Purpose

Tulsa Public Schools has established as a goal that all students achieve scientific literacy. The National Science Education Standards, Oklahoma Priority Academic Student Skills**,** and the Tulsa Model for School Improvement provide a foundation for students to achieve this goal. These documents spell out the vision of ***Tulsa INQUIRES!*** which makes scientific literacy for all a reality.

A sound grounding in science strengthens many of the skills that people use every day, such as solving problems creatively, thinking critically, working cooperatively in teams, using technology effectively, and valuing lifelong learning.

Tulsa INQUIRES! will demand changes in the way we teach and learn science. This approach to teaching and learning incorporates strategies that reflect how science itself is done, emphasizing inquiry as a way of achieving knowledge and understanding about the world. ***Tulsa INQUIRES!*** invokes the following changes in:

- how students are taught
- how their performance is assessed
- how teachers are educated and keep pace
- the relationship between schools and the rest of the community (National Science Education Standards, 1999).

Tulsa INQUIRES! also emphasizes rigorous content knowledge so that students gain a deeper understanding of science and realize the value that understanding science has in our society.

Research

The Third International Mathematics and Science Study (TIMSS, 1995, 1999) data about the performance of students in the United States as compared to other countries substantiates concerns of science educators and policy makers. The majority of Americans are scientifically illiterate and serious reform in science and mathematics education is paramount to our nation's continued success. Experts agree that "hands-on" as well as "minds-on" experiences are essential for laying the foundation for all students to achieve science literacy (National Research Council, 1999).

The National Standards for Science Education call for all students to be engaged in active inquiry in order to develop their understanding of science through the combination of scientific knowledge with reasoning and thinking skills. Additionally, the hallmark report from the United States Department of Labor, the Secretary's Report for Achieving Necessary Skills (SCANS, 1991), cites that once students understand how science impacts their daily lives, it becomes easier for them to see the connection between science education and the world of work. ***Tulsa INQUIRES!*** acknowledges these findings and is focused on building effective scaffolding by which to attain the goal of science literacy for all students through strong, researched based, standards-driven, and inquiry grounded science curricula vertically articulated Pre-K through 12th grade.

The *National Science Education Standards* envision change throughout the system. The science content standards encompass the following changes.

Content

LESS EMPHASIS ON	**MORE EMPHASIS ON**
Knowing scientific facts and information	Understanding scientific concepts and developing abilities of inquiry
Studying subject matter disciplines (physical, life, earth sciences) for their own sake	Learning subject matter disciplines in the context of inquiry, technology, science in personal and social perspectives, and history and nature of science
Separating science knowledge and science process	Integrating all aspects of science content
Covering many science topics	Studying a few fundamental science concepts
Implementing inquiry as a set of processes	Implementing inquiry as instructional strategies, abilities, and ideas to be learned

Inquiry Process

LESS EMPHASIS ON	**MORE EMPHASIS ON**
Activities that demonstrate and verify science content	Activities that investigate and analyze science questions
Investigations confined to one class period	Investigations over extended periods of time
Process skills out of context	Process skills in context
Emphasis on individual process skills such as observation or inference	Using multiple process skills; manipulation, cognitive, and procedural
Getting an answer	Using evidence and strategies for developing or revising an explanation
Science as rote exploration and experiment	Science as argument and explanation
Providing answers to questions about science content	Communicating science explanations
Individuals and groups of students analyzing and synthesizing data without defending a conclusion	Groups of students often analyzing and synthesizing data after defending conclusions
Doing few investigations in order to leave time to cover large amount of content	Doing more investigations in order to develop understanding, ability, values of inquiry and knowledge of science content
Concluding inquires with the results of the experiment	Applying the results of experiments to scientific arguments and explanations
Management of materials and equipment	Management of ideas and information
Private communication of student ideas and conclusions to teacher	Public communication of student ideas and work to classmates

Goal

The goal of *Tulsa INQUIRES!* is to raise student achievement in science through improved teaching that focuses on the integration of content knowledge and process skills so that all students will gain a deeper understanding of scientific principles and processes, how they are applied and integrated across the curriculum, and how they affect their lives.

Tulsa INQUIRES! incorporates eleven critical components that guide teaching and learning across the district. Schools are encouraged to examine current practice to determine to what extent these eleven critical components are included in the schools' science instruction. The components are:

- Standards Driven Instruction
- Inquiry
- Unifying Content and Process Skills
- Integration of Content Areas
- Scientifically Research-Based Resources
- Professional Development
- Flexible Grouping
- Differentiated Instruction
- Effective Questioning and Communication
- Assessment
- Parental Involvement.

Principals should provide time so that teachers are able to plan and prepare for instructional delivery.

Critical Components

Standards Driven Instruction

The national content standards upon which our state standards are based, are organized by PreK-5, 6-8, and 9-12. These standards provide expectations for the vertical articulation of science curriculum over the course of PreK-12 education.

A standards driven system defines a vision of a scientifically literate populace. They outline what students need to know, understand, and be able to do to be scientifically literate at different grade levels. They describe an educational system in which:

- all students demonstrate high levels of performance
- teachers are empowered to make the decisions essential for effective learning
- communities of teachers and students are focused on learning science
- supportive educational programs and systems nurture achievement (NRC, 1999).

Inquiry

Inquiry is a way to discover science. Therefore, the process of inquiry itself must be taught so that it can be used to deliver science content in a standards-based classroom. Research offers compelling evidence that students learn science well when they construct their own understanding. Therefore, students must have the opportunity to:

- Make observations
- Ask questions
- Formulate procedures
- Conduct experiments
- Gather data
- Communicate results**.**

These behaviors occur most readily when students work cooperatively in groups, engage in discussion, make presentations, and become increasingly responsible for their own learning. Inquiry, rather than being a distinct topic to be covered, becomes the context in which all concepts and processes are learned.

Flexible Groups

Flexible grouping is an effective strategy students can collectively use to construct their own understanding. The following list will help teachers determine when and how to implement flexible grouping. Flexible grouping can be accomplished by:

- Using whole group instruction when introducing new concepts and skills
- Forming smaller, short-term groups as needed to reinforce learning and address individual achievement levels
- Reviewing and adjusting groups often, moving students as achievement levels change, avoiding underplacement, and involving other teachers in making placement decisions
- Providing in-class instruction in small groups for low achievers, avoiding pull-out classes
- Delivering high-quality instruction to students in lower-ability groups; varying learning materials and activities, demonstrating enthusiastic teacher behavior, providing opportunities to respond to higher-order questions
- Using heterogeneous cooperative learning groups for some learning activities
- Composing cooperative learning groups that represent not only different ability levels, but also both genders, different ethnic/racial backgrounds and socioeconomic strata
- Structuring cooperative learning groups so that there are both group rewards and individual accountability
- Making use of peer tutoring and peer evaluation groups to provide students feedback and support on their work (Cotton, 2000).

Differentiated Instruction

Differentiation is a way of thinking about teaching and learning. It is a philosophy. As such, it is based on the following set of beliefs.

- Students who are the same age differ in their readiness to learn, their interests, their styles of learning, their experiences, and their life circumstances.
- The differences in students are significant enough to make a major impact on what they need to learn, the pace at which they need to learn it, and the support they need from teachers and others to learn it well.

