vocabulary Acquisition and Use: Grade 4: 4. Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on grade 4 reading and content, choosing flexibly from a range of strategies. 4c. Consult reference materials (dictionaries, glossaries, thesauruses), both print and digital, to find the pronunciation and determine or clarify the precise meaning of key words and phrases. 5. Demonstrate understanding of figurative language, word relationships, and nuances in word meanings. 5c. Demonstrate understanding of words by relating them to their opposites (antonyms) and to words with similar but not identical meanings (synonyms). 6. Acquire and use accurately grade-appropriate general academic and domain-specific words and phrases, including those that signal precise actions, emotions, or states of being and that are basic to a particular topic. **Grades 4, 5, 6: L.4.3a.** Choose words and phrases to convey ideas precisely.

Typical basic lesson: Match the sets of four descriptive adjectives printed on the cards with the corresponding objects. See Figure 1 below for eight of the cards from a descriptive adjective object box with the theme of "bees." The card fronts show the adjectives; the card backs show the corresponding object and a fact that goes with the theme of "bees" to increase content knowledge. The objects, therefore, are shown by the photographs on the card backs. Students use a print or digital dictionary to define unfamiliar words and learn their applications to real objects as they work with the materials.

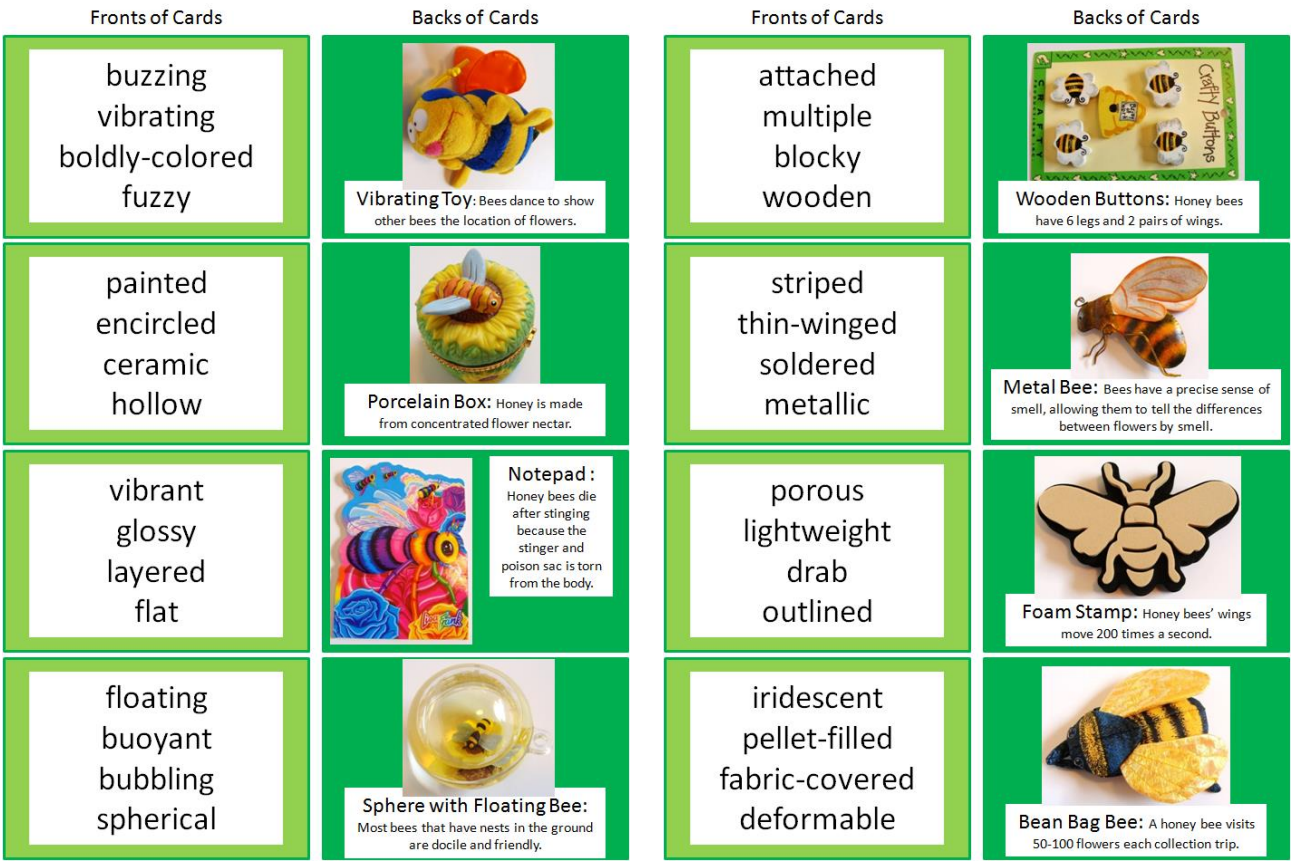


Figure 1. Example cards from the "Bees" set of descriptive adjective object box materials.

