# Science of Spin ™
# and the 2010 TEKS Science Objectives
# Grades K-5

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The Science of Spin ™ program is an interdisciplinary program between science and physical education. Math, Language Arts, Social Studies, and additional Science are also incorporated into the Interdisciplinary Curriculum provided to the school. This writing summarizes how the Science of Spin ™ program supports the Texas Essential Knowledge and Skills **science** objectives.

**Format of this document**

Page 1-2 identifies the Science concepts that are addressed as part of the Science of Spin ™ presentation and curriculum.

Pages 3-7 discusses in detail how these concepts are addressed in the Science of Spin ™.

Pages 8-22 identifies specific TEKS statements of science objectives by grade level and explains in general how the Science of Spin™ addresses these concepts.

***NOTE: Keep in mind that some of these concepts, though not specifically named in the TEKS Objectives are contained in the science textbooks and taught in the classroom in order to build upon in mastering the TEKS Objectives.***

## SCIENCE

**Introduction**

TEKS Science objectives for grades K-5 identify increasingly complex concepts of science. The Science of Spin ™ assembly program is designed to primarily support science concepts in the area of physics, particularly in the area of **Force, Motion and Energy**. The Science of Spin ™ Interdisciplinary Curriculum, however, which is provided to the school as part of the program, continues to support not only physics, but also simple systems and scientific processes such as the Scientific Method, which is addressed in increasing complexity in all grade levels.

**During Science of Spin Presentation**:

1. Gyroscopic Stability
2. Distribution of Mass
3. Planes of Spin – vertical, horizontal, diagonal
4. Friction – force which causes change
5. Air Resistance (drag)
6. Levers – effect on energy production
7. Gravity – natural force that causes motion
8. Potential & Kinetic Energy – transfer of energy

**Additions to Science of Spin Presentation when possible:**

9. Reinforcement of Importance of Reduce, Reuse, Recycle to our world
10. Color Mixing as demonstrated through spinning objects

**Additions included in Interdisciplinary Curriculum / Products**

11. Systems
12. Scientific Method
13. Electricity – flows in a circuit and can produce light

## Summary of Science Concepts Addressed Grades K-5

1. **Gyroscopic Stability (i.e. spinning energy)** This physics concept relates for Force, Motion and Energy. Newton's First Law of Motion states, "Every object in a state of uniform motion tends to remain in that state of motion unless an external force is applied to it." The students are to observe that a spinning object will continue to rotate around a fixed point, its axis, until acted upon, and thereby affected by, a force.

**The Science of Spin ™ Presentation addresses Gyroscopic Stability throughout the program in the following manner:**

**- Once a wheel is spinning in a particular plane (review of horizontal, vertical and diagonal planes of spin), it does not want to change its plane of spin, as long as it has Gyroscopic Stability (spinning energy). This concept is continually repeated throughout the program using objects such as a wheel, a gyroscope, a yo-yo, a spin top, and a football.**

**a. The gyroscope or spin top remain upright while spinning on its point and not fall off when hanging from the string due to its gyroscopic stability.**

**b. The wheel remains upright while spinning across the floor, until acted upon by enough ground friction or an outside force, such as a wall, to halt the spin.**

**2. Distribution of Mass.** This physics concept relates for Force, Motion and Energy. The students are to observe that an object with a greater mass distribution on the outside rim will move a greater distance or spin longer than one with less outside rim mass, given that the speed begins the same.

**The Science of Spin ™ Presentation addresses Distribution of Mass throughout the program in the following manner:**

**- When two or more objects are spun or thrown while spinning, each with the same speed of spin, the object having the greatest percentage of mass on the outside rim will spin the longest or travel the furthest. This concept is visually reinforced with demonstrations of flying discs, spin tops and footballs.**

**3. Planes of Spin.** This physics concept relates to Force, Motion and Energy in describing the position and direction of an object. Planes are also an important function of mathematics. Students are to observe the different planes in which a spinning object may spin.

**The Science of Spin ™ Presentation addresses Planes of Spin when demonstrating with the wheel, as well as the spin top in concept 1 – Gyroscopic Stability. Students are expected to respond to the presenter in**

**answering what plane a particular object is spinning in; i.e. horizontal, vertical or diagonal.**

**4. Friction.** Friction is directly related to Force, Motion and Energy, as it is a force that must be addressed with any type of motion. The students are introduced to friction being an example of something that causes change.

**The Science of Spin ™ Presentation addresses Friction throughout the program in the following manner:**

**- Describing why a wheel, yo-yo or spin top eventually stops and falls over. A discussion ensues regarding where the friction exists in each of these examples (ground, air, hand, and string). Air Friction (air resistance) is most specifically discussed as it relates to flying discs.**

**5. Air Resistance (Drag).** This is yet another part of Force, Motion and Energy. As a type of friction, air resistance (drag) is also an outside force affecting motion. In addition, designing objects in such a way (thinner, rounded edges, etc) so as to reduce wind drag will, therefore, increase efficiency. Students are to observe the effect of air resistance when an object is thrown.

