Chemistry in the K–8 Classroom
A Focus Group Report

Prepared for

OMSI
OREGON MUSEUM OF SCIENCE AND INDUSTRY

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Report of results for Teacher Focus Groups

Executive summary

Background

In support of Chemistry Manual development, two focus groups and surveys were conducted with teachers of grades K–4 and 5–8 to learn more about what helps chemistry activities succeed in the classroom in May of 2006. The outcomes of these activities will be used to inform manual development as well as to develop questions for a subsequent survey of a broader population of K–8 teachers.

Primary findings from the surveys

What scientific equipment do teachers have available?

Across the grades, most teachers are likely to have access to graduated cylinders, thermometers, and scales. In grades 5–8 many teachers are likely to have access to beakers, flasks, or Petri dishes, but many K–4 teachers are not. Across the grades, many teachers are not likely to have access to measuring spoons, Bunsen burners, hot plates, microwaves, or sinks.

What textbooks are commonly used?

No textbook was identified as one commonly used by teachers within any grade level. In fact, many of the K–4 teachers do not use a textbook at all.

How are written procedure sheets used by teachers?

When asked about the use of written procedure sheets, teachers across the grades suggested their students used them in one of two ways. Either students refer to them while the teacher verbally guides the activity or students use them with limited help from the teacher.

What supplemental information do teachers find most helpful?

Teachers were asked what supplemental information to activities was most helpful for them. Across the grades, the most common response from teachers was *troubleshooting tips for setting up and running activity*.

Primary findings from the focus groups

What are the characteristics of successful science activities?

Teachers were asked to identify the characteristics of successful science activities. Across the grades, most of the responses were in these categories:

- engaging and interesting for students,
- multi-sensory/multi-ability, and
- logistically easy to implement.

Are specific assessment methods used by teachers?

The issue of assessment methods was discussed only with K–4 teachers. These teachers strongly suggested that they did not use assessment methods offered in activities. Rather, these teachers relied on their own methods.

Should we create activities to certain standards?

The issue of standards was discussed only with 5–8 grade teachers. These teachers strongly suggested they did not want activities designed specifically to standards. Rather, they wanted activities on concepts and skills that they could use to augment their larger approach to standards, topics, or cross-curricular goals.

How should we group and index activities in the manual?

Across the grades, teachers suggested that they wanted activities presented by concepts and skill. In addition, they wanted the activities indexed by multiple categories: concept, skill, topic, age, standard, time.

Full report

Introduction

These evaluation activities were conducted to support OMSI's efforts to develop chemistry activities for teachers of K–8 (funded by the Dreyfus Foundation). Two focus groups were conducted to find out more about what makes hands-on science activities successful for K–8 classrooms. Focus group participants were also asked to complete a brief survey. This document presents the results of the surveys and the focus groups.

Methods

Participants
Two focus groups were held in an OMSI classroom on May 22 (K–4 grade teachers) and May 25 (5–8 grade teachers) of 2006. A total of 26 teachers participated in the two focus groups—11 teachers of grades K–4 and 15 teachers of grades 5–8. Twenty participants were women and six were men. An OMSI staff member recruited the participants from urban, suburban, rural, public, private, and alternative schools. Each teacher received free science equipment and a gift certificate to the OMSI Science Store as a thank you for participating.

Survey procedure
Focus group participants were asked to complete a brief survey before the discussion began. The survey consisted of four questions related to science activities in the classroom. The survey for K–4 teachers is in Appendix A (first four questions); the survey for grade 5–8 teachers is in Appendix B (first four questions).

Focus group procedure
Focus group participants discussed three questions that were presented verbally by two co-facilitators. Discussion questions 1 and 3 were the same for both focus group sessions; discussion question 2 differed between the two sessions. Each focus group lasted 90 minutes and was recorded by a note taker on a laptop computer. The agenda and discussion questions for K–4 teachers is in Appendix C; the agenda and discussion questions for teachers of grades 5–8 is in Appendix D.

Each of the three focus group questions concluded with the teachers writing summaries of their thoughts to "recap" questions. The recap questions were in the same instrument as the survey questions. The recap questions for K–4 teachers are in Appendix A (last three questions) and the recap questions for grade 5–8 teaches are in Appendix B (last three questions).