First Activity for Increasing Complexity: Generate a Venn diagram to sort items from the box.
Complex thinking skills: Applying the logic of a Venn diagram and mentally trying different adjectives until an appropriate combination of labels for the circles and available objects is found. See Figure 2 and Figure 3 below.

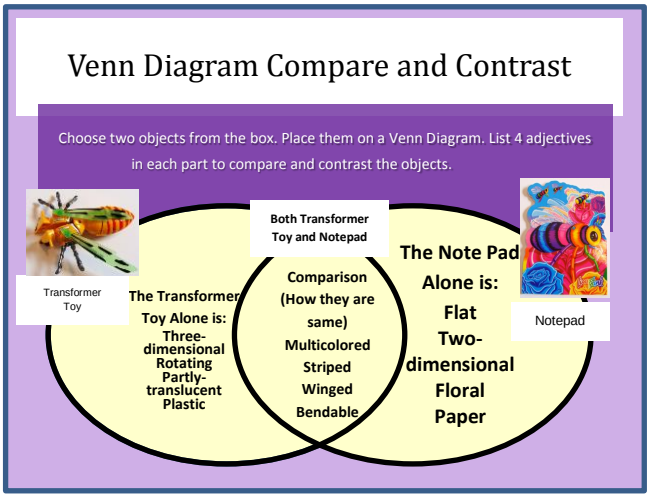


Figure 2. Venn Diagram Compare and Contrast

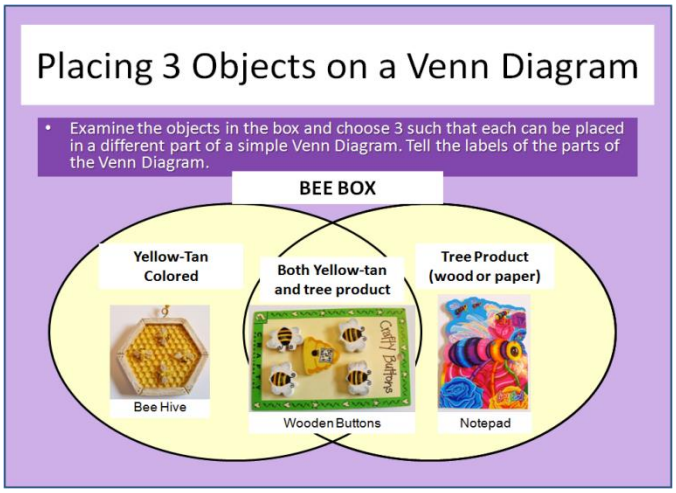
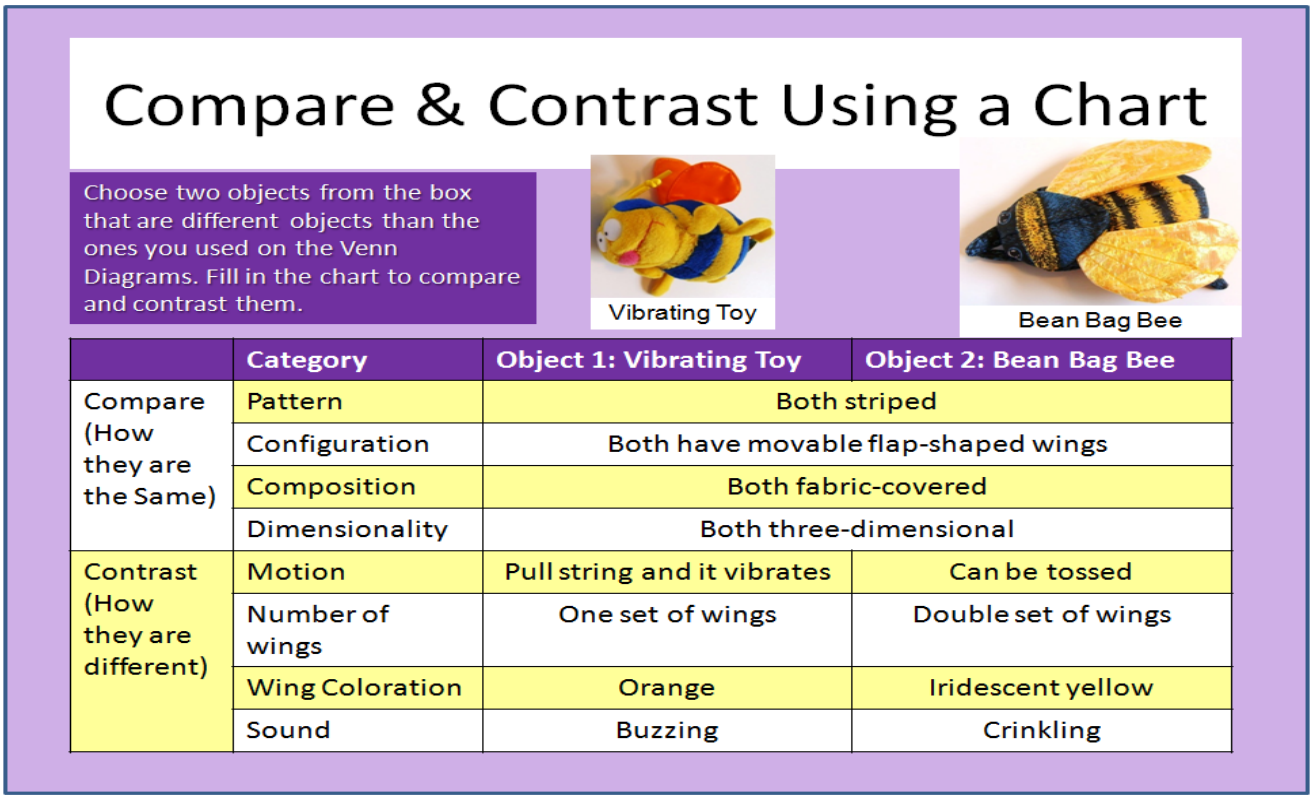