**The Science of Spin ™ Presentation addresses Air Resistance throughout the program in the following manner:**

**- In comparing the flight of 2 different styles of flying discs, one which is solid throughout and one which is a thinner, "ring" style, the question becomes, "Which of these flying discs, thrown with the same velocity of spin (force), will spin the longest?" One reason is that of aerodynamics, that is, the thinner flying disc will be more aerodynamic because of its shape and more efficient interaction with the air (air resistance).**
**See also concept 4. Friction.**

**6. Levers.** Levers are an ideal tool to use in the explanation of Force, Motion and Energy. The student is to observe the increased amount of force, motion and energy that is generated as the lever gets longer.

**The Science of Spin ™ Presentation addresses Levers in the following manner:**

**- Description that the finger, hand, forearm and entire arm all are levers. To achieve the longest spin possible with a yo-yo requires the longest lever available, the entire arm. Yo-yos that are thrown with the wrist generate less spin time.**

**- A diabolo is used to demonstrate the use of levers to generate power, to transfer energy, and to throw the diabolo high into the air.**

**- Presenter questions the students about what sports use levers? Not only the obvious ones such as baseball, golf and tennis, but also football and soccer, as the entire body is a set of levers. This also reinforces why the yo-yo string is placed on the finger between the first and second knuckle and**

**NOT at the base of the finger….again, to include the finger in achieving the longest lever possible.**

**7. Gravity.** Related to Force, Motion and Energy, gravity is, of course, a force that has an effect on virtually all motion. The students are to observe how gravity relates to a spinning object, both when it is spinning and when it is at rest.

**The Science of Spin ™ Presentation addresses Gravity in the following manner:**

**- The very first yo-yo trick taught to a volunteer member of the audience is called the 'Gravity Pull' where gravity pulls the yo-yo down and the player pulls it back up.**

**- Another popular yo-yo trick, 'Reach for the Moon' is described as being difficult because the yo-yo is going *against* gravity.**

**- Gravity is also described as the force causing a gyroscope or spin top to fall off of one's hand or the string, or a wheel to fall over, if the object is not spinning.**

**8. Potential & Kinetic Energy.** Related to the study of Force, Motion and Energy, potential and kinetic energy are two different forms of energy. The students are to observe that force and motion are related to potential and kinetic energy.

**The Science of Spin ™ Presentation addresses Energy in the following manner:**

**- While demonstrating the diabolo skill toy, the transfer of potential energy in the muscles of the arm (when still) to the kinetic energy of the arm, sticks, and string (when moving).**

**- Energy is then described as being converted into spinning energy of the diabolo through the use of friction between the string and the diabolo axle itself (transfer of energy).**

**- Energy is described as never being lost. The most dramatic example is when a student stands on a turntable, holding a wheel which is spun. When asked to tip the wheel from a vertical to a horizontal position, the student spins around. Because the spinning object does not want to change its plane of spin (concept 1-Gyroscopic Stability), the energy it takes to force it to change its plane is dramatically transferred through the student's body, and shown to spin him/her around. (Note: This demonstration is only done if time permits.)**

**9. Reduce, Reuse, and Recycle.** All grade levels are encouraged to learn and demonstrate ways we all can conserve our natural resources. Presenter frequently explains why a hat is has been chosen to be "reused" as a bag rather than throwing it out and making an additional purchase of a bag to hold the large spinning top. Examples speak volumes.

**10. Color Mixing.** Visual demonstration of color mixing becomes simple when using a spinning object. A top painted red and white will appear pink when spun. Presenter quizzes the students about other color combinations.

**11. Systems**. All grade levels study our world with regard to increasingly complex systems. The students should understand a whole in terms of its components and how these components relate to each other and to the whole.

**The Science of Spin ™ Presentation** addresses simple systems in the following manner:

- a yo-yo cannot work without a string and visa versa
- describe yo-yos with fixed axles vs. ball-bearing axles and the effect on performance.
- describes Hubble Telescope and how telescope is ineffective without the gyroscope working inside of the telescope.

**The Science of Spin ™ Interdisciplinary Curriculum** contains simple experiments that may be used in the classroom involving:

- fixed vs. ball-bearing axle and the effect on performance
- mass distribution (yo-yos will varying amounts of rim weight and the effect on performance)

**12. Scientific Method**. Scientific investigations are explored at all grade levels, particularly through the use of the scientific method. The students are expected to be able to conduct classroom investigations, ask questions, observe, gather information, make measurements and draw conclusions. The students are also expected to summarize their findings verbally and/or through the use of tables and graphs.

**The Science of Spin ™ Interdisciplinary Curriculum** has grade appropriate experiments that can be done with yo-yos and spinning tops in the classroom utilizing measurement and the Scientific Method in predicting outcomes, as well as mathematical calculations involving:

- measurement
- sorting
- drawing inferences related to functionality
- summarize their findings using tables and graphs

**13. Electricity** Electricity relates to Force, Motion and Energy. The Law of Conservation of Energy states that energy can neither be created or destroyed, it just changes form. The student should understand that complex systems may not work if some parts are removed, such as a light bulb in a circuit.