Survey Results

Survey question 1
Please estimate the science equipment you have available for your classroom.
Participants were given a table listing eleven types of science equipment (beakers, flasks, graduated cylinders, measuring spoons, Petri dishes, thermometers, scale, Bunsen burner, hot plate, microwave, sink) and asked to report the availability of each according to these categories: none, 1 per class, 1 per group, and 1 per student. The results to this question are summarized in Table 1.

Across the grades, most teachers are likely to have access to graduated cylinders, thermometers, and scales. In grades 5–8 many teachers are likely to have access to beakers, flasks, or Petri dishes, but many K–4 teachers are not. Across all grades, many teachers are not likely to have access to measuring spoons, Bunsen burners, hot plates, microwaves, or sinks.

Table 1. Availability of science equipment in the classroom (continued on next page).

Types of science equipment	Availability in the classroom		
	Total (out of 26)	K–4 teachers (out of 11)	5–8 teachers (out of 15)
Beakers			
None	8	6	2
1 per class	0	0	0
1 per group	12	4	8
1 per student	3	1	2
Flasks			
None	9	7	2
1 per class	0	0	0
1 per group	12	3	9
1 per student	3	1	2
Graduated cylinders			
None	4	3	1
1 per class	2	2	0
1 per group	12	4	8
1 per student	4	2	2
Measuring spoons			
None	8	3	5
1 per class	2	2	0
1 per group	10	4	6
1 per student	4	1	3
Petri dishes			
None	8	5	3
1 per class	1	0	1
1 per group	7	3	4
1 per student	9	3	6
Thermometers			
None	2	1	1
1 per class	0	0	0
1 per group	14	5	9
1 per student	6	3	3
Scale			
None	1	0	1
1 per class	8	6	2
1 per group	11	5	6
1 per student	1	0	1

(Table 1 continues on next page).

Table 1 continued. Availability of science equipment in the classroom.

Types of science equipment	Availability in the classroom		
	Total (out of 26)	K–4 teachers (out of 11)	5–8 teachers (out of 15)
Bunsen burner			
None	21	9	12
1 per class	1	1	0
1 per group	1	1	2
1 per student	1	0	1
Hot plate			
None	10	5	5
1 per class	11	6	5
1 per group	2	0	2
1 per student	1	0	1
Microwave			
None	15	8	7
1 per class	9	3	6
1 per group	0	0	0
1 per student	1	0	1
Sink			
None	8	4	4
1 per class	12	7	5
1 per group	1	0	1
1 per student	1	0	1

Survey question 2
Which textbook do you use to teach science in your classroom?
Please list the publisher and title or describe the cover.
For teachers of grades K–4, five of the eleven teachers all used different types of textbooks and six out of eleven of them did not use a textbook at all. The 15 teachers of grades 5–8 reported using 18 different books, none of which were used by more than two teachers. These data suggest that no textbook is commonly used across or within a grade to teach science in the classroom.

Survey question 3
Hands-on science activities often come with a written procedure sheet for students to follow. How do you most often use such procedures?
Participants were asked to choose a response from four phrases; these phrases are reported in Table 2 along with the frequency of participants' responses. The most frequent responses were: 1) My students refer to them while I verbally guide the activity (14 responses) and 2) My students use them with limited help from me (13 responses).

Three teachers wrote their own responses in addition to selecting from one of the responses provided. One of these teachers wrote, "I usually modify it to suit my style, my students. I always have a handout." Another explained that she provides oral instructions while students refer to the sheets and then continues verbally guiding the students as they do the activity because of different learning styles. The third teacher said her method "varies."

Table 2. Ways that teachers use written procedure sheets that accompany hands-on science activities.

Type of use	Total (out of 26)	K–4 teachers (out of 11)	5–8 teachers (out of 15)
My students refer to them while I verbally guide the activity.	14	7	7
My students use them with limited help from me.	13	5	8
My students don't or can't use such sheets; I prefer to give all instructions orally.	3	1	2
I require them to use the sheets without help from me.	0	0	0
Other	3	0	3

Survey question 4
Many resources provide supplemental information to the teacher.
Choose THREE of the following that you feel are most useful in aiding instruction.
Participants were presented with 12 types of supplemental information for a science activity and asked to check the three most useful for them. The majority of teachers (18 out of 26) responded that *troubleshooting tips for setting up and running [an] activity* was the most helpful for them.