- Students will learn best when supportive adults push them slightly beyond where they can work without assistance.
- Students will learn best when they can make a connection between the curriculum and their interests and life experiences.
- Students will learn best when learning opportunities are natural.
- Students are more effective learners when classrooms and schools create a sense of community in which students feel significant and respected.
- The central job of schools is to maximize the capacity of each student (Tomlinson, 2000; Brandt, 1998; Danielson, 1996; Schlechty, 1997; Wiggins & McTighe, 1998).

Differentiation, one facet of expert teaching, reminds us that these things are likely to happen for the full range of students when curriculum and instruction fit each individual.

Unifying Content and Process Skills

Learning science will bring a double benefit because science is both a method and a set of ideas; both process and content. The processes used in doing scientific inquiry and the development of conceptual understanding work in concert; they must go hand in hand. ***Tulsa INQUIRES!*** will focus on developing teachers' ability to seamlessly interweave process and content in their instruction.

Integration

In real life, learning experiences are not separated into academic disciplines or subject areas. A student's classroom experiences should mirror this**.** Interconnections among the disciplines, when emphasized at all grade levels, will support learning by making the science curriculum more meaningful.

Brain research has shown that long-term memory, or true learning, depends upon information that makes sense and has meaning. Subject integration helps a student make sense and understand the meaning of new information. The integration of subject areas often reveals interdependency among the disciplines. For example, it would be impossible to analyze the results of a science inquiry without understanding the mathematics skills needed for data analysis.

Effective Questioning and Communication

When teachers ask salient open-ended questions and allow for an appropriate window or wait time, they can spur student thinking and be privy to valuable information gained from the response (Rowe, 1974). Questions do not need to occur solely in whole-group discussion. The strategy can occur one-on-one as the teacher circulates around the room. In addition to optimal wait-time, effective questioning requires a solid understanding of the subject matter, attentive consideration of each student's remarks, as well as skillful crafting of further leading questions that will extend student thinking.

Researched-Based Resources

Effective science teaching depends on the availability and organization of materials, equipment, media, and technology. ***Tulsa INQUIRES!*** supports the teaching of science in the following ways.

- A Pre-K and K leadership team will study developmentally appropriate standards-based curriculum such as *FOSS, AIMS,* and *GEMS*.
- Grades 1-8 will participate in the implementation of a complete science module program, *Science and Technology for Children*. The STC science module program is a comprehensive, research-based, National Science Foundation-supported curriculum that will enhance the development of student knowledge and skills.
- Leadership teams from all district high schools will systematically investigate standards based, research supported curriculum programs in biology, chemistry, physical science, and physics. These programs include *CPO Physics, Conceptual Physical Science, Biological Science Curriculum Study, Insights into Biology, and Chemistry in the Community*

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Professional Development

It is our goal to support the delivery of science instruction that incorporates the use of scientifically research-based resources. For teachers teaching grades 1-8, professional development during the 2004-2005 school year will focus on the science content strand of physical science. By narrowing the focus, teachers will reach a deeper understanding of the content knowledge, along with the instructional skills that are required to infuse rigor in their coursework and teach to higher levels of student understanding. Elementary and middle school science teachers will be trained and supported in the classroom as they use one science kit at a specifically scheduled time during the school year.

Along with the elementary and middle school training, a leadership team of representatives from all district high schools will participate in a series of professional development sessions that focus on pilot implementation strategies, experimental design, and assessment alignment to standards and benchmarks. Beginning in February and continuing through May of 2005, high school science teachers will have an opportunity to visit pilot classrooms. The visits will be used as part of the action research embedded in the pilot programs. All teachers will participate in a survey of current science practices across the district.

In the second stage of ***Tulsa INQUIRES!*** teachers will continue training and participate in activities that will lead into the science textbook adoption in 2005-2006. Prior to the science adoption, teachers will complete a follow-up survey. A timeline and kit rotation schedule is included in the appendix of this document.

Assessment

The Teacher's Role

Much of the responsibility for implementing the science standards rests with classroom teachers. Assessment is no exception. The standards recognize the importance of teachers' ongoing assessments. Teachers are in the position to best use assessment in powerful ways for both formative and summative purposes, including improving classroom practice, planning curricula, developing self-directed learners, reporting student progress, and investigating their own teaching practices. Teachers participation in classroom activities positions them to gain information and insight into their students' understandings, actions, interests, intentions, and motivation that would be difficult to glean from tests (Darling-Hammond, 1994; Moss, 1994, 1996). Teachers not only need to interpret the assessment-generated information; they also must use the information to adapt their teaching repertoires to the needs of their students.

The requirements of No Child Left Behind indicate that science will be tested in 2007-2008 in grades five, eight, and high school at the end of instruction. Tulsa Inquires will assist teachers in the delivery of instruction that supports improving student performance district wide.

The Student's Role

Student participation in the assessment process becomes essential if the standards are to be actualized for all students. Specifically, self-assessment becomes crucial for feedback to be effective. Students are the ones who must ultimately take action to bridge the gap between where they are and where they are heading (Sadler, 1989). Brown (1994) stresses the strategic element of being aware of particular strengths and weaknesses: "Effective learners operate best when they have insight into their own strengths and weaknesses and access to their own repertoires of strategies for learning."

The School's Role

In–depth case studies conducted by Darling-Hammond and colleagues (1995) report how teachers and students in five schools use assessment to inform instruction and stimulate greater learning. Their work reinforces that assessment makes learning central and cannot be separated from other aspects of schooling. By focusing on schools where assessment occurs through "real-world" challenges that engage students in the assessment process, the studies provide examples of the role that observation, logs, portfolios, journal writing, and self- and peer-assessment can play in facilitating powerful learning.

Assessment Emphasis

Less emphasis on	**More emphasis on**
Assessing what is easily measured	Assessing what is most highly valued
Assessing discrete knowledge	Assessing rich, well-structured knowledge
Assessing scientific knowledge	Assessing scientific understanding and reasoning
Assessing to learn what students do not know	Students engaged in ongoing assessment of their work and that of others
End-of-term assessments by teachers	Assessing to learn what students understand
Development of external assessments by measurement experts alone	Teachers involved in the development of external assessments

Assessment Types, Purpose, Roles and Responsibilities

Type	**Purpose**	**Roles & Responsibilities**
Formative	Improve learning	Student and teacher
	Inform instruction	Student and teacher
Summative	Grading	Teachers and external tests
	Placement	Teachers and external tests
	Promotion	Teachers and external tests
	Accountability	External tests (and teacher)

Parental Involvement

Parents are their children's first and most influential teachers. What parents do to help their children learn is a critical factor in achieving success. Studies show that when parents are involved in their children's learning at home in a particular subject, such as science, the children show higher achievement in that subject (Epstein, 1988). Families simply need to encourage children's natural curiosity and watch and learn along with them. Parents can model the pursuit of lifelong learning, inquiry, and curiosity by reading, asking questions, discussing scientifically related articles, and visiting museums and science centers with their children (American Academy for the Advancement of Science; Project 2061, 2004).

