ASA
AMERICAN STATISTICAL ASSOCIATION

NCTM
NATIONAL COUNCIL OF TEACHERS OF MATHEMATICS

The Statistics Teacher Network

www.amstat.org/education/stn

Number 73 | The Statistics Teacher Network | ASA/NCTM Joint Committee on the Curriculum in Statistics and Probability | Fall 2008

The Editor's Corner

We hope you enjoy Issue 73 of the Statistics Teacher Network. This issue contains three articles which span the grade levels from K-12: *Looking at Data*, by Todd Frauenholtz presents an activity that introduces histograms and focuses on measures of shape, center and spread; *Collecting, Depicting, and Understanding Data*, by Angela Walmsley discusses some basic graphing concepts; and *Stating Probabilities* which I authored examines various ways to quantify and state probabilities. This issue also contains a very informative article by Katherine Halvorsen on the American Statistical Association's "Meeting Within a Meeting" which is a summer workshop for K-12 teachers.

Congratulations to all of the 2008 Statistics Poster and Project winners. This is an annual competition open to students from all grade levels K-12 and information on the winners can be found at: *http://www.amstat.org/education/index.cfm?fuseaction=2008posters.* Information on participating in the next competition can be found at: *http://www.amstat.org/education/index.cfm?fuseaction=poster1.* This is a wonderful opportunity for students and one I encourage teachers to consider.

I encourage and welcome any articles or ideas you have for consideration for publication. Please email me directly at *dwebb@bemidjistate.edu.*

Best Regards,

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Derek Webb
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Congratulations to the 2008 Poster and Project winners.

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Looking at Data

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Of the five National Council of Teachers of Mathematics (NCTM) content standards, one getting significant publicity lately is the data analysis and probability standard. Students in the elementary grades need opportunities to experience data to introduce them to the mathematics in the data analysis and probability strand just as students in upper grades need experiences with probability and data. Initially these activities focus on collecting data like how many pockets do you have or which item is your favorite. Next they move to organizing the data into tables and graphs.

The Principles for Standards and School Mathematics (National Council of Teachers of Mathematics publication, 2000 – more information can be found at: *http://standards.nctm.org*) and the *Guidelines for Assessment and Instruction in Statistics Education (GAISE)* Report (American Statistical Association publication, 2007 – more information can be found at: *http://www.amstat.org/education/gaise)* indicate students need to develop their own questions. These questions can then be addressed with data they collect, organize, and display. In the analysis stage, students should select appropriate statistical methods to analyze the data, then develop and evaluate inferences and predictions based on the data. Certainly, students will need to know several different statistical methods, such as calculating the mean, median, mode, range, and mean absolute deviation in order to determine which would be appropriate for answering the question they ask.

The following activity is appropriate for the intermediate grades and involves students measuring their heights and then organizing data in tables and graphs. To begin, show students how to measure their heights using a student volunteer, a wall, and a meter stick (if only yard sticks are available then this activity may be done in inches). A class discussion should occur discussing the meter sticks (some have inches on one side and cm on the other), if students' hair counts, if they should wear shoes, etc. This discussion helps students to think about the measurement process that generates the data. The measurement process is an important part of generating quality data and is often overlooked by teachers and students alike. Seek comments that will address the idea of error in the data (i.e., wearing shoes will distort the height).

Then, with students working in groups of three (recorder, measurer, and person being measured), have the class measure and record each students' height. Students will measure the height of each member in the group in cm – rounding to the nearest centimeter. Students will then combine all of their group data to create a table of the entire class data set. Each group will use the table of class data to create a histogram to make conclusions. Each group should be allowed to make their own histogram because groups may choose differing numbers of bins (classes) and different bin (class) widths. This allows the teacher and students to discuss how a histogram is useful for giving similar information on the distribution of data even if created slightly differently.

Have students in each group look at the graph of the class data and share their thoughts with the class. Common observations are the tallest, shortest, middle, some groups or gaps in the data, measures of center. Guide students to discuss the shape of the distribution, measures of center, and spread. Care should be taken when discussing the data— some individuals may be sensitive about being the tallest or shortest.