Table 3. Supplemental information teachers found most useful for aiding instruction.

Types of supplemental information	Total (out of 26)	K–4 teachers (out of 11)	5–8 teachers (out of 15)
Troubleshooting tips for setting up and running an activity	18	9	9
Pre-printed student data collection tables	11	4	7
Common misconceptions	9	3	6
Resources for teacher research	7	2	5
Fun facts related to topic	7	3	4
Possible answers, sample results	6	4	2
Sample inquiry questions	6	0	6
Activity scoring rubric	4	3	1
Resources for student research	4	1	3
Verbal assessment questions	3	3	0
Tips for running the activity with special groups (ELL, handicapped, gifted, etc.)	1	1	0
Useful phrases for Internet search engines	1	0	1
Other	3	0	0

Focus group results

Discussion and recap questions 1 (K–8 teachers)
What makes chemistry/science activities successful?
When teachers were asked to discuss and prioritize the characteristics of great science activities in the classroom, three characteristics received the most support: 1) engaging and interesting for the students, 2) multi-sensory and multi-ability, and 3) logistically easy to implement. The discussion around these three characteristics is described briefly below.

Engaging/interesting for students
Teachers suggested that activities be engaging and interesting for students by being relevant, real world, and occurring across time. Related to this, teachers said in order to engage students it was important to start concrete before proceeding to an open-ended activity. That is, students need to feel comfortable with and understand the information before they can experiment and use their creativity. For younger kids, one teacher said "[they] need to be concrete, put a sticker there, put this picture in a bar graph." While another teacher said that she liked building on previous activities to increase the complexity, for example, first teaching her students to make "x" and "y" labels and then, over time, coming up with the data to plot in the graph. Teachers in the K–4 group found that tracking a theme helped hold the students' interest, for example observing leaves across the seasons or conducting experiments at different stages of growth.

Multi-sensory/multi-ability
Teachers suggested that activities be multi-sensory and multi-ability. One teacher remarked: "[the activity] has to be hands-on, they remember when they did hands-on, got dirty, took pictures…."

Teachers also suggested that activities be adaptable to meet students' needs. Teachers of older children noted that student attention spans were an issue and therefore experiments need to keep students engaged and not have them waiting for extended periods of time for a subsequent step. One teacher in the 5–8 grade group said: "it's best if [data collection] is happening quickly." The teachers also suggested that collaborative work, or work in which every student has a role to play, is successful. One K–4 teacher commented on how 4th grade is different from kindergarten: "Kindergarten is much more work together in groups, in 4th, everyone is on their own graph and kids with graphing calculators are at the extreme."

Logistically easy
Teachers suggested that activities be logistically easy to implement. One teacher in the K–4 group said that she has her students "help me set up, because I can't leave them alone." In the grade 5–8 group, another teacher said that being "easy to set up" was key, and she suggested being able to "explain it with kids as you set it up." Yet another teacher recommended "at a glance" setup sheets that include a time estimate.

Table 4 lists the categories of teachers' responses to the open-ended recap question, *Please list the top 5 characteristics of great science activities*. The responses have been grouped into eight categories based on the over-arching themes they suggested. These groups are: 1) engaging/interesting for students, 2) multi-sensory/ability, 3) logistically easy, 4) curriculum focused, 5) multi-user, 6) multi-outcome, 7) occurs over time, and 8) teacher familiarity (Table 4).

Table 4. Characteristics of great science activities.