**The Science of Spin ™ product offerings frequently include a LED lighted yo-yo. Students are encouraged to discover how this works (either through the**

**use of a centrifugal switch or one caused by motion detection, making electrical contact when the yo-yo is spun). Energy is changed from mechanical energy to electrical energy to light energy.**

## TEKS Specifics by Grade Level – Grades K through 5

The Science of Spin ™ program (consisting of both the assembly presentation and/or the Interdisciplinary Curriculum) address the following TEKS Objectives. Notation should be made that the Science of Spin presentation is usually presented to students in Grades 3 through 5, however, Kindergarten as well as Grades 1 and 2 TEKS will be addressed briefly here as well. The Science of Spin Curriculum, however, addresses all grade levels 1 through 5.

## GRADES K-5

**TEKS 112.11, 112,12, 112.13, 112.14, 112.15, 112.16 (a) Introduction:** states:

> **(1)** "Science, as defined by the National Academy of Sciences, is the "**use of evidence to construct testable explanations and predictions of natural phenomena**, as well as the knowledge generated through this process."
> **(2)** ""Recurring themes are pervasive in sciences, mathematics, and technology. These ideas transcend disciplinary boundaries and include **patterns, cycles, systems, models, and change and constancy."**
> **(3)** "The study of elementary science includes…using **scientific methods, analyzing information, making informed decisions, ……while addressing the major concepts and vocabulary, in the context of physical**, earth, and life **sciences**."

Physical Science is defined as any of the sciences, such as **physics,** chemistry, astronomy, and geology, that analyze the nature and properties of energy and nonliving matter.
The **Science of Spin** ™ **Presentation** repeatedly demonstrates testable explanations in describing many facets of Force, Motion and Energy.
Through these visual demonstrations, students gain the knowledge of these concepts easily and effortlessly through the use of items familiar to them in their limited world view (spinning toys), increasing their exposure to these concepts and to the vocabulary associated with them.

## KINDERGARTEN

**TEKS 112.11 (a) Introduction:** As described above for all K-5

**TEKS 112.11 (a)(4)** states:

"In Kindergarten, students **observe and describe** the natural world using their five senses. **Students do science as inquiry in order to develop and enrich their abilities to understand** scientific concepts and processes. **Students develop vocabulary through their experiences investigating properties of common objects**, earth materials, and organisms."

**(A) "**A central theme throughout the student of scientific investigation and reasoning; **matter and energy; force, motion, and energy;…**Scientific investigation and reasoning involves…asking questions…and **seeking answers to those questions through simple observations** and descriptive investigations."**"**

**The Science of Spin TM Presentation** is interactive and engaging, allowing students to understand simple concepts **of force, motion and energy** through both observation and discussion. Terms are used grade appropriately. For example, "friction" may be called "friction," but also defined as "rubbing," with the activity of everyone rubbing their hands together to produce heat.

**(B)** "Matter is described in terms of its physical properties, including relative **size** and **mass**, shape, **color**, and texture. …. The location and **motion of objects** are explored."

**The Science of Spin TM Presentation** uses many terms and concepts related to spinning objects and their physical properties, as well as their motion. Grade appropriate terms are used depending on the audience in attendance.

**TEKS 112.11 (b)(1)(C)** states:

"demonstrate how to use, conserve, and dispose of natural resources and materials such as conserving water and **reusing or recycling** paper, plastic, and metal."

**The Science of Spin TM Presenter** encourages the concept of "Reduce, Reuse and Recycle" whenever possible during the presentation. An example is when the presenter frequently explains why a hat is has been chosen to be "reused" as a bag rather than throwing it out and making an additional purchase of a bag to hold the large, and VERY impressive spinning top.

**TEKS 112.11 (b)(2)** states:

"Scientific investigation and reasoning. The student develops abilities to ask questions and seek answers in classroom and outdoor investigations. The student is expected to:

**(A)** "ask questions about organisms, **objects,** and events observed in the natural world;"

**(B) "**plan and conduct simple descriptive investigations such as **ways objects move;"**

**(C) "**collect data and **make observations** using simple experiments….;"

**(D)** "**record and organize data** using pictures, numbers, and words;"

**(E) "communicate observations with others** about simple descriptive investigations;"

**Science of Spin ™ Interdisciplinary Curriculum** has simple grade appropriate experiments in both Science and Math that can be done with yo-yos and spinning tops in the classroom utilizing measurement and the Scientific Method in predicting outcomes.

**TEKS 112.11 (b)(5)(A)** states:

"**Matter and energy**. The student knows that objects have properties and patterns. The student is expected to:"

**(A)** "observe and record properties of objects, including relative **size** and **mass,** such as **bigger or smaller** and **heavier or lighter**, shape**, color**, and texture;…"

**The Science of Spin ™ Presentation** uses many terms and concepts related to spinning objects and their physical properties, as well as their motion. Grade appropriate terms are used depending on the audience in attendance.

**TEKS 112.12 (b)(6)** states:

"**Force, motion, and energy**. The student knows that **force, motion, and energy** are related and are a part of everyday life. The student is expected to:"

**(D) "**observe and describe the ways that objects can move such as in a **straight line**, zigzag, **up and down**, **back and forth**, **round and round**, and fast and slow."

**The Science of Spin ™ Presentation** is full of observable objects in motion! Students visually track ways the yo-yo moves…up and down, back and forth and round and round. **In Physical Education**, while learning the yo-yoing skills, students use these terms of "push/pull" and "up/down" as they practice. They wind their yo-yo by wrapping the string "round and round" or by putting the yo-yo on the floor and walking backwards "in a straight line."