Figure 3. Placing Three Objects on a Venn Diagram.

Second Activity to Increase Complexity (shown below in Figure 4): Choose two items from the descriptive adjective object box. Create a chart that compares and contrasts them, noting the general category for each characteristic.
Complex thinking skills: Determining a category name for the different characteristics is challenging because one must think abstractly of what category will encompass the characteristic. Blank forms for the first and second activities are provided in Figure 5 and Figure 6.



	Category	Object 1: Vibrating Toy	Object 2: Bean Bag Bee
Compare (How they are the Same)	Pattern	Both striped	
	Configuration	Both have movable flap-shaped wings	
	Composition	Both fabric-covered	
	Dimensionality	Both three-dimensional	
Contrast (How they are different)	Motion	Pull string and it vibrates	Can be tossed
	Number of wings	One set of wings	Double set of wings
	Wing Coloration	Orange	Iridescent yellow
	Sound	Buzzing	Crinkling

Figure 4. Compare and Contrast Chart

Venn Diagram

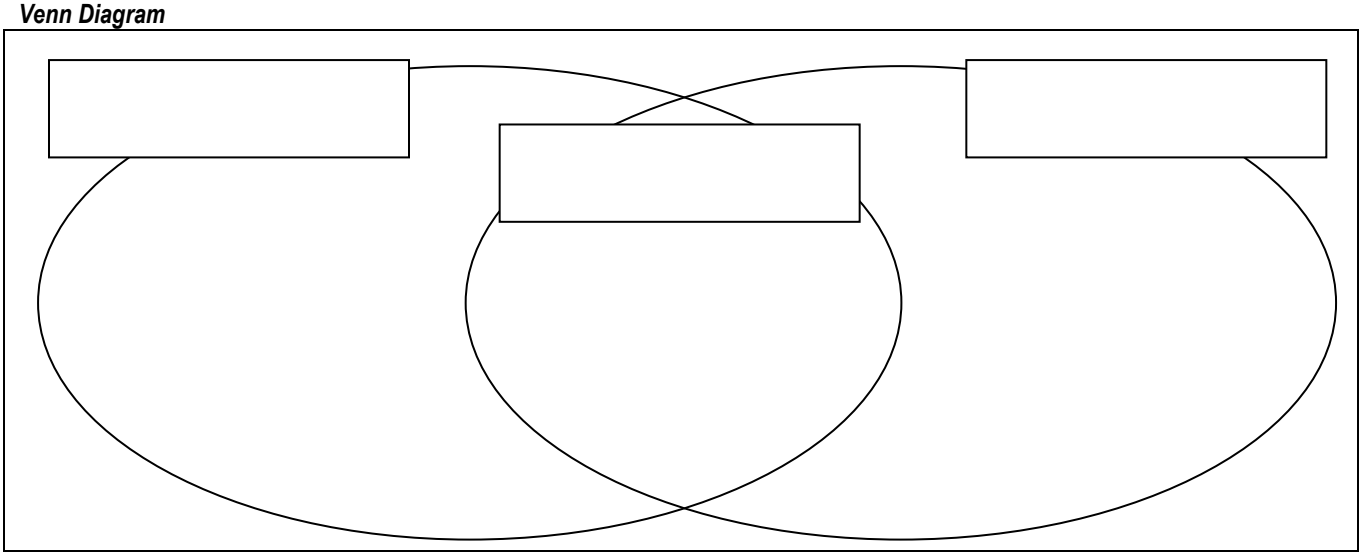


Figure 5. Blank Venn Diagram

Compare and Contrast Chart

Compare: Tell how they are similar	***General Category***	***Object 1:***	***Object 2:***
Contrast: Tell how they are different			

Figure 6. Blank Compare and Contrast Chart

Third Activity to Increase Complexity: Generate additional descriptive adjectives for a chosen item (try to generate 20 adjectives). See Figure 7 below. Discuss which are synonyms and the differences between the words.

Creative thinking skill of *fluency*. It requires the student to consider many different aspects of an object such as its texture, luster, configuration, size, density and to also generate synonyms to increase the number of words.

Porcelain Box

hollow	**raised**	**multicolored**
floral	**flat-bottomed**	**hard**
encircled	**snapping**	**painted**
compact	**rigid**	**round**
textured	**enclosing**	**circular**
colorful	**clasped**	**hinged**
ceramic	**unglazed**	**empty**

Figure 7. Porcelain Box Object and Set of Twenty Descriptive Adjectives

Fourth Activity to increase complexity: Create a cinquain poem for one of the objects with *no words repeated*. See the example in Figure 8.

Creative thinking skill: Expressing emotion or a message through vocabulary choice.