Characteristics of great science activities	Total (out of 26)	K–4 teachers (out of 11)	5–8 teachers (out of 15)
Engaging/interesting for students	**34**	**13**	**21**
Connects to students; high interest (real-life)	17	6	11
Engages students, sustained student involvement	7	0	7
Age-appropriate concepts and skills	5	5	0
Event—something happens, whether works or not	3	2	1
Authentic activity; authentic measurements	2	0	2
Multi-sensory/multi-ability	**34**	**11**	**23**
Hands-on	12	6	6
Multiple skill levels for each activity	5	0	5
Visual/tactile results	4	2	2
Measurable; changes to observe and record	4	1	3
Differentiated for wide range of students	3	0	3
Follow-up ideas, resources for further exploration	2	2	0
Multiple learning style approaches	2	0	2
Hands get dirty	1	0	1
Allows for personal creativity	1	0	1
Logistically easy	**34**	**17**	**17**
Materials readily available	12	8	4
Easy set-up/clean-up	9	2	7
Easy to use/read, short directions, easy discussion	8	4	4
Really works (given our constraints—time, etc.)	2	0	2
Activity sheets easy to fill out (ready-made)	1	1	0
Time allotments—clocks	1	1	0
Cheap	1	1	0
Curriculum-focused	**24**	**13**	**11**
Interdisciplinary/cross-curricular	6	1	5
Uses/helps teach scientific process (or part of)	5	5	0
Inquiry questions/inquiry based	4	2	2
Pre/post discussion (predicting/evaluating outcome)	3	3	0
Related to curriculum; meets/matches state benchmarks	3	1	2
Criteria-based rubric for scoring at many levels	1	0	1
Includes computer use	1	0	1
Includes writing/group work	1	1	0
Multi-user	**6**	**1**	**5**
Involves everyone actively; roles/responsibilities	4	0	4
Can be done in small groups or individually	2	1	1
Multi-outcome	**4**	**0**	**4**
Open-ended	2	0	2
Unpredictability of results	1	0	1
Discovery-based/data-producing	1	0	1
Occurs over time	**2**	**1**	**1**
Activities that build on each other; experiment in stages	2	1	1
Teacher familiarity	**3**	**1**	**2**
Background info for teacher—how and why and vocab	2	1	1
Instructor is interested/inspired by topic	1	0	1

Discussion question and recap question 2 (K–4 teachers)
What specific assessment methods do you use for hands-on science activities?
When asked, *what specific assessment methods do you use for hands-on science activities*, teachers mentioned a variety of techniques. These included: 1) informal observation, 2) informal recording, 3) group discussion, 4) self-assessment against criteria, 5) self-assessment against the group, 6) tests, 7) portfolio reviews, 8) teacher prepared checklists, and 9) criteria established by an outside group. Teachers said that when students were asked to self-assess, they were always informed of this process in advance.

Overall, these teachers said they do not use the assessment sections of activities; they "ignore" these sections. Assessment among these K–4 teachers was generally informal. One teacher said that the state of Oregon does not formally assess science learning until grade 5 and most teachers have their own criteria for assessment. One teacher said, "I record on the class list, next to each child's name, what stage they're at."

Teachers said writing was used for informal assessment. One teacher said, "we use science journals, materials, procedure lists, a couple of sentences about interaction, about the activity that day; it's my way of assessing if they are understanding, their effort. Taking the time to write." Another teacher had each student keep his/her own data collection sheets in a journal. They wrote the answers and drew what they predicted, and while she didn't always test it, she could informally assess that they had grasped the concepts. While creating a written record of what was learned was a useful technique, writing was not an option for all students. A kindergarten teacher offered the following example: "Since kindergarteners cannot journal…we do it together, then at the end they get printed pages of what we did, then they draw the pictures to go along and that's their book." Teachers found pre-printed data tables to be a useful resource, even for the younger grades.

Teachers also said observation was used for informal assessment. Teachers looked for things like "collaborates with other students," "make sure all kids are working in a group…walk around and make sure all kids are being engaged." For younger kids, one teacher said, "you have to give them jobs to do, give them something to do to pull them in." Teachers also observe students demonstrating their knowledge individually and in front of the class.

During the discussion, an informal vote was taken on which methods teachers use in which grades (K–4).

Table 5. K–4 teachers who use each kind of assessment method by grade.