Parents can create opportunities for children to experience science at home. For example, most elementary students would naturally assume that a basketball would fall faster than a tennis ball because the basketball is larger and heavier. Parents can help children perform an experiment to observe that the results of gravity are the same and that both will reach the floor at the same time. In this way, students learn that it is not always wise to trust their intuition and that there is a scientific method that can be used to distinguish facts from opinions and misconceptions.

Parents can use the radio, television, and the Internet to encourage home-based science projects and investigations with their children. Examples of science related media outlets include:

- Weather Channel
- Animal Planet
- National Geographic Channel
- Discovery Channel
- Learning Channel
- National Public Radio Science Fridays
- Discovery.com
- Marcopolo.com
- Science and Literacy.com

Parent, school and community partnerships provide multiple avenues for sharing resources, promoting science literacy, and providing enrichment in science and technology. The Tulsa Area Chamber of Commerce sponsors the award winning program, *Partners in Education* that teams area businesses with neighborhood schools in order to provide sites with needed materials and support. Community science programs aimed at energy awareness and conservation are offered by entities such as The Nation Energy Foundation, the American Association for Petroleum Geologists, American Power and Light, the Tulsa Metropolitan Environmental Trust and Oklahoma Energy Resources Board. Tulsa Public Schools' *Parents as Teachers* program provides an opportunity for parents to participate in their child's classroom experiences. District science fairs are effective in strengthening community involvement in schools' science programs. They serve to strengthen students' content proficiency, promote careers in scientific research, raise public awareness of science education, and provide a platform for school, community and business partnerships.

Schools are encouraged to share "science at home" activities in their communications with parents. For example, each newsletter could include directions for a simple science experiment that could be done at home. In conclusion, research shows that a robust, highly interactive network of parents, community members, peers, and educators' stimulates a child's learning and development (Bronfenbrenner, 1989).

THE ROLE OF THE TEACHER IN THE INQUIRY CLASSROOM

WHAT IS THE TEACHER DOING?

In the inquiry classroom, the teacher's role becomes less involved with direct teaching and more involved with modeling, guiding, facilitating, and continually assessing student work. Teachers in inquiry classrooms must constantly adjust levels of instruction to the information gathered by informal assessment.

The teacher's role is more varied, including greater responsibility for creating and maintaining conditions in which students can build understanding. In this capacity, the teacher is responsible for developing student ideas and maintaining the learning environment.

In addition to the process skills that the student must hone in the inquiry environment, there are also skills a teacher must develop in order to support student learning of scientific ideas. In an inquiry environment, you may see the following teacher behaviors.

Teachers Model Behaviors and Skills

- Shows students how to use new tools or materials
- Guides students in taking more and more responsibility in investigations
- Helps students design and carry out skills of recording, documenting, and drawing conclusions

Teachers Support Content Learning

- Helps students form tentative explanations while moving toward content understanding
- Introduces tools, materials and scientific ideas appropriate to content learning
- Uses appropriate content terminology, as well as scientific and mathematical language

Teachers Use Multiple Means of Assessment

- Sensitive to what students are thinking and learning
- Identifies areas in which students are struggling
- Talks to students, asks questions, makes suggestions, shares, and interacts
- Moves around and is available to all students
- Helps students go to the next stage of learning with appropriate clues and prompts

Teachers Act as Facilitators

- Uses open-ended questions that encourage investigation, observation, and thinking
- Listens to students' ideas, comments, and questions, in order to help them develop their skills and thought processes
- Suggests new things to look at and try, and encourages further experimentation and thinking
- Encourages student dialogue (Ash, 1999).

Teaching for Equity

The learning styles of underrepresented groups, such as females and some minorities should be investigated. Additionally, disaggregated test data should be analyzed to plan for improved student achievement and meeting the requirements of the No Child Left Behind Act.

THE ROLE OF THE STUDENT IN THE INQUIRY CLASSROOM

WHAT ARE THE STUDENTS DOING?

Imagine yourself in an inquiry environment. What would you expect to see? These guidelines were created by observing students as they did "hands-on, minds-on" exploration. The intent is not to use this guide as a checklist, but to use it as a statement of what is valued in the areas of science process and science content development.

When students are doing inquiry-based science, an observer will see the following student behaviors.

Students View Themselves as Active Participants in the Process of Learning

- Look forward to doing science
- Demonstrate a desire to learn more
- Seek to collaborate and work cooperatively with their peers
- Confident in doing science; demonstrate a willingness to modify ideas, take risks, and display healthy skepticism
- Respect individuals and differing points of view

Students Accept an "Invitation to Learn" and Readily Engage in the Exploration Process

- Exhibit curiosity and ponder observations
- Take the opportunity and time to try out and persevere with their own ideas

Students Plan and Carry Out Investigations

- Design a fair test as a way to try out their ideas, not expecting to be told what to do
- Plan ways to verify, extend, or discard ideas
- Carry out investigations by handling materials with care, observing, measuring, and recording data

Students Communicate Using a Variety of Methods

- Express ideas in a variety of ways: notebooks, reporting out, drawing, graphing, charting
- Listen, speak, and write about science with parents, teachers, and peers
- Use the language of the processes of science
- Communicate level of understanding of concepts that they have developed to date

Students Propose Explanations and Solutions and Build a Store of Concepts

- Offer explanations both from a store of previous experience and from knowledge gained as a result of ongoing investigation
- Use investigations to answer their own questions
- Sort out information and decide what is important (what does and doesn't work)

- Revise explanations and consider new ideas to gain knowledge (build understanding)

Students Raise Questions

- Ask questions both verbally and through actions
- Use questions that lead to investigations that generate or redefine further questions and ideas
- Value and enjoy asking questions as an important part of science

Students Use Observations

- Observe carefully, as opposed to just looking
- See details, seek patterns, detect sequences and events; notice changes, similarities, and differences
- Make connections to previously held ideas

Students Critique Their Science Practices

- Create and use quality indicators to assess own work
- Report and celebrate strengths and identify areas of improvement
- Reflect with adults and peers (Ash, 1999).

THE ROLE OF THE ENVIRONMENT IN THE INQUIRY CLASSROOM

WHAT DO TEACHERS AND STUDENTS DO TO CREATE A POSITIVE LEARNING ENVIRONMENT?

Creating the proper environment is a necessary condition for maintaining an inquiry classroom, but it is not sufficient in itself. The environment of an inquiry classroom can look quite different from our standard picture of a typical classroom. An inquiry classroom may be very active and filled with materials. Students will be having conversations about scientific phenomena, or collecting evidence from independent investigations.

The three major areas of development in any inquiry endeavor are:

- Content and conceptual understanding and development
- Skills and activities of doing science
- Attitudes and habits of mind

It takes a well planned environment to support all these elements for students engaged in the inquiry experience. In addition to the guidelines expressed above, an inquiry classroom must make it possible, on a social and practical level, for students to be engaged in inquiry.

Students Work in an Appropriate and Supportive Physical Environment

- The room is set up to support small-group interaction and investigation.
- Lists of student questions are prominent and available for all to see.
- A variety of general supplies is available, both at desks and in easily accessed cabinets.
- A variety of materials specific to the area being explored is easily accessible.
- Student work is displayed in a variety of ways in order to reflect their investigations.

Students Work in an Appropriate and Supportive Emotional Environment

- Their thinking is solicited and honored.
- They are comfortable expressing ideas and opinions and speaking up.
- They are comfortable interacting with one another, and with the teacher.
- They are encouraged to share information and ideas with each other—as individuals or in groups.
- They know what they are doing and why.