Notepad

First Line	**One noun, a synonym for the object**	**Notepad,**
Second Line	**Two adjectives**	**Glossy, multicolored.**
Third Line	**Three –ing words (gerunds)**	**Scribbling, embellishing, refining:**
Fourth Line	**A four-word phrase or sentence**	**Busy bee works hard.**
Fifth Line	**One noun, a synonym for the object and different than the first line**	**Treasure!**

Figure 8. Creating a Cinquain Poem Related to an Object

Extension of the Literacy Activity

One participant at the conference volunteered the idea to create a descriptive adjective box based on a novel students are reading in class. An example, is the novel, *The Great Gatsby*. The items in the box could include a daisy, artificial eggs, an apple, play money, and flapper fringe. The items represent characters, locations, or themes throughout the novel. Students could also be grouped to create the boxes; one group would create a character box, another group would find items related to locations or settings from the book, and another for themes. An activity to accompany the boxes of materials made by groups would be a presentation to their peers in which group members might discuss the importance of the items and how they represent specific parts or aspects of the novel. Students might ask their peers in other groups to create a chart describing the items. The columns headings for the chart might be the following: the item, what it represents, explanation of how it represents it, and other possible items to indicate this same idea. Students could also create storyboards based on the items in the box or use the storyboard as a retelling tool.

Mathematics: Exploring Volume

Sets of household objects or toys may be used for mathematics volume and area activities. These might be objects from sets that were used in the literacy activities described previously, or they may be new objects selected specifically for volume exercises. If a new set of objects is assembled, one might make use of some descriptive mathematical terms to describe the pieces such as: angular, ovoid, hexagonal, prismatic, faceted, intersecting, 6-centimeter, symmetrical, linear, cubic, rectangular, rhomboid, dodecahedral, rounded, spherical, right-angled, mirrored, projecting, or crosshatched.