## GRADE 1

**TEKS 112.12 (a) Introduction:** As described above for all K-5

**TEKS 112.12 (a)(4)** states:

In Grade 1, students observe and describe the natural world using their five senses. **Students do science as inquiry in order to develop and enrich their abilities to understand** scientific concepts and processes. **Students develop vocabulary through their experiences investigating properties of common objects**, earth materials, and organisms."

**(A)** "A central theme in first grade science is active engagement in **asking questions, communicating ideas**, and exploring with scientific tools in order to explain scientific concepts and processes like scientific investigation and reasoning: matter and **energy**; **force, motion, and energy;**…"

**The Science of Spin ™ Presentation** is interactive and engaging, allowing students to understand simple concepts of **force, motion and energy** through both observation and discussion. Terms are used grade appropriately. For example, "friction" may be called "friction," but also defined as "rubbing," with the activity of everyone rubbing their hands together to produce heat.

**TEKS 112.12 (a)(4)(B)** states:

"Matter is described in terms of its physical properties, including relative **size** and **mass**, shape, **color**, and texture." "The location and **motion** of objects are explored."

**The Science of Spin ™ Presentation** uses many terms and concepts related to spinning objects and their physical properties, as well as their motion. Grade appropriate terms are used depending on the audience in attendance

**TEKS 112.12 (b)(1)(C)** states:

"identify and learn how to use natural resources and materials, including conservation and **reuse or recycling** of paper, plastic, and metals."

**The Science of Spin ™ Presenter** encourages the concept of "Reduce, Reuse and Recycle" whenever possible during the presentation. An example is when the presenter frequently explains why a hat is has been chosen to be "reused" as a bag rather than throwing it out and making an additional purchase of a bag to hold the large, and VERY impressive spinning top.

**TEKS 112.12 (b)(2)** states:

**(A)** "ask questions about organisms, **objects,** and events observed in the natural world;"

**(B) "**plan and conduct simple descriptive investigations such as **ways objects move;"**

**(C)** "collect data and **make observations** and provide reasons for explanations using simple equipment…;"

**(D)** "**record and organize data** using pictures, numbers, and words;"

**(E) "communicate observations and provide reasons for explanations** using student-generated data from simple descriptive investigations;"

**Science of Spin ™ Interdisciplinary Curriculum** has simple grade appropriate experiments in both Science and Math that can be done with yo-yos and spinning tops in the classroom utilizing measurement and the Scientific Method in predicting outcomes.

**TEKS 112.12 (b)(5)(A)** states:

"**Matter and energy**. (A) classify objects by observable properties of the materials from which they are made such as **larger and smaller, heavier and lighter**, shape**, color**, and texture;"

**The Science of Spin ™ Presentation** uses many terms and concepts related to spinning objects and their physical properties, as well as their motion. Grade appropriate terms are used depending on the audience in attendance.

**TEKS 112.12 (b)(6)** states:

"**Force, motion, and energy**. The student knows that **force, motion, and energy** are related and are a part of everyday life. The student is expected to:"

**(D)** "demonstrate and record the **ways that objects can move** such as **in a straight line**, zip zag, **up and down**, **back and forth**, **round and round**, and fast and slow."

**The Science of Spin ™ Presentation** is full of observable objects in motion! Students visually track ways the yo-yo moves…up and down, back and forth and round and round. **In Physical Education**, while learning the yo-yoing skills, students use these terms of "push/pull" and "up/down" as they practice. They wind their yo-yo by wrapping the string "round and round" or by putting the yo-yo on the floor and walking backwards "in a straight line."

## GRADE 2

**TEKS 112.13 (a) Introduction:** As described above for all K-5

**TEKS 112.13 (a)(4)** states:

"In Grade 2, **careful observation** and investigation are used to learn about the natural world and reveal patterns, changes, and cycles. Students should understand that certain types of questions can be answered by using observation and investigations and that the information gathered in these may change as new observations are made…"

> **The Science of Spin ™ Presentation** is interactive and engaging, allowing students to understand simple concepts of **force, motion and energy** through both observation and discussion. Terms are used grade appropriately. For example, "friction" may be called "friction," but also defined as "rubbing," with the activity of everyone rubbing their hands together to produce heat.

**(A) "**Within the physical environment, students expand their understanding of the properties of objects such as shape, **mass,** temperature, and flexibility…" "Students **manipulate objects to demonstrate a change in motion and position**."

**The Science of Spin ™ Presentation** uses many terms and concepts related to spinning objects and their physical properties, as well as their motion. Grade appropriate terms are used depending on the audience in attendance.

**TEKS 112.13 (b)(1)(C)** states:

"identify and learn how to use natural resources and materials such as conserving water and **reuse or recycling** of paper, plastic, and metals."

**The Science of Spin ™ Presenter** encourages the concept of "Reduce, Reuse and Recycle" whenever possible during the presentation. An example is when the presenter frequently explains why a hat is has been chosen to be "reused" as a bag rather than throwing it out and making an additional purchase of a bag to hold the large, and VERY impressive spinning top.