Type of assessment	Teachers who use it
Informal visual	All teachers
Listening, watching, and recording	1st grade teachers; one 2nd and one 3rd grade teacher
Group recap/discussion	Teachers across the grades
Students self-assess against the group	1st and 4th grade teachers
Tests	1st, 3rd, and 4th grade teachers (K and 1st to a lesser extent)
Portfolios	3rd and K–4
Students self-assess against criteria	3rd and 4th grade teachers
Pre-planned checklist (in lieu of less formal approach)	Almost no teachers
Criteria established by an outside group	None

Table 6 lists teachers' responses to the recap question, *please list the top three features you would like to see in the assessment section of a written science activity.* The majority of their responses related to types of assessment *methods*. The method mentioned most often was the data collection sheet (8 responses).

Table 6. Top features teachers would like to see in the assessment sections of written science activities.

Top three features for assessment section of written science activities	K–4 teachers (out of 11)
Methods	**20**
Data collection sheets (visuals, graphic, etc., to fill in)	8
Follow-up/recap questions (discussion/journal prompts)	4
Assessment of understanding questions	3
Involvement in activity	1
Culminating activity to show student learning	1
Review of main concepts from unit	1
Formal test at end	1
Group discussion questions	1
Usability	**5**
Only a few items to look at	1
Rubric with criteria for each level of grade	1
Checklist of items included in activity	1
Variety of assessment methods	1
Variety of questions—specific to activity and general	1
Other	**7**
Combination of words and pictures	2
Big ideas	2
Related to scientific inquiry method	1
Worksheets with pictures—take home	1
Resources for further exploration (biblio, websites)	1

Discussion question and recap question 2 (grade 5–8 teachers)
What science and inquiry standards are the most difficult to meet?
On the topic of standards, it was clear that these teachers were more concerned with student learning than meeting standards. As one teacher suggested: "Develop good activities, and the standards will be there; I would hate to see you try to design activities to a standard."

When teachers of grades 5–8 were asked, *What science and inquiry standards are the most difficult to meet,* teachers mentioned the topics: life science, genetics, chemistry, earth science, geology, and plant and animal adaptations. Teachers expressed a need to make activities hands-on and "easy to see" for students. Many teachers noted that it was difficult to illustrate concepts in earth science or geology without taking field trips.

One teacher mentioned specifically that the genetics activities were "too abstract" and difficult for students to grasp. Another teacher said these concepts were probably above students' developmental level, however they were on state exams.

Another issue raised by teachers was frustration with lack of materials and resources, especially for chemistry activities. One teacher asked, "How do we incorporate [technology]?" Another teacher

addressed time constraints by suggesting that lessons become interdisciplinary, "The only way I see to get around the time limitations is to integrate science and math and reading as much as possible; find a way to squeeze it all together somehow."

Teachers offered suggestions on successful methods for communicating difficult concepts to students. One suggestion was planning "thematically." In particular, one teacher said: "lots of teachers plan thematically. If they have something with a theme…kids will internalize that and get the message and you'll see the "ah ha" across the board." Other suggestions included having extensions for activities so that advanced kids can take activities a step further, having materials in other languages (especially Spanish), and providing a "blog" or "blackboard" where teachers can post their activities and questions. It was also noted that much of the information teachers need is available for standards, but they do not always know where to find it.

Table 7 lists teachers' responses to the open-ended recap question, *list three science standards you would like more activities to address*. Responses to this question fell into eleven categories. Six responses related to chemistry.

Table 7. Types of science standards teachers would like more activities to address.

Science standards	5-8 teachers (out of 15)
Chemistry, chemical reactions	6
Geology—history/processes	5
Genetics	4
Earth science	2
Environmental	1
Physics—chemistry connection	1
Basic measurement graphing	1
Student connecting concept themes	1
Underlying themes—change, density, cycles	1
Weather (not weather tools)	1
Astronomy (making space more real)	1

Table 8 lists teachers' responses to the open-ended recap question, *list three inquiry skills or standards you wish your students could practice more*. Responses to this question fell into 15 categories; teachers tended to focus on inquiry *skills* instead of specific *standards*. The most frequent response was deriving/communicating conclusions (seven responses).

Table 8. Inquiry skills/standards teachers wish their students could practice more.