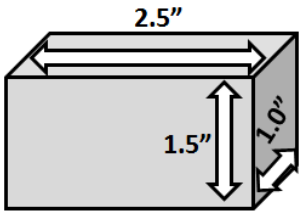
Volume may be measured or approximated in different ways. Several ideas are listed in the next section. One way, for example, is to stack base ten blocks next to the object to roughly approximate its three-dimensional shape, then determine the number of cubic units. Students may generate their own list of ideas of the materials they would like to use for measuring the volume of various objects. Students may also choose objects that they think will be best to measure by submersion and measuring the volume displacement in water or certain fluid materials such as sand, birdseed, or uncooked rice. For example, it may be more difficult to accurately measure an irregularly-shaped object's volume in sand as opposed to measuring a regularly-shaped object. Students could also put the same objects in all the materials and determine the volume measurements according to characteristics of objects.

Mathematics Volume Lessons involving Descriptive Adjective Object Boxes

Common Core Mathematics Standards (2010b) Addressed:
Solve real-world and mathematical problems involving surface area, and volume.
CCSS.Math.Content.6.G.A.2 Find the volume of a right rectangular prism with fractional edge lengths by packing it with unit cubes of the appropriate unit fraction edge lengths, and show that the volume is the same as would be found by multiplying the edge lengths of the prism. Apply the formulas $V = l\ w\ h$ and $V = b\ h$ to find volumes of right rectangular prisms with fractional edge lengths in the context of solving real-world and mathematical problems.
CCSS.Math.Content.6.G.A.4 Represent three-dimensional figures using nets made up of rectangles and triangles, and use the nets to find the surface area of these figures. Apply these techniques in the context of solving real-world and mathematical problems.

Figure 9 on the next page shows a basic volume lesson for determining the volume of a rectangular prism.

Typical basic lesson: Locate a rectangular prism in one of the descriptive adjective object boxes and measure it. Find the **volume** of a rectangular prism by measuring the height, width, and length of the prism and multiplying them by each other. For the rectangular prism at right, multiply 2.5 x 1.5 x 1 = 3.75 cubic inches



Find the **surface area** of the rectangular prism by determining the areas of the six sides and add them together. Because of the symmetry of the rectangular prism, one can multiply each unique side's area by two. (2 x 2.5 x 1.5) + (2 x 2.5 x 1.0) + (2 x 1.5 x 1.0) = 7.5 + 5.0 + 3.0 = 15.5 square inches

Figure 9. Typical Basic Lesson

Activity for Increasing Complexity

Choose a three-dimensional, irregularly shaped object from one of the descriptive adjective object boxes. Generate three or more different methods of estimating the volume of the object. Calculate volumes for each method. Evaluate the methods, explaining their strengths and weaknesses. See Table 1 for an example comparison chart.

Volume by Approximating with Rectangular Prisms: Estimate several boxes (rectangular prisms) that, when placed on top of each other or side-by-side, would approximately equal the volume of the object; calculate and add the volumes of the boxes. If the object is basically shaped like a rectangular prism, measure its length, width, and height to calculate an estimate of its volume.

Volume by Displacement: Measure a graduated cylinder of table salt, sand, birdseed, or water (if the object is waterproof). Determine the top surface level of the substance. Push the object into salt, sand, seed, or water. Shake gently or tamp to eliminate air holes. Re-measure surface level and determine the volume of salt, sand, seed, or water displaced.

Volume by Approximating with Cylinders: Estimate volume by adding together cylinders that approximate the object, or use just one cylinder if the object is basically cylindrical in shape. Use the formula for a cylinder to determine the volume: $V = \pi r^2 h$; calculate and add the volumes of the cylinders.

Volume by Determining Surface Area with Grid and Average Thickness: For an object of approximately even thickness, photograph the object and determine the surface area by superimposing a grid over the photo and counting squares. Then determine the "average" thickness by measuring it in a typical place. Multiply the surface area by thickness.

Volume by Approximating with Base Ten Block Unit Cubes*:* Place the object on a flat side. Stack base ten cubes next to the object to create a three-dimensional volume of approximately the same size and shape. Count the cubes.