**TEKS 112.13 (b)(2)** states:

**(A)** "ask questions about organisms, **objects,** and events during **observations** and investigations;"

**(C)** "**collect data from observations** using simple equipment…;"

**(D)** "**record and organize data** using pictures, numbers, and words;"

**(E) "communicate observations and justify explanations** using student-generated data from simple descriptive investigations;"

**Science of Spin ™ Interdisciplinary Curriculum** has simple grade appropriate experiments in both Science and Math that can be done with yo-yos and spinning tops in the classroom utilizing measurement and the Scientific Method in predicting outcomes.

**TEKS 112.13 (b)(5)(A)** states:

"**Matter and energy**. (A) classify matter by physical properties, including shape, **relative mass,** relative temperature, texture, flexibility, and whether material is a solid or liquid;"

**TEKS 112.13 (b)(6)** states:

"The student knows that **forces cause change and energy exists in many forms.** The student is expected to:

**(C) "trace the change in the position of an object over time such as a cup rolling on the floor and a car rolling down a ramp; and"**

**(D) "compare patterns of movement of objects such as sliding, rolling, and spinning."**

**The Science of Spin ™ Presentation** continually addresses the concepts of **force and energy**. The most dramatic may be when a bicycle wheel is spun and released to the ground, spinning and traveling independently across the floor. Discussion ensues about whether the wheel will continue to travel forever or stop and by what force will it eventually stop? It could be friction or by some other outside force, such as a wall. And, what force or energy keeps the wheel upright? Of course, the answer is the force of spin…spinning energy, gyroscopic stability, or in other words, rotational inertia. Discussion continues about how much easier it is to keep a bicycle upright when the wheels are spinning faster than when they are spinning slower, or why it is easier to balance a basketball on your finger if the basketball is spinning than if it is not spinning.

## GRADE 3

**TEKS 112.14 (a) Introduction:** As described above for all K-5

**TEKS 112.14 (a)(4)** states:

"In Grade 3, students learn that the study of science uses appropriate tools and safe practices in planning and implementing investigations, **asking and answering questions, collecting data by observing** and measuring, and by **using models to support scientific inquiry** about the natural world."

**The Science of Spin ™ Presentation** is interactive and engaging, allowing students to understand simple concepts of **force, motion and energy** through both observation and discussion. Terms are used grade appropriately. Demonstrations using a variety of spinning toys, or **models**, reinforce concepts in an interesting way, and one that will be remembered by students due to their unique and fun nature. For example, during the discussion of levers, it is taught that a longer lever will give the most power. That may not be very interesting until you demonstrate how using your entire arm (lever) when you release your yo-yo will give you a MUCH longer spin time than if you release only with your wrist, as most people will typically do. Now, what student doesn't want a LONG spin with their yo-yo? That is something they will remember, and they will remember why, which is the beauty of relating science concepts to their world.

**TEKS 112.14 (b)(1)(B)** states:

"make informed choices in the use and conservation of matural resources by **recycling or reusing** materials such as paper, aluminum cans, and plastics."

**The Science of Spin ™ Presenter** encourages the concept of "Reduce, Reuse and Recycle" whenever possible during the presentation. An example is when the presenter frequently explains why a hat is has been chosen to be "reused" as a bag rather than throwing it out and making an additional purchase of a bag to hold the large, and VERY impressive spinning top.

**TEKS 112.14 (b)(2)** states:

"Scientific investigation and reasoning. The student is expected to:"

**(A) "**plan and implement descriptive investigations, including **asking and answering questions, making inferences,** …..to solve a specific problem in the natural world."

**(C) "**construct maps, graphic organizers, **simple tables, charts, and bar graphs** using tools and current technology **to organize, examine, and evaluate measured data**;"

**(D) "analyze and interpret patterns in data to construct reasonable explanations based on evidence from investigations;"**

**(E) "demonstrate that repeated investigations may increase the reliability of results;"**

**(F) "communicate valid conclusions supported by data in writing, by drawing pictures, and through verbal discussion."**

**Science of Spin ™ Interdisciplinary Curriculum** has simple grade appropriate experiments in both Science and Math that can be done with yo-yos and spinning tops in the classroom utilizing measurement and the Scientific Method in predicting outcomes.

**TEKS 112.14 (b)(3)** states:

**"**Scientific investigation and reasoning. The student is expected to:"

**(A) "**in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, **logical reasoning, and experimental and observational testing,**…..so as to **encourage critical thinking by the student;"**

**The Science of Spin ™ Presentation** is interactive and engaging by not only showing through observable demonstrations, but also through verbal inquiry of the students about what they think may or may not happen in a particular situation. For example, after demonstrating the concept of gyroscopic stability with a variety of spinning objects, a new object is introduced. Students are challenged to use their logical reasoning based on what they have previously observed to decide what they believe will happen in the next observable demonstration.

**TEKS 112.16 (b)(5)** states:

**"Matter and energy.** The student knows that matter has physical properties and those properties determine how matter is classified, changed, and used. The student is expected to:

**(A) "**classify matter by physical properties, including shape, **relative mass,** "

**The Science of Spin ™ Presentation** addresses **Distribution of Mass** throughout the program in the following manner:

- When two or more objects are spun or thrown while spinning, each with the same speed of spin, the object having the greatest percentage of mass on the outside rim will spin the longest or travel the furthest. This concept is visually reinforced with demonstrations of flying discs, spin tops and footballs.