Students Work in a Variety of Configurations to Encourage Communication

- Work may be done in student pairs, small or large groups, or as a whole-class.
- Students have many opportunities to respond to feedback and learn from one another.
- Students become part of a “community of learning,” supporting and affecting each other’s thinking (Ash, 1999).

FREQUENTLY ASKED QUESTIONS ABOUT INQUIRY

HOW CAN TEACHERS USE INQUIRY AND MAINTAIN CONTROL OF THEIR STUDENTS?

To have productive experiences, inquiry requires considerable planning and organization on the part of both teachers and students. Teachers need to create procedures for organization and management of materials, guidelines for student use of materials, and engaging in conversation. Students need to learn how to work with materials in an organized fashion, communicate their ideas with one another, listen to each other's ideas with respect, and accept responsibility for their own learning. In addition, it is always helpful when students know what is expected of them in terms of behavior and performance. As students become collaborators, they recognize the conditions for progress themselves and need less external control.

In inquiry-based teaching, is it ever okay to tell students the answers to their questions?

Yes. Understanding requires knowledge, and not all the knowledge that is needed can be acquired by inquiry. Decisions about how to respond to students' questions depend on the teacher's goals and the context of the discussion. For example, a student may pose the question "What is the boiling point of water at sea level?" One way to respond to that question would be to set up a simple investigation to find out. The investigation could set the stage for more complex inquiries. If learning to use reference material is important, a teacher might have the student look up the information. Or, if there is a higher priority for how the student spends his or her time, the teacher could simply provide the answer.
The important point is that investigations lead to deeper understanding and greater transfer of knowledge. Decisions about responding to students' questions should reflect that fact.

Should a teacher ever say "no" to an investigation that students propose themselves?

Yes. As noted in the previous answer, a teacher's response should depend on his or her goals for students. What might they learn if they conducted the inquiry? Are there cost or safety concerns that might weigh against doing a particular investigation? What topics and approaches are most feasible in light of the school science curriculum and guiding standards? Would it be best for students to design their own investigations or conduct investigations proposed either by the teacher or provided by the instructional materials?
A large number of learning outcomes, particularly inquiry abilities, are best learned through investigations, and those noticed by students' own questions can be invaluable learning opportunities. Students also learn the characteristics of questions that can be properly investigated if they have opportunities to pose and investigate questions. One approach might be for teachers to ask students or help them determine what learning goals they will achieve by pursuing their questions and which goals they will not achieve.

The fact that students are motivated to ask questions and inquire into them is an indication that the teacher is making science relevant and exciting. But not all investigations that students propose will be worth pursuing.

Does *Tulsa INQUIRES!* imply that teachers should use inquiry in every lesson?

No. In fact, many teaching approaches can serve the goal of learning science. Although ***Tulsa INQUIRES!*** emphasizes inquiry, this should not be interpreted as recommending a single approach to science teaching. Teachers should use different strategies to develop students' knowledge, understandings, and abilities. Conducting hands-on science activities does not guarantee inquiry, nor is reading about science incompatible with inquiry" (National Research Council, 1996).

Everyone knows that investigations often take longer than other ways of learning, and there are simply not enough hours or days in the school year to learn everything through inquiry. The challenge to the teachers is to make the most judicious choices about which learning goals can be best reached through inquiry and what the nature of that inquiry should be. Other teaching strategies can come into play for other learning goals.

How much structure and how much freedom should teachers provide in inquiry-oriented lessons?

The type and amount of structure can vary depending on what is needed to keep students productively engaged in pursuit of a learning outcome. Students will little experience in conducting scientific inquiries will probably require more structure. For example, a teacher might want to select the question driving an investigation. She or he also might decide to provide a series of steps and procedures for the students guided by specific questions and group discussion. The instructional materials themselves often provide questions, suggestions, procedures, and data tables to guide student inquiry.
As students mature and gain experience with inquiry, they will become adept at clarifying good questions, designing investigations to test ideas, interpreting data, and forming explanations based on data. With such students, the teacher still should monitor by observation, ask questions for clarification, and make suggestions when needed. Often, teachers begin the school year providing considerable structure and then gradually provide more opportunities for student-centered investigations.

Many teachers in the primary grades have considerable success with whole class projects. An example is a class experiment to answer the question: "What is the 'black stuff" on the bottom of the aquarium?" Guided by the teacher, the students can focus and clarify the question. They can ponder where the 'black stuff' came from based on their prior knowledge of goldfish, snails, and plants. Using their prior knowledge, the students then can propose explanations and decide what they need to set up a fair test. How many aquariums will the need? What will be in each aquarium? What are they looking for? How will they know when they have answered the questions?

After a number of well structured whole-class inquiries, with ample time to discuss procedures and process as well as conclusions and explanations, students are more prepared to design and conduct their own inquiries.

How much do teachers need to know about inquiry and about science subject matter to teach science through inquiry?

The more teachers know about inquiry and about science subject matter, and the more they themselves are effective inquirers, the better equipped they are to engage their students in inquiry. It generally does not work for teachers to stay one step ahead of the students when using inquiry-oriented instruction. However, to a certain extent, teachers can develop their own understanding through inquiry as they investigate with their students and participate in professional development programs. Teachers also can consult with other teachers to learn more about a topic, refer to science background material printed in teacher’s guides, and invite into the classroom parents, scientists, and others who have expertise to help in learning about the topic. Like their students, teachers should view themselves as learners, being eager to try new ways of teaching and extend and sharpen their subject matter knowledge. They should use their own teaching as a reference point for inquiry about their own improvement. Therefore, their ability to teach through inquiry increases each successive year.

How can teachers improve their use of inquiry in science teaching?

Collaboration can be an important catalyst of change. New understandings develop and new classroom practices emerge when teachers collaborate with peers and experts. Collaboration addresses not only the technical problems of reform, but cultural issues as well.

As Anderson (1996) says,

> "Collaborative working relationships among teachers provide a very important context for the re-assessment of educational values and beliefs. In this context, where the focus is the actual work of each teacher's own students, one's values and beliefs are encountered at every turn. It is a powerful influence. The teachers in our cases did not do their work in isolation; they worked together with fellow teachers in their team or department. Crucial reform work takes place in this context."

Appropriate professional development is a powerful way for teachers to improve their use of inquiry. Teachers can become wise consumers of professional development as they broaden their images and sources of learning (Inquiry and the National Science Education Standards, 1999).