Table 1. Comparison of Different Volume Determination Methods

Method Comparison	Strength	Weakness
Approximating with Rectangular Prisms	The volume of a rectangular prism is easy to calculate. One could actually make little boxes out of paper to approximate the object.	Depends upon how well the rectangular prisms approximate the shape of the object
Displacement	Determining the final volume with the object submerged minus the original volume is fairly easy. This method should actually measure volume.	Some of the substance may be lost; object might not fit into graduate cylinder or measuring cup.
Approximating with Cylinders	The volume of a cylinder is fairly easy to calculate. One could actually make little cylinders out of paper to approximate the object.	Depends upon how well the cylinders approximate the shape of the object
Surface Area Grid and Thickness	Easy to count the squares on a grid. Multiplying the surface area times the thickness is easy.	Depends upon having an object of fairly even thickness. Need a camera or place grid over object.
Approximating with Base Ten Block Unit Cubes	Counting unit cubes is easy.	Depends upon how well the cubes approximate the shape of the object

Social Studies: Exploring Burial Practices

There are many ways to increase the complexity of the Common Core for gifted and talented students. For the area of social studies, students can be given a broad topic and asked to choose a suitable subtopic to explore through researching information and making a corresponding object box. One possibility might be the cultural practice of burying the dead. Ancient or historic burial practices may be examined as the broad topic. Students could choose a country (or region) and examine the burial practices of its inhabitants. This process allows students choice within parameters.

After the aforementioned introductory activity of locating information about burial practices, students might analyze information about aspects that are both similar and different for the burial practices of the ancient country chosen by the student and those of people living currently in America by charting these similarities and differences on a Venn diagram. Another activity students could do, once they've found the similarities and differences, is to make cards, each featuring a description of the burial practice idea specific to either America or the chosen country on one side and a picture of the idea on the other side. This allows students to have a visual

representation to supplement the information on the other side of the card. Students could be creative and draw their own pictures of their conception of how the idea should be represented. These cards can then be matched to objects in an object box that represent each concept. For example, students might assemble a set of objects representing mummies. The cards may also be used to form a compare and contrast chart or placed on a Venn diagram with sections of the diagram labeled.

Iowa Core Essential Concept and/or Skill: *Understand the role of culture and cultural diffusion on the development and maintenance of societies. (SS.6-8.H.3)* (Iowa Department of Education, 2010):

- Understand ways groups, societies, and cultures have met human needs and concerns in the past.
- Understand how information and experiences from the past may be interpreted by people from diverse cultural perspectives and frames of reference.
- Understand language, literature, the arts, architecture, other artifacts, traditions, beliefs, values, and behaviors have contributed to the development and transmission of culture.

Basic Lesson

Match the descriptive cards with the mummies in a descriptive adjective object box. Categorize the mummies in the box as representing genuine religious beliefs versus fantasy. See Figure 10 below for the cards that feature images of the objects.

Figure 10. Descriptive Adjective Object Box Cards for the mummy box

Activity for Increasing Complexity

Students should research the better known mummies of the world. After finding detailed information, making a descriptive adjective object box, and sorting the objects on a Venn diagram, students may provide a presentation to classmates on the burial similarities and differences of their chosen country compared to modern America. After all the presentations, students could have a class discussion on some similarities and differences they see between all of the chosen countries and modern America and the basic human needs these burial practices satisfy. Students can discuss any cultural universals that occur in the different societies. Students can discuss factors making some of these burial practices acceptable today, while also discussing why some practices would not be allowed in modern America. Such a discussion allows students to use higher order thinking skills. During this discussion, students should explore rituals from Ancient Egypt and compare to today's burial rituals. Who had elaborate funerals? What was the importance of pyramids? Research mummies and the Egyptian mummification process. Compare the transmission of culture today and in Ancient Egypt. See Table 2 (next page).

Table 2. Comparison of Burial and Death Practices

Cultural Aspect	Modern America	Ancient Egypt
Funeral service	Preparation of body in secret at mortuary, funeral services, procession of cars, burial in cemetery	Secret rites, funeral procession, burial tomb
Coping with fear of death	Halloween decorations, religious beliefs of heaven	Tomb artwork and religious belief of life after death
Role-play, costumes, masks	Kids dress as spirits and popular characters during trick-or-treat	High priests dressed as Egyptian gods during funeral
Objects	Jack-o-lanterns to scare away evil spirits	Protection charms in mummy wrappings
Food	Trick-or-treat candy, apples	Storage of food in the tomb for the afterlife
Widespread acceptance	Populace participates in trick-or-treating	Populace accepted religion; viewed funeral procession
Literature	Ghost stories, horror movies, songs, poems, Halloween cards.	Book of the dead, verbal stories, tomb writing in hieroglyphics

Second Activity to Increase Complexity

Students research the lesser known, natural mummies of the world:

- Research two of the bog bodies of northern Europe (Lindow Man, Weerdinge Men, Windeby Girl, Tollund Man, Grauballe Man, etc.)
- Research the bog bodies of North America, like the peat mummies at Windover, Florida.
- Research the natural mummification process found in peat bogs.
- Make connections between popular media and solving the mysteries of natural mummies.