**TEKS 112.14 (b)(6)** states:

**"Force, motion and energy.** The student knows that **forces cause change and that energy exists in many forms**. The student is expected to:"

**(A) "explore different forms of energy, including mechanical, light,** sound, and heat/thermal in everyday life;"

**(B) "demonstrate and observe how position and motion can be changed by pushing and pulling objects to show work being done such as swings, balls, pulleys, and wagons; and"**

**(C) "observe forces such as** magnetism and **gravity acting on objects."**

**The Science of Spin ™ Presentation** refers to different **forces and motion**. Lessons in **pulleys** and **levers** are an ideal tool to use in the explanation of **Force, Motion and Energy** and in doing work. The student is to observe the increased amount of force, motion and energy that is generated as the lever gets longer.
**Gravity** is also used throughout the presentation. With the **"Gravity Pull"** yo-yo trick, gravity pulls the yo-yo down and the player pulls it back up, while with "Reach for the Moon," it goes against gravity, rather than with it. **Gravity** is also described as the force causing a gyroscope or spin top to fall off of one's hand or the string, or a wheel to fall over, once the object has stopped spinning, as it has lost all of it's "spinning energy."

**TEKS 112.14 (b)(8)** states:
**(C)** "construct models that demonstrate the relationship of the Sun, Earth, and Moon, including orbits and positions;"

The Hubble Telescope is mentioned during the **Science of Spin ™ Presentation** as a way to show the importance of gyroscopes in space exploration and investigation. It is stated that without the gyroscope in the telescope, it is not possible to identify the position of the telescope in space. "You cannot see the sun rising in the East and setting in the West. You are in the middle of nowhere!" Of course, spin is also in space. The earth spins and the planets spin in rotational orbit around the sun.

## GRADE 4

**TEKS 112.15 (a) Introduction:** As described above for all K-5

**TEKS 112.15 (a)(4)** states:
"In Grade 4, investigations are used to learn about the natural world. Students should understand that certain types of questions can be answered by investigations and that methods, models, and conclusions built from these investigations change as new observations are made. **Models of objects and events are tools for understanding the natural world and can show how systems work**."

**The Science of Spin ™ Presentation** is interactive and engaging, allowing students to understand simple concepts of **force, motion and energy** through both observation and discussion. Terms are used grade appropriately. Demonstrations using a variety of spinning toys, or **models**, reinforce concepts in an interesting way, and one that will be remembered by students due to their unique and fun nature. For example, during the discussion of levers, it is taught that a longer lever will give the most power. That may not be very interesting until you demonstrate how using your entire arm (lever) when you release your yo-yo will give you a MUCH longer spin time than if you release only with your

wrist, as most people will typically do. Now, what student doesn't want a LONG spin with their yo-yo? That is something they will remember, and they will remember why, which is the beauty of relating science concepts to their world.

**(A)** "Within the natural environment, students know that earth materials have properties that are constantly changing due to **Earth's forces**."

**The Science of Spin ™ Presentation** continually refers to forces and energy. The most obviously of Earth's forces is that of **gravity**, which affects everything. **Gravity** is used throughout the presentation as it affects the yo-yo in going down the string, and the spin top falling off the hand or the wheel in falling over once the force of spin has depleted.

**TEKS 112.15 (b)(1)(B)** states:

"Scientific investigation and reasoning. The student is expected to:"
"make informed choices in the use and conservation of natural resources and **reusing and recycling** of materials such as paper, aluminum, glass, cans and plastic."

**The Science of Spin ™ Presenter** encourages the concept of "Reduce, Reuse and Recycle" whenever possible during the presentation. An example is when the presenter frequently explains why a hat is has been chosen to be "reused" as a bag rather than throwing it out and making an additional purchase of a bag to hold the large, and VERY impressive spinning top.

**TEKS 112.15 (b)(2)** states:

"Scientific investigation and reasoning. The student uses scientific inquiry methods during laboratory and outdoor investigations. The student is expected to:"

**(A)** "plan and implement descriptive investigations, including **asking well-defined questions, making inferences,…**to answer his/her questions;"
**(B)** "**collect and record data** by observing and measuring…"
**(C)** "**construct simple tables, charts, bar graphs**, and maps using tools and current technology **to organize, examine, and evaluate data**;"
**(D)** "**analyze data and interpret patterns to construct reasonable explanations from data** that can be observed and measured;"
**(F)** '**communicate valid, oral, and written results** supported by data."

**Science of Spin ™ Interdisciplinary Curriculum** has simple grade appropriate experiments in both Science and Math that can be done with yo-yos and spinning tops in the classroom utilizing measurement and the Scientific Method in predicting outcomes.

**TEKS 112.15 (b)(3)(A)** states:

"in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, **logical reasoning,** and experimental and **observational**

**testing,** including examining all sides of scientific evidence of those scientific explanations, so as to **encourage critical thinking by the student;"**

**The Science of Spin ™ Presentation** is interactive and engaging by not only showing through observable demonstrations, but also through verbal inquiry of the students about what they think may or may not happen in a particular situation. For example, after demonstrating the concept of gyroscopic stability with a variety of spinning objects, a new object is introduced. Students are challenged to use their logical reasoning based on what they have previously observed to decide what they believe will happen in the next observable demonstration.