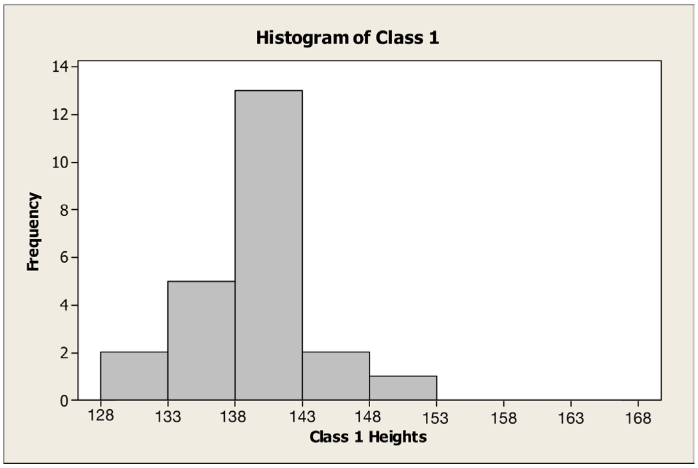
Finally, consider two example classes of sixth graders given below. Their heights are listed in cm and graphed in histograms. Note that the two graphs are created with the same horizontal axis scale. This is important if the histograms are to be compared to each other. What do you notice about the histograms of these two classes of sixth graders? You can have your students compare the heights of your class to the heights of these two example classes and draw conclusions. Have the students speculate on what the graph might look like if the two sixth grade data sets and your class data set were combined into one.

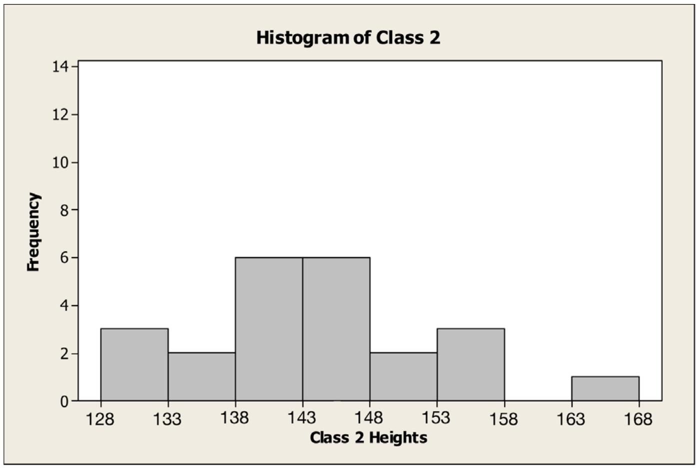
Heights in two sixth grade classes:

Class 1: 130, 132, 134, 135, 136, 136, 137, 138, 138, 138, 139, 139, 139, 140, 140, 141, 142, 142, 142, 142, 143, 147, 148.

Class 2: 130, 132, 132, 137, 137, 138, 138, 138, 139, 139, 139, 145, 146, 147, 147, 147, 147, 150, 152, 153, 155, 156, 163.

Class discussions should address the topics of shape, center, and spread. Students should clearly understand that the mean and median are measures of center that help to identify the middle or center of the group. The mode is the value which occurs most frequently in the data. If we are wondering how much taller is the tallest 6^{th} grader than the shortest 6^{th} grader then the center of the group will not help us answer this question and a measure of spread would be more appropriate. The range is one measure of spread and could be used to easily an-





swer this question. If we are interested in how far, on average, are people's heights from the middle then mean absolute deviation would be the appropriate method to answer the class question.

This activity is just one of many to introduce intermediate students to the mathematics in the data analysis and probability strand. Depending on your students' backgrounds, your class may get further on the activity than others. Eventually students will be designing and conducting larger studies with robust statistical analyses, but they need to start with more basic concepts first.

Statistics for Class 1:

Center: **Mean** = 139.0 = (3198/23)
(add class heights and divide by number of students)
Median = 139 (middle number in list when ordered in increasing value)
Mode = 142 (number that occurs most frequently)

Spread: **Range** = 18 = (148 – 130)
(difference between tallest and shortest)
Mean Absolute Deviation 3.2= (17/23)
(sum of |height – mean| for all students divided by the number of students.)
Recall: | | means the "absolute value."