An interesting subtopic might be to investigate different instances of people being buried in bogs in northern Europe and later found as peat was excavated for modern use. After researching the different bog bodies, the increase in complexity will occur as students make connections to popular media. Students should attempt to make a table of ideas on their own. There are so many different crime shows that the students have most likely seen, and they can generate connections of how bog bodies are investigated through their literature research. Another way to increase complexity is to have students not only connect to investigative techniques from popular media, but have the students explore and present historic or current cases. This topic creates a great opportunity for a literacy connection to increase complexity. Have students read a murder mystery or two and then create a table of connections with the bog bodies from the investigation techniques in the story.

Table 3 (below) provides some ideas for connections to popular media.

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Table 3. Comparison of Scientific Techniques Used in Investigating Bog Bodies to Those Shown in the Popular Media

Techniques in Current Popular Media	Mystery of Deaths of Bog Bodies
CSI: Crime Scene Investigation show conducts autopsies	Well-preserved stomach contents
X-Files Agent Dana Scully does autopsies and examines unusual features of corpses	Well- preserved skin and orange hair
Sherlock PBS Series: Sherlock Holmes is able to deduce facts from small clues on clothing	Preserved clothing and hats
Bones series has Dr. Temperance Brennan ("Bones") examine human remains to determine manner of death.	Cause of or motive for death
48 Hours Mystery and Cold Case files use modern techniques to unravel the mysteries behind people's deaths	Origins of the people through CT scans, three-dimensional imaging, and radiocarbon dating, DNA analysis

Extension of the Social Studies Object Box Idea

Another idea to have students create "get to know you" boxes at the start of class. Inside each student's set will be items that describe their background, talents, interests, pets, and characteristics. A restriction to place on the box would be to limit the students to one picture, the rest being actual three-dimensional items. This way, the students must think more critically about who they are, what describes them, and how to represent those ideas physically. The cards to accompany this box can be the traditional descriptive adjective cards describing the items. See Figure 11 for example objects in a student's set.

After matching the items to their sets of descriptive adjectives, classmates would guess what each object might represent. The back of each of the descriptive adjective card should have a brief explanation of what the object represents. Once the items have been matched and inferences as to the

meanings of objects have been made, each peer adds one item to a list of additional items that might be put into the set to represent the maker of the box and explains his or her reasoning. This activity forces the student to use the items in the box to better understand their peers. For example, a student may have a small guitar in their box. The peer could add sheet music to the chart because the student is interested in music or playing music. At the end of the school year, students could revisit their boxes and reflect on the items: what has changed? Would they still have those items in there? Is the list a good representation of items they would include? Students could reflect verbally in a discussion or write their thoughts in a journal.

Hedgehog figure: Has pet hedgehog
Angel and Peace: Is well-behaved
Bird: Likes to bird-watch
Fossil coral: Born in Michigan (State Fossil)
Gear: Wants to be an engineer

Figure 11. Objects in a Student's "Get to Know Me" Set

Science: Investigating Colony Collapse Disorder

Basic Lesson

Object boxes can be used in science to provide hands-on representations of concepts to hold student attention and improve learning. Provide an object box that is focused on an organism such as bees, caterpillars, bats, or spiders. Make a web of interdependency of organisms in the environment with this animal at the center. Such a web is shown below in Figure 12.

Iowa Core Essential Concept and/or Skill: ***Understand and apply knowledge of:***

- ***Interdependency of organisms, changes in environmental conditions, and survival of individuals and species.***

First Activity to Increase Complexity

A set of materials focusing on Colony Collapse Disorder, the current vast reduction in bee colonies in the United States, may include items affected by the disorder such as flowers, beeswax products, and honey. It may contain other items representing crops affected by the loss of flower pollination such as a vegetable seed packet and a plastic squash or tomato. Simulated pesticides or herbicides (a small bottle or box with the image of the product's ad glued or taped to it to represent the chemical may also be included (Never include anything dangerous or poisonous in an object box.) Perhaps a statement about GMO's (genetically modified organisms) from an organic food product package can be included to represent genetic modifications of crops. See Table 4 (next page).

One set of cards that accompanies the items has a set of four adjectives on each card to describe each item, as in a typical descriptive adjective object box. Another set of cards; to be made by the students, goes into further detail about possible causes of Colony Collapse Disorder, connecting specific ideas with objects in the box. This step adds to the complexity of the activity, as students will need to locate additional information about Colony Collapse Disorder to successfully complete the matching.