**TEKS 112.15 (b)(5)** states:

**"Matter and energy.** The student knows that matter has measureable physical properties and those properties determine how matter is classified, changed, and used. The student is expected to:"

**(A) "**measure, compare, and contrast physical properties of matter, including size, **mass,** ……"

**The Science of Spin ™ Presentation** addresses **Distribution of Mass** throughout the program in the following manner:

- When two or more objects are spun or thrown while spinning, each with the same speed of spin, the object having the greatest percentage of mass on the outside rim will spin the longest or travel the furthest. This concept is visually reinforced with demonstrations of flying discs, spin tops and footballs.

**TEKS 112.15 (b)(6)** states:

"**Force, motion and energy.** The student knows that **energy exists in many forms** and can be observed in cycles, patterns, and systems**.** The student is expected to:"

**(A) "differentiate among forms of energy; including mechanical,** sound, **electrical**, **light**, and heat/thermal;"

**(C) "**demonstrate that **electricity travels in a closed path, creating an electrical circuit**,…."

**(D) "design an experiment to test the effect of force on an object such as a push or a pull, gravity, friction,** or magnetism."

**(A) The Science of Spin ™ Presentation** addresses **potential** and **kinetic energy** during the diabolo demonstration. **Potential energy** in a resting arm is transferred to **kinetic energy** once the arm is engaged in action. That **kinetic energy** is then transferred to the stick and the string. Since the string is not directly connected to the diabolo, this kinetic energy is then transferred once again, via friction (transfer of energy), to the diabolo itself and thus producing the spin.

The arm of a yo-yo player also has potential energy that is then transferred into kinetic energy once the arm is engaged, releasing the yo-yo.

**Energy** is also described as never being lost. The most dramatic example is when a student stands on a turntable, holding a wheel which is then spun. When

asked to tip the wheel from a vertical to a horizontal position, the student spins around. Because the spinning object does not want to change its plane of spin (concept 1-Gyroscopic Stability), the energy it takes to force it to change its plane is dramatically transferred through the student's body, and shown to spin him/her around. (Note: This demonstration is only done if time permits.)

**(C) (D) Products:** In addition, a product frequently used is one of two different LED lighted yo-yos, each of which has a battery operated circuit. In one, a bar causes contact with a post completing the circuit during the centrifugal force caused by the rotation of the yo-yo. In the other, a motion detector causes the contact, completing the circuit. Completion of the circuit, in either case, lights the yo-yo. Students are encouraged to discover on their own how these work.

**TEKS 112.15 (b)(8)** states:

**Earth and space.** "The student knows that there are recognizable pattern in the natural world and among the Sun, Earth, and Moon system."

The Hubble Telescope is mentioned during the **Science of Spin ™ Presentation** as a way to show the importance of gyroscopes in space exploration and investigation. It is stated that without the gyroscope in the telescope, it is not possible to identify the position of the telescope in space. "You cannot see the sun rising in the East and setting in the West. You are in the middle of nowhere!" Of course, spin is also in space. The earth spins and the planets spin in rotational orbit around the sun.

## GRADE 5

**TEKS 112.16 (a) Introduction:** As described above for all K-5

**TEKS 112.16 (a)(4)** states:

"In Grade 5, investigations are used to learn about the natural world. Students should understand that certain types of questions can be answered by investigations and that methods, models, and conclusions built from these investigations change as new observations are made. **Models of objects and events are tools for understanding the natural world and can show how systems work**."

**The Science of Spin ™ Presentation** is interactive and engaging, allowing students to understand simple concepts of **force, motion and energy** through both observation and discussion. Terms are used grade appropriately. Demonstrations using a variety of spinning toys, or **models**, reinforce concepts in an interesting way, and one that will be remembered by students due to their unique and fun nature. One example is given in section Grade 4 TEKS 112.15 (a)(4). Another would be when flying discs are discussed. The flying disc with the greatest amount of mass on the outside rim will fly the furthest when thrown with the same velocity of spin. This is demonstrated by model and will be remembered by students the next time they want to throw a flying disc the furthest possible!

**(A)** "Within the physical environment, students learn about the physical properties of **matter…**Students explore the uses of **light,** thermal**, electrical**, and sound **energies.**

**Products:** In addition, a product frequently used is one of two different LED lighted yo-yos, each of which has a battery operated circuit. In one, a bar causes contact with a post completing the circuit during the centrifugal force caused by the rotation of the yo-yo. In the other, a motion detector causes the contact, completing the circuit. Completion of the circuit, in either case, lights the yo-yo. Students are encouraged to discover on their own how these work.

**TEKS 112.16 (b)(2)** states:

"Scientific investigation and reasoning. The student uses scientific inquiry methods during laboratory and outdoor investigations. The student is expected to:"

**(A)** "**describe, plan, and implement simple experimental investigations**, testing one variable:
**(B)** "**ask well-defined questions, formulate testable hypotheses,** and select and use appropriate equipment and technology;"
**(C)** "**collect information by detailed observations** and accurate measuring**;"**
**(D)** "**analyze and interpret information to construct reasonable explanations** from direct (observable) and indirect (inferred) evidence;"
**(E)** "demonstrate that repeated investigations may increase the reliability of results;"
**(F)** "**communicate valid conclusions** in both written and verbal forms; and**"**
**(G)** "**construct appropriate simple graphs, tables**, maps, and **charts** using technology…**to organize, examine, and evaluate information**."