Inquiry skills or standards	5–8 teachers (out of 15)
Deriving/communicating conclusions	7
Forming/designing questioning strategies	5
Scientific process: hypothesis→analysis	4
Data analysis (analyzing results)	4
Writing—report lab and topic	3
Developing an experiment	2
Inquiry/inquiry study	2
Basic chemistry/processes identification/identify when variables change	1
Seeing the world as a scientist	1
Testing with variables	1
Students can design concepts	1
Easy→hard	1
Measurable	1
Graphing ideas	1
Ways to gather information (use of probes?)	1

Discussion question and recap question 3 (K–8 teachers)
What categories should we use to group our activities in a user-friendly way?
When asked, *what categories should we use to group our activities in a user-friendly way*, teachers across the grades expressed a desire to have activities cross-referenced on multiple categories such as concept, skill, topic, age, standard, and time. When prioritizing, it seemed most teachers thought grouping by concept and then by skill would be the most helpful for them.

One of the co-facilitators mentioned that OMSI considered preparing a DVD to accompany activities that would include an instruction manual and demos for the experiments. This idea was well received by teachers. Teachers suggested the DVD include standards for each state as well as materials in multiple languages (specifically Spanish, Russian, or Hebrew). One teacher in a bilingual school said, "lots of schools have dual language immersion programs" and "often times the teacher has to translate activities [him/herself]."

Table 9 lists teachers' responses to the open-ended recap question, *rank the two most teacher-friendly ways of organizing science activities together in a book.* We interpreted the most common response to be by concept (23 responses).

Table 9. Most teacher-friendly ways of organizing science activities in a book.

Ways to organize activities	Total (out of 26)	K–4 teachers (out of 11)	5–8 teachers (out of 15)
Theme based (by concept)	23	11	12
Skills	9	6	3
Comprehensive indexes to link activities together (standards, ages, theme, skill)	5	0	5
Sub-headings or listing of scientific process	2	2	0
Subject	2	0	2
Topic	2	0	2
Real-world connections (cross-reference these with concepts)	2	0	2
Suggested order of activities (what activity comes before next—builds on previous activities)	1	1	0
Cross-reference to interdisciplinary work	1	1	0
Physical science concept model	1	1	0
Difficulty level	1	0	1
DVD to accompany (can use to sort activities by criteria)	1	0	1
Objective	1	0	1
Resources available online with weekly updates (e.g., JASON online)	1	0	1
Standards	1	0	1

Overall summary of results

The survey and focus group findings described in this report are summarized in the Executive Summary on the first page of this document.

Appendix A
Survey and re-cap questions K – 4 Teacher Focus Group

Focus Group Discussion

What Makes Chemistry Activities Successful?

5:00 – 6:30 pm, May 22, 2006

Name _____School _____
Grade(s) taught _____ Years as a teacher?_____

Please take a moment and fill out the following survey:

1. Please estimate the science equipment you have available for your classroom.

	None	1 per class	1 per group	1 per student	Comments?
Beakers					
Flasks					
Graduated cylinders					
Sink					
Hot plate					
Microwave					
Petri dishes					
Thermometers					
Scale (units?)					
Bunsen burner					
Measuring spoons					

2. Which textbook do you use to teach science in your classroom? Please list the publisher and title, or describe the cover:

_____
_____
_____

3. Hands-on science activities often come with a written procedure sheet for students to follow. How do you most often use such procedures? (choose one)
   _____ I require them to use the sheets without help from me
   _____ My students use them with limited help from me
   _____ My students refer to them while I verbally guide the activity
   _____ My students don't or can't use such sheets; I prefer to give all instructions orally

SURVEY CONTINUED ON OTHER SIDE

4. Many resource guides provide supplemental information to the teacher. Choose **three** of the following that you feel are most useful in aiding instruction.

____*Activity scoring rubric*
____*Common misconceptions*
____*Verbal assessment questions*
____*Possible answers, sample results*
____*Troubleshooting tips for setup and running activity*
____*Resources for teacher research*
____*Tips for running the activity with special groups (ELL, handicapped, gifted, etc)*
____*Useful phrases for internet search engines*
____*Fun facts related to topic*
____*Resources for student research*
____*Pre-printed student data collection tables*
____ *Other (please list: _____*

THANK YOU FOR TAKING OUR SURVEY.
PLEASE WAIT BEFORE GOING TO THE NEXT SECTION.

RECAP QUESTION #1
Please rank the top 5 characteristics of great science activities
1.