Statistics for Class 2:

Center: **Mean** = 143.8 = (3307/23)
Median = 145
Mode = 147

Spread: **Range** = 33 = (163 – 130)
Mean Absolute Deviation = 7.2 = (165.2 / 23)

Note: The statistics for your class will vary by classroom.

Some comparisons:

The **shape** of the distribution of heights for class 1 is clustered around a large peak in the middle. The shape of the class 2 heights is somewhat clustered in the middle, but is flatter and more evenly spread out than class 1. Students may note the gap in the data between the tallest student and the rest of class 2.

Measures of center (mean, median, and mode) for class two are higher than for class one. A conclusion students should reach is that class two is generally taller than class one. Compare to your classroom.

Measures of spread (range and mean absolute deviation) for class two are larger than for class one. A conclusion students should reach is that class two is more spread out than class one. This is visually apparent if students note the range based on the values on the x-axis scales of each graph. Also, there is a larger difference between the tallest and shortest students in class two than class one. Compare to your classroom.

Note: **Mean Absolute Deviation (MAD)** is an intuitive version of "standard deviation." When students in elementary and middle schools are introduced to and understand MAD, then learning standard deviation in high school and college will come more easily because they will have an understanding of the concept being measured. MAD is taught in some textbooks, but not all. You may want to consider this when choosing a textbook. For a discussion of MAD, see page 44 of the *Guidelines for Assessment and Instruction in Statistics Education (GAISE) Report: A Pre-K – 12 Curriculum Framework* at *www.amstat.org/education/gaise.*

Collecting, Depicting, and Understanding Data

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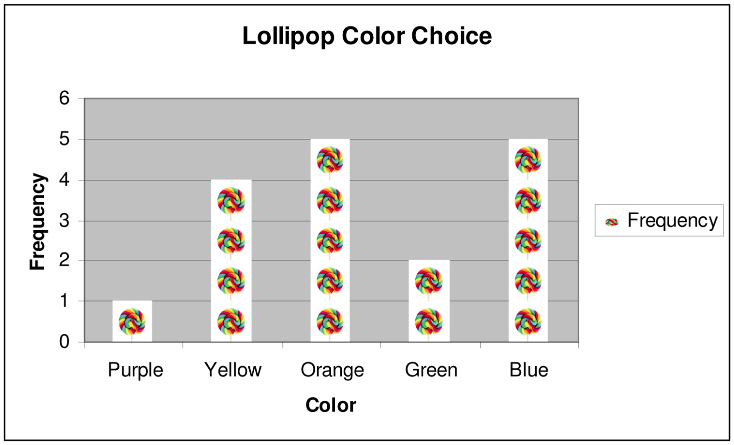
One goal in the topic of data analysis for children in grades PreK-12 is to "select and use appropriate statistical methods to analyze data." This is one attribute of the standard of **Data Analysis and Probability** from the National Council of Teachers of Mathematics *Principles and Standards for School Mathematics* (National Council of Teachers of Mathematics publication, 2000 – more information can be found at: *http://standards.nctm.org.)* This is also a topic stressed in the publication *Guidelines for Assessment and Instruction in Statistics Education (GAISE) Report* which is a new publication I recommend to all teachers Pre-K-12 who teach statistics (American Statistical Association publication, 2007 – more information can be found at: *http://www.amstat.org/education/gaise.)* An "appropriate statistical method" for analyzing data is to use graphs to display the data. Traditionally, the topics of data and chance have been "saved" for students in the middle or high school grades. Typically, these students have been given a data set and asked to create a specific type of graph, such as a pie chart or bar chart. While this gives them skills in creating graphs, it does not help them understand how to collect their own data and then choose the best means for displaying their results. If we can spiral the topic of data analysis into curriculum for students as they progress through their education, then eventually they should be able to apply particular statistical techniques and methods that they feel are most appropriate for a particular situation involving data. The topic of graphing data can easily be introduced very early in a student's education.