QUESTIONING STRATEGIES

QUESTIONING FOR QUALITY THINKING	STRATEGIES TO EXTEND THINKING
Recalling Who, what, when, where, how ___________________?	o Remember wait time Provide at least five seconds of thinking time after a question and after a response.
Comparing How is ________ similar to/different from _________?	o Ask follow-ups e.g., "Why? How do you know? Do you agree? Will you give an example? Can you tell me more?"
Identifying Attributes and Components What are the characteristics/parts of _______________?	o Cue responses to open ended questions e.g., "There is not a single correct answer to this question. I want you to consider alternatives."
Classifying How might we organize ____________ into categories?	o Use think-pair-share Allow individual thinking time, discussion with a partner, and then open up for class discussion.
Ordering Arrange _______into sequence according to ________.	o Call on students randomly Avoid the pattern of only calling on those students with raised hands.
Identifying Relationships and Patterns Develop an outline/diagram/web of _______________.	o Ask students to unpack their thinking e.g., "Describe how you arrived at your answer."
Representing In what other ways might we show/illustrate ________?	o Ask for summary to promote active listening e.g., "Could you please summarize our discussion thus far?"
Identifying Main Ideas What is the key concept/issue in __________________? Retell the main idea of __________ in your own words.	o Challenge reasoning Require students to defend their reasoning against different points of view.
Identifying Errors What is wrong with ______________________________?	o Survey the class e.g., "How many people agree with the author's point of view?" (thumbs up, thumbs down)
Inferring What might we infer from _______________________? What conclusions might be drawn from ____________?	o Allow for student calling e.g., "Richard, will you please call on someone to respond?"
Predicting What might happen if __________________________?	o Encourage student questioning Provide opportunities for students to generate their own questions.
Elaborating What ideas/details can you add to _________________? Give an example of ______________________________.	
Summarizing Can you summarize ______________________________?	
Establishing Criteria What criteria would you use to judge/evaluate _______?	
Verifying What evidence supports __________________________? How might we prove/confirm ____________________?	

Science Rubric for Teachers

A Tool for Reflection

Directions: Check the behaviors according to frequency of use.

	Seldom	**Sometimes**	**Always**
1. I show students how to use new tools or materials.			
2. I guide students in take more responsibility in investigations.			
3. I help students design and carry out skills of recording, documenting, and drawing conclusions.			
4. I help students form tentative explanations while moving toward content learning.			
5. I introduce tools, materials, and scientific ideas appropriate to content learning.			
6. I use appropriate content terminology, as well as scientific and mathematical language.			
7. I am sensitive to what students are thinking and learning.			
8. I identify areas in which students are struggling and provide intervention strategies.			
9. I talk with students, ask questions, make suggestions, share and interact.			
10. I move around and am available to all students.			
11. I help students go to the next stage of learning with appropriate clues and prompts.			
12. I use open-ended questions that encourage investigation, observation, and thinking.			
13. I listen to students' ideas, comments, and questions in order to help them develop their sills and thought processes.			
14. I suggest new things to look at and try, and encourage further experimentation and thinking.			
15. I use a variety of comprehension strategies (graphic organizers such as time lines, KWL charts, t-charts, Venn diagrams; note taking and summarizing; and questioning).			
16. I use a variety of methods of instruction and classroom stimulation—projects, experiments. Investigations, materials, flexible grouping, field trips, speakers, and technology.			
17. I use a variety of ongoing assessment embedded in instruction to determine a student's progress --observations, portfolio assessment, electronic portfolios, interview assessments, logs and journals, and projects.			
18. I provide a safe and secure, student-centered environment and encourage students to take risks.			
19. I model and communicate with students that they are valued.			
20. I communicate and demonstrate that there are multiple solutions rather than a single method to achieve the answers.			
21. I provide dialogue between teacher and student, and encourage self-reflection and self-evaluation.			
22. I provide lessons addressing the multiple intelligences and different learning styles.			
23. I provide a meaningful "real–life" science curriculum aligned with the TPS pacing calendar and the strategies of the Tulsa Model.			
24. I provide electronic resources for students to integrate, apply, and extend themes, concepts, and skills.			
25. I collaborate with the library media specialist to integrate science and other content areas to facilitate use of the Organized Investigator research model.			
26. I encourage parental involvement in student learning			

Science Checklist for Principals

Teacher:____________________________________ Grade:________ Date:__________________

Teacher Behavior	Seldom	Sometimes	Always
1. Shows students how to use new tools or materials.			
2. Guides students in take more responsibility in investigations.			
3. Helps students design and carry out skills of recording, documenting, and drawing conclusions.			
4. Helps students form tentative explanations while moving toward content learning.			
5. Introduces tools, materials, and scientific ideas appropriate to content learning.			
6. Uses appropriate content terminology, as well as scientific and mathematical language.			
7. Is sensitive to what students are thinking and learning.			
8. Identifies areas in which students are struggling and provide intervention strategies.			
9. Talks with students, ask questions, make suggestions, shares and interacts.			
10. Moves around and am available to all students.			
11. Helps students go to the next stage of learning with appropriate clues and prompts.			
12. Uses open-ended questions that encourage investigation, observation, and thinking.			
13. Listens to students' ideas, comments, and questions in order to help them develop their sills and thought processes.			
14. Suggests new things to look at and try, and encourage further experimentation and thinking.			
15. Uses a variety of comprehension strategies (graphic organizers such as time lines, KWL charts, t-charts, Venn diagrams; note taking and summarizing; and questioning).			
16. Uses a variety of methods of instruction and classroom stimulation—projects, experiments. Investigations, materials, flexible grouping, field trips, speakers, and technology.			
17. Uses a variety of ongoing assessment embedded in instruction to determine a student's progress --observations, portfolio assessment, electronic portfolios, interview assessments, logs and journals, and projects.			
18. Provides a safe and secure, student-centered environment and encourage students to take risks.			
19. Models and communicates with students that they are valued.			
20. Communicates and demonstrates that there are multiple solutions rather than a single method to achieve the answers.			
21. Provides dialogue between teacher and student, and encourage self-reflection and self-evaluation.			
22. Provides lessons addressing the multiple intelligences and different learning styles.			
23. Provides a meaningful "real–life" science curriculum aligned with the TPS pacing calendar and the strategies of the Tulsa Model.			
24. Provides electronic resources for students to integrate, apply, and extend themes, concepts, and skills.	`		
25. Collaborates with the library media specialist to integrate science and other content areas to facilitate use of the Organized Investigator research model.			
26. Encourages parental involvement in student learning			

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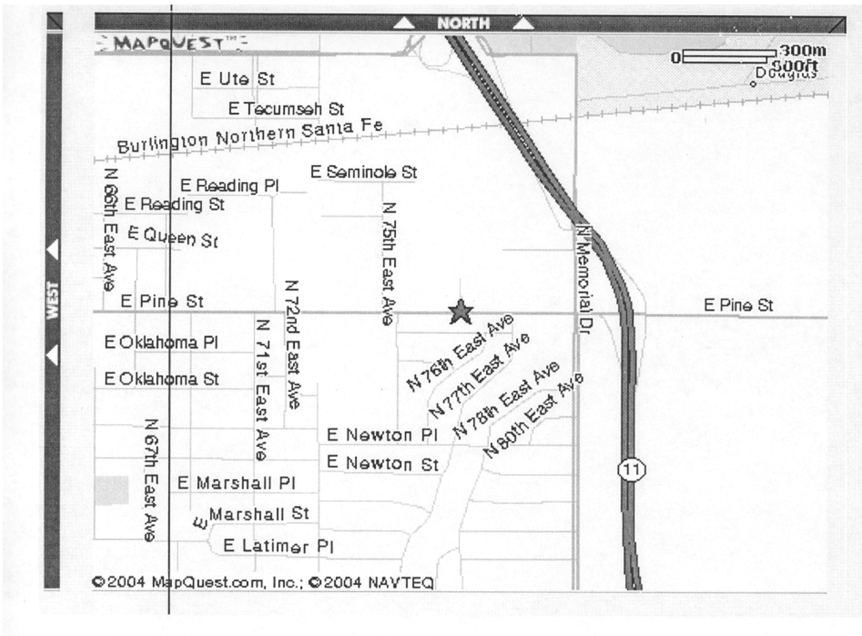
Science Warehouse Information

Science Warehouse Address: 1555 N. 77 E. Ave. Tulsa, Ok. 74115

Map to Warehouse:



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APPENDIX

Tulsa INQUIRES!
Timeline

2004-2005

- Formation of PreK-K leadership team to study developmentally standards-based curriculum.
- ***Tulsa INQUIRES!*** kit training grades 1-8.
- Formation of high school leadership teams to pilot curriculum.