**Science of Spin ™ Interdisciplinary Curriculum** has simple grade appropriate experiments in both Science and Math that can be done with yo-yos and spinning tops in the classroom utilizing measurement and the Scientific Method in predicting outcomes.

**TEKS 112.16 (b)(3)** states:

Scientific investigation and reasoning. The student is expected to:"
**(A)** "in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, **logical reasoning,** and experimental and **observational testing,** including examining all sides of scientific evidence of those scientific explanations, so as to **encourage critical thinking by the student;"**
**(C)** "draw or **develop a model** that represents how something works or looks that cannot be seen such as how a soda dispensing machine works;.."

**(A) The Science of Spin ™ Presentation** is interactive and engaging by not only showing through observable demonstrations, but also through verbal inquiry of

the students about what they think may or may not happen in a particular situation. For example, after demonstrating the concept of gyroscopic stability with a variety of spinning objects, a new object is introduced. Students are challenged to use their logical reasoning based on what they have previously observed to decide what they believe will happen in the next observable demonstration.

**(C)** See reference to **models** in TEKS 112.16 (a)(4)

**TEKS 112.16 (b)(5)** states:

**"Matter and energy.** The student knows that matter has measureable physical properties and those properties determine how matter is classified, changed, and used. The student is expected to:

**(A) "**classify matter based on physical properties, including **mass,** ……"

**The Science of Spin ™ Presentation** addresses Distribution of Mass throughout the program in the following manner:

- When two or more objects are spun or thrown while spinning, each with the same speed of spin, the object having the greatest percentage of mass on the outside rim will spin the longest or travel the furthest. This concept is visually reinforced with demonstrations of flying discs, spin tops and footballs.

**TEKS 112.16 (b)(6)** states:

"**Force, motion and energy.** The student knows that **energy exists in many forms** and can be observed in cycles, patterns, and systems. The student is expected to:"

**(A)** "explore the uses of **energy**, including **mechanical**, **light**, thermal, **electrical**, and sound energy;"

**(B) "differentiate among forms of energy; including mechanical,** sound, **electrical**, **light**, and heat/thermal;

**(C) "**demonstrate that **the flow of electricity in circuits requires a complete path through which an electric current can pass and can produce light,** heat, and sound**;**"

**(D) "design an experiment to test the effect of force on an object such as a push or a pull, gravity, friction,** or magnetism."

**Science of Spin ™ Presentation** addresses many facets of **Force, Motion and Energy** throughout the program. **Potential** and **kinetic energy** is directly addressed during the diabolo demonstration.

**Potential** energy in a resting arm is transferred to **kinetic** energy once the arm is engaged in action. That **kinetic energy** is then transferred to the stick and the string. Since the string is not directly connected to the diabolo, this **kinetic** energy is then transferred once again, via friction, to the diabolo itself and thus producing the spin.

The arm of a yo-yo player also has **potential** energy that is then transferred into **kinetic** energy once the arm is engaged, releasing the yo-yo.

**Energy** is also described as never being lost. The most dramatic example is when a student stands on a turntable, holding a wheel which is then spun. When asked

to tip the wheel from a vertical to a horizontal position, the student spins around. Because the spinning object does not want to change its plane of spin (concept 1-Gyroscopic Stability), the energy it takes to force it to change its plane is dramatically transferred through the student's body, and shown to spin him/her around. (Note: This demonstration is only done if time permits.)

**(A) (B) (C) Products:** In addition, a product frequently used is one of two different LED lighted yo-yos, each of which has a battery operated circuit. In one, a bar causes contact with a post completing the circuit during the centrifugal force caused by the rotation of the yo-yo. In the other, a motion detector causes the contact, completing the circuit. Completion of the circuit, in either case, lights the yo-yo. Students are encouraged to discover on their own how these work.

**(D)** The **Science of Spin ™ Presentation** presents ideas for possible experiments to test the effect of force on an object. For example, two flying discs with varying amounts of rim weight or varying amounts of air resistance (air friction or drag) due to its shape. The **Science of Spin ™ Interdisciplinary Curriculum** also has suggestions for possible experiments, such as yo-yos with different styles of axles with different amounts of friction, which will directly affect length of spin.

**TEKS 112.16 (b)(8)** states:

**Earth and space.** "The student knows that there are recognizable pattern in the natural world and among the Sun, Earth, and Moon system. The student is expected to:"

**(C)** "demonstrate that Earth rotates on its axis once approximately every 24 hours causing the day/night cycle and the apparent movement of the Sun across the sky;"

The Hubble Telescope is mentioned during the **Science of Spin ™ Presentation** as a way to show the importance of gyroscopes in space exploration and investigation. It is stated that without the gyroscope in the telescope, it is not possible to identify the position of the telescope in space. "You cannot see the sun rising in the East and setting in the West. You are in the middle of nowhere!"
Of course, spin is also in space. The earth spins on its axis, causing our day and night and the planets spin in rotational orbit around the sun.