Data analysis often begins with children in grades PreK-2 by sorting information and then arranging the physical objects. This is an example of a basic graphing technique that very young students can do and understand. These physical objects can then be transferred into a pictograph, and then later into a bar chart which the child can discuss. For example, a class may collect apples and physically lay out the apples in lines according to the colors of red, yellow, and green. Students at this age are often most interested in looking at data familiar to them and answering questions such as "which has the most" and "which has the least." Then, the students can draw a pictograph of these apples, followed by a bar graph of the apples. This allows for the transfer of ideas from the actual object to a more abstract way to depict the information. This increase in abstraction is important in all areas of mathematics and follows the three stages of representation of mathematical ideas as expressed by Bruner in the 1960s: "enactive, iconic, and symbolic" (Herrera & Owens, 2001, p.85). The first stage requires students to use manipulatives or hands-on materials to solve problems; the second stage moves students toward using pictures, drawings, or representation of some sort on paper; and the last stage moves students into the abstractness of solving mathematics problems without other assistance.

Pictographs are used in the early grades as an introductory way for students to move from the first stage (enactive) to the second stage (iconic) in data presentation and analysis. Some textbooks cover pictographs and many teachers use them in their classrooms. Pictographs can also be created with technology including the TI-73 graphing calculator and Microsoft Excel. The illustration shows a simple example of a pictograph created in Microsoft Excel. Students were asked a simple question: "If you could choose from the following lollypop colors, which would you choose?" The x-axis displays the qualitative (categorical) variable color and the various colors are given. The y-axis displays the frequencies of each color and the frequencies are displayed in the graph as lollypops. Instructions on how to create a pictograph using Microsoft Excel can be found at the following website: *http://www.microsoft.com/education/createpictograph.mspx.*

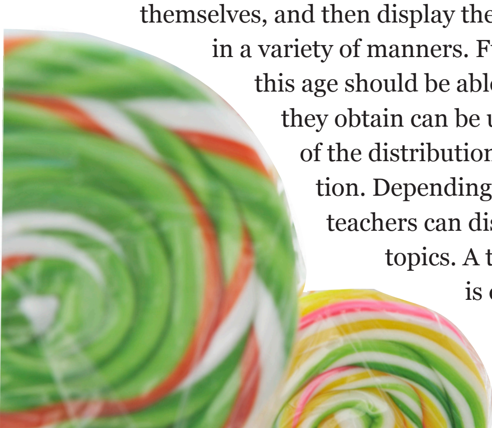


Another good website resource where students and teachers can explore building various graphs is the National Library of Virtual Manipulatives found at: *http://nlvm.usu.edu/en/NAV/vlibrary.html.*

By grades 3-5, students should be collecting their own data and displaying it graphically. However, prior to this, students should be able to display data by first tallying a collection of data that they have collected. This introduces the concepts of tallying and frequency. Then students learn, over time, how to depict these results in a number of ways such as pictographs, a traditional bar graph or a dot plot. A big step in these grades is for students to be able to understand and discuss an entire distribution of data, not just focus on individual observations. Students should also learn how to compare two groups of data. For example, the class that created the lollypop pictograph could conduct a poll of each student's favorite candy bar and create a bar graph of this data. They then could consider basic questions such as: "are lollypop color preferences evenly distributed amongst the colors or is there one color that is preferred over the rest? Is this also the case for candy bars?" Students could then go one step further and break the data down based on gender (introducing a second variable) and consider questions about student preference and whether or not there is a relationship between gender of a student and preference.

By the time students reach the middle grades, grades 6-8, they should be collecting data and choosing more advanced statistical methods to quantify and display the results. Because students at this grade level should be able to calculate the mean, median, mode, and quartiles of a data set, they can also be taught how to create and interpret graphs such as the stem-and-leaf graph or a box-and-whiskers graph. Performing these calculations helps the students discuss measures of center such as the mean and what happens to the distribution as displayed in a graph when outliers are present or not. For example, students could use the Internet to locate the prices of houses for sale in a particular area or neighborhood and then graph these prices in a stem-and-leaf graph, as well as calculating the mean. This graph should allow the students to discuss shape and skewness related to housing costs in one area, and how one very expensive house can skew the graph and affects the value of the mean significantly.