2005-2006

- Attend the textbook caravan.
- Second phase of ***Tulsa INQUIRES!*** training.
- Begin districtwide book study.
- Vote on district textbook adoption.
- Schedule professional development training for new science adoption.

Elementary Science Kit Rotation Schedule

		1st quarter	2nd quarter	3rd quarter	4th quarter
AREA ONE					
Addams	K	2 Wood	2 Trees	2 Animals 2X2	
	1st	2 Solids & Liquids	2 Weather	2 Organisms	2 Comparing & Measuring
	2nd	3 Changes	3 Soils	3 Butterflies	3 Balance & Weighing
	3rd	2 Chemical Test	2 Rocks & Minerals	2 Plant Growth & Dev.	2 Sound
	4th	1 Electric Circuits	1 Land & Water	1 Animal Studies	1 Motion & Design
	5th	2 Food Chemistry	2 Microworlds	2 Ecosystems	2 Floating & Sinking
Grissom	K	3 Trees	3 Animals 2X2	3 Wood	
	1st	1 Solids & Liquids	1 Weather	1 Organisms	1 Comparing & Measuring
	2nd	1 Changes	1 Soils	1 Butterflies	1 Balance & Weighing
	3rd	3 Chemical Test	3 Rocks & Minerals	3 Plant Growth & Dev.	3 Sound
	4th	3 Electric Circuits	3 Land & Water	3 Animal Studies	3 Motion & Design
	5th	3 Food Chemistry	3 Microworlds	3 Ecosystems	3 Floating & Sinking
Marshall	K				
	1st	4 Solids & Liquids	4 Weather	4 Organisms	4 Comparing & Measuring
	2nd	3 Changes	3 Soils	3 Butterflies	3 Balance & Weighing
	3rd	3 Chemical Test	3 Rocks & Minerals	3 Plant Growth & Dev.	3 Sound
	4th	3 Electric Circuits	3 Land & Water	3 Animal Studies	3 Motion & Design
	5th	2 Food Chemistry	2 Microworlds	2 Ecosystems	2 Floating & Sinking
Patrick Henry	K	4 Wood	3 Animals 2X2	3 Trees	
	1st	3 Solids & Liquids	3 Weather	3 Organisms	3 Comparing & Measuring
	2nd	3 Changes	3 Soils	3 Butterflies	3 Balance & Weighing
	3rd	1 Chemical Test	1 Rocks & Minerals	1 Plant Growth & Dev.	1 Sound
	4th	2 Electric Circuits	2 Land & Water	2 Animal Studies	2 Motion & Design
	5th	1 Food Chemistry	1 Microworlds	1 Ecosystems	1 Floating & Sinking
Phillips	K	2 Animals 2X2	2 Trees	2 Wood	
	1st	2 Solids & Liquids	2 Weather	2 Organisms	2 Comparing & Measuring
	2nd	2 Changes	2 Soils	2 Butterflies	2 Balance & Weighing
	3rd	2 Chemical Test	2 Rocks & Minerals	2 Plant Growth & Dev.	2 Sound
	4th	3 Electric Circuits	3 Land & Water	3 Animal Studies	3 Motion & Design
	5th	3 Food Chemistry	3 Microworlds	3 Ecosystems	3 Floating & Sinking
Remington	K	2 Animals 2X2	2 Trees	2 Wood	2 Fabric
	1st	2 Solids & Liquids	2 Weather	2 Organisms	2 Comparing & Measuring
	2nd	2 Changes	2 Soils	2 Butterflies	2 Balance & Weighing
	3rd	3 Chemical Test	3 Rocks & Minerals	3 Plant Growth & Dev.	3 Sound
	4th	2 Electric Circuits	2 Land & Water	2 Animal Studies	2 Motion & Design
	5th	3 Food Chemistry	3 Microworlds	3 Ecosystems	3 Floating & Sinking
Wright	K	2 Animals 2X2	2 Trees	2 Wood	
	1st	2 Solids & Liquids	2 Weather	2 Organisms	2 Comparing & Measuring
	2nd	2 Changes	2 Soils	2 Butterflies	2 Balance & Weighing
	3rd	2 Chemical Test	2 Rocks & Minerals	2 Plant Growth & Dev.	2 Sound
	4th	2 Electric Circuits	2 Land & Water	2 Animal Studies	2 Motion & Design
	5th	2 Food Chemistry	2 Microworlds	2 Ecosystems	2 Floating & Sinking

Park	K				
	1st				
	2nd	1 Changes			
	3rd				
	4th				
	5th				
Robertson	K				
	1st				
	2nd	1 Changes			
	3rd				
	4th				
	5th				
Eliot	K				
	1st				
	2nd	1 Changes			
	3rd				
	4th				
	5th				
McClure	K				
	1st				
	2nd	1 Changes			
	3rd				
	4th				
	5th				
Grimes	K				
	1st				
	2nd	1 Changes			
	3rd				
	4th				
	5th				
Carnegie	K				
	1st				
	2nd	1 Changes			
	3rd				
	4th				
	5th				
Key	K				
	1st				
	2nd	1 Changes			
	3rd				
	4th				
	5th				