Extension

This extension focuses on students' research ability. The matching activity described previously can be a warm-up to writing a research paper by helping the student create an outline and gain background knowledge on the topic. This allows the teacher's object box activity to integrate language arts into the science lesson. A discussion about cause and effect can follow. The students should be able to create a table based on the information gathered about the Colony Collapse Disorder and how its effects are represented through the items in the box.

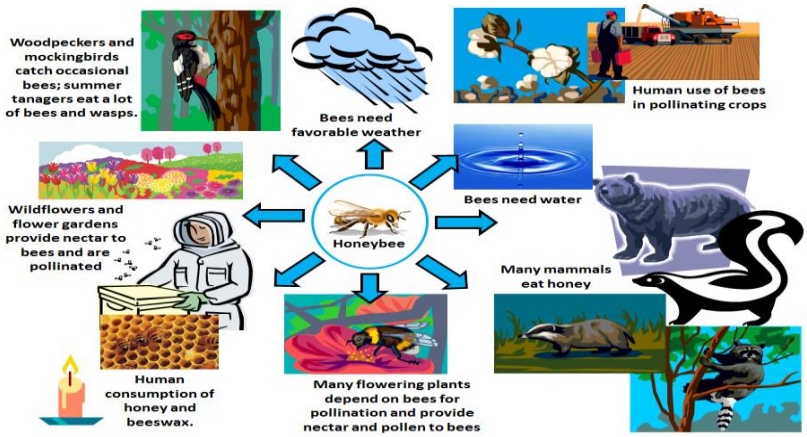

Figure 12. Diagram showing interdependence of organisms and environmental factors related to the honeybee

Table 4. Example items that might be in the **Colony Collapse Disorder Box**

A few honeybees made of different materials	Artificial flowers to represent wild or planted flowers for the bees	Seed packets or real examples of crops like corn, wheat, and cotton that might not be pollinated
Ceramic honey jar representing honey	Products made from beeswax such as lip gloss or candle	Plastic examples of fruit or vegetables that might not get pollinated
Small bottle with an ad about an insecticide taped to it to represent insecticides	Small box with label of a common herbicide glued to it to represent herbicides	Genetically Modified Organism – perhaps a statement cut from a food product or a part of a crop plant labeled "GMO"

Extending to Other Current Events Affecting Organisms

Students could research topics other than the issues of reduction in bee colonies. They could examine current science-related issues in the news such as the Ebola outbreak in several countries of Africa. After researching an issue, students form small groups to generate solutions. Students, then, could have a classroom science conference in which each group presents their solutions to the rest of the class. Students are assessed on how well they convey their ideas and whether their solution idea could actually be implemented. See Table 5 below for some recent events and issues.

A great way to increase complexity in science is to integrate another related problem. The book *Silent Spring* by Rachel Carson (1962) focuses on similar ideas to the colony collapse disorder. Have students read the book and make connections between the environmental problems in the book (such as the pesticide DDT causing thin egg shells in birds) and the environmental consequences of the Colony Collapse Disorder.

Combining reading about environmental problems of the past with the current issue of Colony Collapse Disorder will challenge students to make multiple connections between the events. *Silent Spring* brings an opportunity for students to learn about the field of ecocriticism, in which literary scholars analyze the environment, generate solutions, and also examine the ways environmental problems and nature are portrayed through literature. Having students write a story or article about the colony collapse disorder from an eco-critical stance will challenge them to take and apply the knowledge they have acquired.

Table 5. Possible Current Events Affecting Organisms

Honeybees	Colony collapse disorder is a serious problem threatening the health of honey bees in the United States. By planting flowers in neighborhoods, people can provide needed nectar and pollen to bees.
Monarch butterflies	Monarch butterflies died in record numbers, possibly due to weather extremes and farming practices that kill milkweed, their food source as caterpillars. Monarch butterflies disseminate pollen, which affects plant diversity. They are also a food source for many birds.
Bats	Many bats are dying because of white-nose syndrome, a fungus infection around the muzzle of bats. The fungus is rapidly spread by humans entering and exploring caves in which bats hibernate. Bats eat a tremendous number of insects each night including mosquitoes and farm pests. Bats pollinate desert cacti.
Spiders	A rare spider that has not been seen for 3 decades was discovered at the site of a 15 million dollar highway construction project in Texas, and the construction project was halted.

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