For grades 9-12, students should be able to conduct research themselves, and then display the results using technology in a variety of manners. Furthermore, students at this age should be able to discuss how a sample they obtain can be used to infer properties of the distribution of the entire population. Depending on the level of the class, teachers can discuss a variety of statistical topics. A teacher can build on what is described above for the middle grades, and ask students to use technology to depict data that has been collected. Using the example above, students could locate 30 house prices each in three different cities in the United States and depict the data in three side by side box-and-whisker plots. A discussion could include how and why each of these graphs may look different from the others. With a more advanced class, a teacher could examine bivariate data in the form of a scatter plot which includes concepts from algebra, the statistical topic of correlation, and "line of best fit" or regression topics. For example, a teacher can ask students to perform a "taste test" of 20 different cookies. The students could then rate each cookie, and a class average can be obtained for each cookie. Then, this information could be graphed against cost of the cookie to see if there is a relationship between cost and taste. Students should be asked to think about how and why their results may be different from other students' results.



Regardless of education level, collecting research and being able to display, discuss, and interpret results is crucial. If students can continually build on what they have been taught before, they have the potential to reach high levels of data analysis and interpretation. These skills are invaluable to all students who will become consumers of statistics as adults as they read and interpret graphical representations of data and must evaluate the information presented to them.

References

Herrera, Terese A., and Douglas T. Owens (2001). "The "new new math"?: Two reform movements in mathematics education." *Theory into Practice 40* (2):84-92.

National Council of Teachers of Mathematics (2000). *Principles and Standards for School Mathematics.* NCTM: Reston, VA.

Statistics Education Web (STEW) IN SEARCH OF Associate Editors and Reviewers

The editor of Statistics Education Web, an online bank of peer-reviewed lesson plans for K–12 teachers of mathematics and science, is accepting applications/nominations for associate editors and reviewers. Those chosen will review lesson plans that showcase the use of statistical methods and ideas in science and mathematics based on framework and levels of the *Guidelines for Assessment and Instruction in Statistics Education (GAISE) Report: A Pre-K–12 Curriculum Framework*. Associate editors and reviewers will be selected for each of the three GAISE levels. Interested persons should electronically submit a letter of interest and a current CV or résumé to the STEW Editor, Scott Street at *STEW.Editor@gmail.com.*

Stating Probabilities

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This article discusses three different ways of quantifying and stating probabilities. You may find that you already teach each way in different contexts in your classes or you may only teach one or two of the ways. No one way is considered the "correct" way – they are all different and convey different information. Consider the experiment of rolling two 6-sided dice (die 1 and die 2) once. Suppose each side has an equal chance of occurring when rolled. The sample space S_1 = {(a, b) where a is the value observed on die 1 and b is the value observed on die 2} has 36 possible outcomes, all equally likely, as given in the following table:

		Die 2					
		1	2	3	4	5	6
	1	(1,1)	(1,2)	(1,3)	(1,4)	(1,5)	(1,6)
	2	(2,1)	(2,2)	(2,3)	(2,4)	(2,5)	(2,6)
Die 1	3	(3,1)	(3,2)	(3,3)	(3,4)	(3,5)	(3,6)
	4	(4,1)	(4,2)	(4,3)	(4,4)	(4,5)	(4,6)
	5	(5,1)	(5,2)	(5,3)	(5,4)	(5,5)	(5,6)
	6	(6,1)	(6,2)	(6,3)	(6,4)	(6,5)	(6,6)

For this experiment, the sum of the numbers on the topmost faces of the two dice is of interest. For example, if a 5 and a 6 are rolled then the sum is 11. The sample space for the sum of the two dice is S_2 = {2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12}. Define the random variable *X* to equal the sum of the topmost faces of the two fair dice.

The probability distribution, which gives the probability of each outcome in the sample space, is given in the following table:

X	2	3	4	5	6	7	8	9	10	11	12
P(X=x)	1/36	2/36	3/36	4/36	5/36	6/36	5/36	4/36	3/36	2/36	1/36

There are three basic ways to state a probability and each has advantages.