Salk	K				
	1st				
	2nd	1 Changes			
	3rd				
	4th				
	5th				
		1st quarter	2nd quarter	3rd quarter	4th quarter
AREA TWO					
Barnard	K				
	1st		2 Solids & Liquids		
	2nd	2 Balance & Weighing	2 Changes	2 Soils	2 Butterflies
	3rd	2 Sound	2 Chemical Test	2 Rocks & Minerals	2 Plant Growth & Dev
	4th	2 Motion & Design	2 Electric Circuits	2 Land & Water	2 Animal Studies
	5th	2 Floating & Sinking	2 Food Chemistry	2 Microworlds	2 Ecosystems
Cooper	K				
	1st		5 Solids & Liquids		
	2nd	2 Balance & Weighing	2 Changes	2 Soils	2 Butterflies
	3rd	5 Sound	5 Chemical Test	5 Rocks & Minerals	5 Plant Growth & Dev
	4th	4 Motion & Design	4 Electric Circuits	4 Land & Water	4 Animal Studies
	5th	3 Floating & Sinking	3 Food Chemistry	3 Microworlds	3 Ecosystems
Kerr	K	2 Trees	2 Wood	2 Animals 2X2	
	1st	4 Comparing & Measuring	4 Solids & Liquids	4 Weather	4 Organisms
	2nd	4 Balance & Weighing	4 Changes	4 Soils	4 Butterflies
	3rd	4 Sound	4 Chemical Tests	4 Rocks & Minerals	4 Plant Growth & Dev
	4th	4 Motion & Design	4 Electric Circuits	4 Land & Water	4 Animal Studies
	5th	4 Floating & Sinking	4 Food Chemistry	4 Microworlds	4 Ecosystem
Lanier	K	2 Wood	2 Animals 2X2	2 Trees	
	1st	3 Comparingin & Measuring	3 Solids & Liquids	3 Weather	3 Organisms
	2nd	3 Balance & Weighing	3 Changes	3 Soils	3 Butterflies
	3rd	2 Sound	2 Chemical Tests	2 Rocks & Minerals	2 Plant Growth & Dev
	4th	3 Motion & Design	3 Electric Circuits	3 Land & Water	3 Animal Studies
	5th	2 Floating & Sinking	2 Food Chemistry	2 Microworlds	2 Ecosystem
McKinley	K				
	1st	3 Comparing & Measuring	3 Solids & Liquids	3 Weather	3 Organisms
	2nd	3 Balance & Weighing	3 Changes	3 Soils	3 Butterflies
	3rd	3 Sound	3 Chemical Tests	3 Rocks & Minerals	3 Plant Growth & Dev
	4th	2 Motion & Design	2 Electric Circuits	2 Land & Water	2 Animal Studies
	5th	3 Floating & Sinking	3 Food Chemistry	3 Microworlds	3 Ecosystem

Owen	K	1 Paper		1 Fabric	
	1st	1 Comparing & Measuring	1 Solids & Liquids	1 Weather	1 Organisms
	2nd	1 Balance & Weighing	1 Changes	1 Soils	1 Butterflies
	3rd	2 Sound	2 Chemical Tests	2 Rocks & Minerals	2 Plant Growth & Dev
	4th	3 Motion & Design	3 Electric Circuits	3 Land & Water	3 Animal Studies
	5th	1 Floating & Sinking	1 Food Chemistry	1 Microworlds	1 Ecosystem
Mitchell	K				
	1st				
	2nd		1 Changes		
	3rd				
	4th				
	5th				
Lindbergh	K				
	1st				
	2nd		1 Changes		
	3rd				
	4th				
	5th				
Peary	K				
	1st				
	2nd		1 Changes		
	3rd				
	4th				
	5th				
Sandburg	K				
	1st				
	2nd		1 Changes		
	3rd				
	4th				
	5th				
Zarrow	K				
	1st				
	2nd		1 Changes		
	3rd				
	4th				
	5th				
Mayo	K				
	1st				
	2nd		1 Changes		
	3rd				
	4th				
	5th				

Disney	K				
	1st				
	2nd		1 Changes		
	3rd				
	4th				
	5th				
Skelly	K				
	1st				
	2nd		1 Changes		
	3rd				
	4th				
	5th				
Columbus	K				
	1st				
	2nd		1 Changes		
	3rd				
	4th				
	5th				
Newcomer	K				
	1st				
	2nd		1 Changes		
	3rd				
	4th				
	5th				

		1st quarter	2nd quarter	3rd quarter	4th quarter
AREA THREE					
Alcott	K				
	1st	1 Organisms	1 Comparing & Measuring	1 Solids & Liquids	1 Weather
	2nd	1 Butterflies	1 Balance & Weighing	1 Changes	1 Soils
	3rd	1 Plant Growth & Dev	1 Sound	1 Chemical Tests	1 Rocks & Minerals
	4th	1 Animal Studies	1 Motion & Design	1 Electric Circuits	1 Land & Water
	5th	1 Ecosystems	1 Floating & Sinking	1 Food Chemistry	1 Microworlds
Cherokee	K	1 Paper	1 Tree	1 Wood	
	1st	1 Organisms	1 Comparing & Measuring	1 Solids & Liquids	1 Weather
	2nd	1 Butterflies	1 Balance & Weighing	1 Changes	1 Soils
	3rd	1 Plant Growth & Dev	1 Sound	1 Chemical Tests	1 Rocks & Minerals
	4th	1 Animal Studies	1 Motion & Design	1 Electric Circuits	1 Land & Water
	5th	1 Ecosystems	1 Floating & Sinking	1 Food Chemistry	1 Microworlds

Greeley	K	2 Fabrics		1 Paper	
	1st	1 Organisms	1 Comparing & Measuring	1 Solids & Liquids	1 Weather
	2nd	1 Butterflies	1 Balance & Weighing	1 Changes	1 Soils
	3rd	1 Plant Growth & Dev	1 Sound	1 Chemical Tests	1 Rocks & Minerals
	4th	1 Animal Studies	1 Motion & Design	1 Electric Circuits	1 Land & Water
	5th	2 Ecosystems	2 Floating & Sinking	2 Food Chemistry	2 Microworlds
Houston	K	3 Trees		3 Animals 2X2	
	1st	4 Organisms	4 Comparing & Measuring	4 Solids & Liquids	4 Weather
	2nd	4 Butterflies	4 Balance & Weighing	4 Changes	4 Soils
	3rd	3 Plant Growth & Dev	3 Sound	3 Chemical Tests	3 Rocks & Minerals
	4th	3 Animal Studies	3 Motion & Design	3 Electric Circuits	3 Land & Water
	5th			3 Food Chemistry	
Lindsey	K	4 Paper		4 Fabrics	
	1st	2 Organisms	2 Comparing & Measuring	2 Solids & Liquids	2 Weather
	2nd	1 Butterflies	1 Balance & Weighing	1Changes	1 Soils
	3rd	2 Plant Growth & Dev	2 Sound	2 Chemical Tests	2 Rocks & Minerals
	4th			1 Electric Circuits	
	5th			1 Food Chemistry	
Penn	K	3 Animals 2X2		3 Trees	
	1st	3 Organisms	3 Comparing & Measuring	3 Solids & Liquids	3 Weather
	2nd	3 Butterflies	3 Balance & Weighing	3 Changes	3 Soils
	3rd	3 Plant Growth & Dev	3 Sound	3 Chemical Tests	3 Rocks & Minerals
	4th	2 Animal Studies	2 Motion & Design	2 Electric Circuits	2 Land & Water
	5th			3 Food Chemistry	
Whitman	K				
	1st				
	2nd			1 Changes	
	3rd				
	4th				
	5th				
Jackson	K				
	1st				
	2nd			1 Changes	
	3rd				
	4th				
	5th				

Bryant	K				
	1st				
	2nd			1 Changes	
	3rd				
	4th				
	5th				
Celia Clinton	K				
	1st				
	2nd			1 Changes	
	3rd				
	4th				
	5th				
Sequoyah	K				
	1st				
	2nd			1 Changes	
	3rd				
	4th				
	5th				
Bell	K				
	1st				
	2nd			1 Changes	
	3rd				
	4th				
	5th				
	K				
	1st				
	2nd			1 Changes	
	3rd				
	4th				
	5th				
		1st quarter	2nd quarter	3rd quarter	4th quarter
AREA FOUR					
Academy Central	K				
	1st				3 Solids & Liquids
	2nd				2 Changes
	3rd	3 Rocks & Minerals	3 Plant Growth & Dev.	3 Sound	3 Chemical Tests
	4th	3 Land & Water	3 Animal Studies	3 Motion & Design	3 Electric Circuits
	5th	3 Microworlds	3 Ecosystems	3 Float & Sink	3 Food Chemistry
Anderson	K				
	1st				3 Solids & Liquids
	2nd				2 Changes
	3rd				3 Chemical Tests
	4th				3 Electric Circuits
	5th				3 Food Chemistry