2.

3.

4.

5.

RECAP QUESTION #2
Please rank the top three features you would like to see in the assessment section of a written science activity.
1.

2.

3.

RECAP QUESTION #3
Please rank the two most teacher-friendly ways of organizing science activities together in a book. Why did you rank them this way?

1.

2.

DON'T FORGET!
Turn in this form to receive your OMSI gift certificate. Thank you!

Appendix B
Survey and re-cap questions 5 – 8 Teacher Focus Group

Focus Group Discussion

What Makes Chemistry Activities Successful?

5:00 – 6:30 pm, May 25, 2006

Name _____School _____
Grade(s) taught _____ Years as a teacher?_____

Please take a moment and fill out the following survey:

5. Please estimate the science equipment you have available for your classroom.

	None	1 per class	1 per group	1 per student	Comments?
Beakers					
Flasks					
Graduated cylinders					
Sink					
Hot plate					
Microwave					
Petri dishes					
Thermometers					
Scale (units?)					
Bunsen burner					
Measuring spoons					

6. Which textbook do you use to teach science in your classroom? Please list the publisher and title, or describe the cover:

_____
_____
_____

7. Hands-on science activities often come with a written procedure sheet for students to follow. How do you most often use such procedures? (choose one)
   _____ I require them to use the sheets without help from me
   _____ My students use them with limited help from me
   _____ My students refer to them while I verbally guide the activity
   _____ My students don't or can't use such sheets; I prefer to give all instructions orally

SURVEY CONTINUED ON OTHER SIDE

8. Many resource guides provide supplemental information to the teacher. Choose **three** of the following that you feel are most useful in aiding instruction.

____*Activity scoring rubric*
____*Common misconceptions*
____*Sample inquiry questions*
____*Possible answers, sample results*
____*Troubleshooting tips for setup and running activity*
____*Resources for teacher research*
____*Tips for running the activity with special groups (ELL, handicapped, gifted, etc)*
____*Useful phrases for Internet search engines*
____*Fun facts related to topic*
____*Resources for student research*
____*Pre-printed student data collection tables*
____ *Other - please list: _____*

THANK YOU FOR TAKING OUR SURVEY.
PLEASE WAIT BEFORE GOING TO THE NEXT SECTION.

RECAP QUESTION #1
Please rank the top 5 characteristics of great science activities
1.

2.

3.

4.

5.

RECAP QUESTION #2
A) Which science standards would you like more activities to address?
B) Which inquiry skills or standards do you wish your students could practice more?

A) Science Standards	**B) Inquiry Skills**
1.	1.
2.	2.
3.	3.

RECAP QUESTION #3
Please rank the two most teacher-friendly ways of organizing science activities together in a book. Why did you rank them this way?

1.

2.

DON'T FORGET!
Turn in this form to receive your OMSI gift certificate. Thank you!

Appendix C
Agenda and focus group questions for K – 4 Teacher Focus Group

Sample Focus Group Agenda

What Makes Hands-On Chemistry Activities Successful?

5:00 **Dinner and Survey**

Introduction to Focus Group and Project

- What is OMSI trying to do?
- Introduction to focus group

5:15 *Participant Introduction: Name, Grade Taught, School, and favorite science activity*

5:32 **Discussion – What Makes Chemistry / Science Activities Successful?**

- Goal: Generate criteria we can meet as we develop new activities.
- Note: Let's use markers and poster paper (or whiteboard) to list the criteria. Tell teachers we will collect their written comments at the end of this particular discussion.

- **Recap Question**: Consider your actual practice in choosing and using hands-on science activities, and then please rank the top five criteria of successful science activities.

5:48 **Discussion – What specific assessment methods do you use for hands-on science activities?**

- Goal: Generate a prioritized list of the most teacher-friendly assessment methods that can be used to inform the questions in our larger survey; learn more about how assessment strategies change as grade level increases.
- Sample Questions
    - What specific assessment methods do you use for hands-on science activities?
    - How do these assessment methods change as grade level changes?
    - Are informal assessment methods preferable to formal assessment at your grade level, and if so … how? Etc.
    - For which grade levels should the activities include data tables for students? Do any teachers always prefer that students make their own data tables?
    - What frustrates you about the assessment sections of science activities? How would you change them?
    - For special populations (e.g. ELL students) what special considerations should we have for making student worksheets?

- **Recap Question**: Please rank the top three features you would like to see in the assessment section of a written science activity.

6:14 **Discussion – We would like to group our activities together in the most teacher-friendly way possible. What categories should we use?**

- Goal: Generate prioritized lists of the most teacher-friendly grouping of science activities that can guide our research.
- **Overheads**: Jake will explain the question to teachers by presenting overhead slides of the tables of contents from several activity books (done at 6:17)

6:17
- We can seed the discussion by mentioning the following ways we could group activities:
    - State or National Standard (e.g., solids, liquids, gases)
    - Science concept (e.g., density)
    - Real world topic (e.g., "kitchen chemistry" or "oceans")
    - Science skill (e.g., measuring)?
    - Other categories are welcome

- **Recap Question**: Rank the two most teacher-friendly ways of organizing science activities together in a book.

6:27 **Thanks, exchange certificates, hand out science activities**

Appendix D
Agenda and focus group questions for 5 – 8 Teacher Focus Group

Sample Focus Group Agenda

What Makes Hands-On Chemistry Activities Successful?

5:00 **Dinner and Survey**

Introduction to Focus Group and Project

- What is OMSI trying to do?
- Introduction to focus group

5:15 *Participant Introduction: Name, Grade Taught, School, and favorite science activity*

5:32 **Discussion – What Makes Chemistry / Science Activities Successful?**

- Goal: Generate criteria we can meet as we develop new activities.
- Note: Let's use markers and poster paper (or whiteboard) to list the criteria. Tell teachers we will collect their written comments at the end of this particular discussion.

- **Recap Question**: Consider your actual practice in choosing and using hands-on science activities, and then please rank the top five criteria of successful science activities.

5:48 **Discussion – What science and inquiry standards are the most difficult to meet?**

- Goal: Generate a list of the three most difficult physical science standards and the two most difficult inquiry standards.
- Preface ideas: We want to make great science activities for teachers to bring to their classrooms, but we understand that teachers are under increasing pressure to meet state and national standards. Students also face this pressure in 5th and 8th grade, when benchmark testing will assess their science skills. How can we make outstanding science activities that simultaneously help teachers and students to meet these standards?

- Sample Questions
    - What science standards do you wish you had more activities for? Which standards are hardest to meet in the classroom?
    - Which science standards do you currently use hands-on activities in order to meet? (are there some standards that cry out for hands-on activities that we should not ignore?)
    - Let's shift the focus away from science standards to inquiry standards. Which inquiry standards are the hardest to meet?
    - Alternatively: Which inquiry skills do you wish your students could practice more?

- Extra Questions
    - Some activities and lessons very effectively meet standards. What are their characteristics?
    - How important is cross-curricular integration at your grade level?

  If math standards or skills are mentioned here:
    - What are the most difficult math standards to meet while conducting science activities?
    - How many teach both math and science at their school?
    - What frustrates you about the inquiry activities you already have?

- **Recap Questions**: 1) Which science standards would you like more activities to address?
  2) Which inquiry skills or standards do you wish your students could practice more?

6:14 **Discussion – We would like to group our activities together in the most teacher-friendly way possible. What categories should we use?**

- Goal: Generate prioritized lists of the most teacher-friendly grouping of science activities that can guide our research.
- **Overheads**: Jake will explain the question to teachers by presenting overhead slides of the tables of contents from several activity books (done at 6:17)

6:17
- We can seed the discussion by mentioning the following ways we could group activities:
    - State or National Standard (e.g., solids, liquids, gases)
    - Science concept (e.g., density)
    - Real world topic (e.g., "kitchen chemistry" or "oceans")
    - Science skill (e.g., measuring)?
    - Other categories are welcome

- Sample follow up questions:
    - Give me some examples of what you mean by "theme."
    - In your mind, how is the theme of an activity different from the real world topic it may reference?

- **Recap Question**: Rank the two most teacher-friendly ways of organizing science activities together in a book.

6:27 Thanks, exchange certificates, hand out science activities.