Springdale	K				
	1st	3 Weather	3 Organisms	3 Comparing & Measuring	3 Solids & Liquids
	2nd	3 Soils	3 Butterflies	3 Balance & Weighing	3 Changes
	3rd	1 Rocks & Minerals	1 Plant Growth & Dev.	1 Sound	1 Chemical Test
	4th	2 Land & Water	2 Animal Studies	2 Motion & Design	2 Electric Circuits
	5th	1 Microworlds	1 Ecosystems	1 Floating & Sinking	1 Food Chemistry
Chouteau	K	1 Paper		1 Fabric	
	1st	3 Weather	3 Organisms	3 Comparing & Measuring	3 Solids & Liquids
	2nd	3 Soils	3 Butterflies	3 Balance & Weighing	3 Changes
	3rd	1 Rocks & Minerals	1 Plant Growth & Dev.	1 Sound	1 Chemical Test
	4th	2 Land & Water	2 Animal Studies	2 Motion & Design	2 Electric Circuits
	5th	1 Microworlds	1 Ecosystems	1 Floating & Sinking	1 Food Chemistry
Emerson	K				
	1st				3 Solids & Liquids
	2nd	2 Soils	2 Butterflies	2 Balance & Weighing	2 Changes
	3rd	2 Rocks & Minerals	2 Plant Growth & dev	2 Sound	2 Chemical Test
	4th	3 Land & Water	3 Animal Studies	3 Motion & Design	3 Electric Circuits
	5th	3 Microworlds	3 Ecosystems	3 Floating & Sinking	3 Food Chemistry
Hawthorne	K	4 Fabric		4 Paper	
	1st				4 Solids & Liquids
	2nd				3 Changes
	3rd	4 Rocks & Minerals	4 Plant Growth & Dev.	4 Sound	4 Chemical Tests
	4th	3 Land & water	3 Animal Studies	3 Motion & Design	3 Electric Circuits
	5th	3 Microworlds	3 Ecosystems	3 Floating & Sinking	3 Food Chemistry
Mark Twain	K				
	1st				
	2nd				1 Changes
	3rd				
	4th				
	5th				
Roosevelt	K				
	1st				
	2nd				1 Changes
	3rd				
	4th				
	5th				
Burroughs	K				
	1st				
	2nd				1 Changes
	3rd				
	4th				
	5th				

Eugene Field	K				
	1st				
	2nd				1 Changes
	3rd				
	4th				
	5th				
Lee	K				
	1st				
	2nd				1 Changes
	3rd				
	4th				
	5th				
Eisenhower	K				
	1st				
	2nd				1 Changes
	3rd				
	4th				
	5th				
Hoover	K				
	1st				
	2nd				1 Changes
	3rd				
	4th				
	5th				
MacArthur	K				
	1st				
	2nd				1 Changes
	3rd				
	4th				
	5th				

Middle School Science Kit Rotation Schedule

		1st quarter	2nd quarter	3rd quarter	4th quarter
AREA ONE					
Clinton	6th	Magnets and Motors - 2	Diversity of Life - 2	Variables - 2	Tech of Paper (E in Sp)
	7th	Properties of Matter - 2	Human Body Systems - 2		Catastrophic Events - 2
	8th	Energy, Machines and Motion - 2	Organisms (Micro to Macro)		Earth History - 2
Nimitz	6th	Magnets and Motors - 2			
	7th	Properties of Matter - 2			
	8th	Energy, Machines and Motion - 2			
Byrd	6th	Magnets and Motors - 2			
	7th	Properties of Matter - 2			
	8th	Energy, Machines and Motion - 2			
Thoreau	6th	Magnets and Motors - 2	Diversity of Life - 2	Variables - 2	Tech of Paper (E in Sp)
	7th	Properties of Matter - 2	Human Body Systems - 2		Catastrophic Events - 2
	8th	Energy, Machines and Motion - 2	Organisms (Micro to Macro)		Earth History - 2
		1st quarter	2nd quarter	3rd quarter	4th quarter
AREA TWO					
Lewis & Clark	6th	Tech of Paper (E in Sp)	Magnets and Motors - 2	Diversity of Life - 2	Variables - 2
	7th	Catastrophic Events - 2	Properties of Matter - 2		Human Body Systems - 2
	8th	Earth History - 2	Energy, Machines and Motion - 2		Organisms (Micro to Macro)
Foster	6th		Magnets and Motors - 2		
	7th		Properties of Matter - 2		
	8th		Energy, Machines and Motion - 2		
Whitney	6th		Magnets and Motors - 2		
	7th		Properties of Matter - 2		
	8th		Energy, Machines and Motion - 2		
Edison	6th	Tech of Paper (E in Sp)	Magnets and Motors - 2	Diversity of Life - 2	Variables - 2
	7th	Catastrophic Events - 2	Properties of Matter - 2		Human Body Systems - 2
	8th	Earth History - 2	Energy, Machines and Motion - 2		Organisms (Micro to Macro)
		1st quarter	2nd quarter	3rd quarter	4th quarter
AREA THREE					
Gilcrease	6th			Magnets and Motors - 1	
	7th				Properties of Matter - 1
	8th				Energy, Machines and Motion - 1
Monroe	6th	Diversity of Life - 2	Variables - 2	Magnets and Motors - 1	Tech of Paper (E in Sp)
	7th	Human Body - 2	Catastrophic Events - 2		Properties of Matter -2
	8th	Organisms (Micro to Macro)	Earth History - 2		Energy, Machines and Motion - 2
Hamilton	6th	Diversity of Life - 2	Variables - 2	Magnets and Motors - 1	Tech of Paper (E in Sp)
	7th	Human Body - 2	Catastrophic Events - 2		Properties of Matter -2
	8th	Organisms (Micro to Macro)	Earth History - 2		Energy, Machines and Motion - 2
		1st quarter	2nd quarter	3rd quarter	4th quarter
AREA FOUR					
Carver	6th	Diversity of Life - 2	Variables - 2	Earth in Space (Pilot)	Magnets and Motors - 2
	7th	Human Body - 2	Catastrophic Events - 2		Properties of Matter - 2
	8th	Organisms (Micro to Macro)	Earth History - 2		Energy, Machines and Motion - 2

Madison	6th				Magnets and Motors - 1
	7th				Properties of Matter - 1
	8th				Energy, Machines and Motion - 1
Cleveland	6th	Diversity of Life - 2	Variables - 2	Tech of Paper (E in Sp)	Magnets and Motors - 2
	7th	Human Body - 2	Catastrophic Events - 2		Properties of Matter - 2
	8th	Organisms (Micro to Macro)	Earth History - 2		Energy, Machines and Motion - 2
Wilson	6th				Magnets and Motors - 1
	7th				Properties of Matter - 1
	8th				Energy, Machines and Motion - 1