Stating a Probability as a Fraction: The probabilities given in the table above are written as fractions and notice that they are not written in lowest terms or *reduced*. This is intentional and sometimes used in probability and statistics settings. There is a good pedagogical reason for not reducing the fractions—the denominator is giving the number of outcomes in the sample space S_1 and the numerator is giving the number of outcomes in the event of interest. Reducing fractions removes this information!

Stating probabilities as fractions is useful from the standpoint that it gives a lot of information regarding the probability of the event being examined. Fractions also aid in computing other events. For example, the probability that *X* equals a 5 or 7 is 4/36 + 6/36 = 10/36 because the events getting a sum of "5 or 7" are mutually exclusive events. Two events E and F are said to be mutually exclusive if their intersection is empty or there are no outcomes common to both events. The fraction 10/36 tells a student (and teacher) much more information than the reduced fraction of 5/18. The fraction 10/36 informs the reader that there are 10 outcomes out of 36 possible outcomes in S_1 that result in *X* equaling a 5 or 7 in S_2.

Stating a Probability as a Decimal: Any probability stated as a fraction can be converted to a decimal such as $P(X = 8) = 5/36 = 0.139$ rounded to the third decimal place. When doing calculations with probabilities it is sometimes useful to have them stated as decimals. For example, the probability of two independent events occurring is the product of their individual probabilities. The outcomes of the two dice are independent (the outcome of one die does not affect the outcome of the other). Two events A and B are said to be independent if P(A and B) = P(A) P(B). In order for the sum of the topmost faces to equal 2, a 1 must be rolled on each die. The probability of this occurring based on the above table is 1/36 or 0.0278 or 2.78%. This probability is computed by multiplying the probabilities of rolling a 1 on each die. The probability of rolling a 1 on each die is 1/6 or 0.1667 or 16.67%. Multiplying the decimals together yields 0.1667*0.1667 = 0.0278. The decimal representation is useful for multiplication because if the probabilities were represented as percentages they would have to be converted to decimals before multiplying. Also note that when students use calculators or spreadsheets they will most likely be using probabilities expressed as decimals.

Stating a Probability as a Percentage: Any of the probabilities in the table above can be turned into percentages. For example, the $P(X = 8) = 5/36$ can be written as 13.89% or, rounded to the nearest whole number, 14%. Many students and teachers are comfortable talking about the probability or likelihood of an event in terms of a percentage: When rolling two dice, the probability, or likelihood, that the sum of the dice is 8 is about 14%. Students often have a better grasp of how likely 14% is as opposed to how likely 0.14 or 5/36 is.

In summary, it is important to understand that there are multiple ways to state probabilities based on the type or context of the problem. Students should be made aware of the different ways and have an understanding of each so that they can make informed decisions as to which to use. Students will also gain confidence, understanding, and experience in interpreting when presented probabilities in various forms.

The American Statistical Association Meeting Within a Meeting:

A Summer Workshop for K – 12 Teachers

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Participants during the 2008 Meeting Within a Meeting K–4 Workshop

At the 2006 Joint Statistics Meetings (JSM) in Seattle, WA, Martha Aliaga, ASA Director of Programs convened the MWM Steering Committee to outline plans for the first Meeting Within a Meeting (MWM) Summer Workshop for K-12 teachers. The committee decided to hold the first workshop at the JSM 2007 in Salt Lake City, Utah. The workshop would be a pilot program for middle school teachers. Middle school was chosen as the focus because it is often a critical juncture for adolescents deciding they can or cannot "do" math. The committee hoped by showing teachers engaging activities to do with their classes more students would improve their quantitative skills and be attracted to taking mathematics and statistics classes.

Goals for MWM

The primary goal of the MWM program in 2007 was to provide an opportunity for Utah middle school and high school teachers who taught math or science courses to discuss and apply the statistical concepts embodied in Utah Secondary Core Curriculum Standard V. Although the objectives and concepts taught under Standard V differ from course to course, the standard may be summarized as follows: Teachers will explore problems that require them to collect, organize, analyze, and draw conclusions from data and apply basic concepts of probability. The MWM program included examining what students can be expected to do at the most basic level of understanding and what can be expected of them as their skill level develops and their experience broadens.

A secondary goal was to encourage cooperation between mathematics and science teachers. By working together on class projects, math and science teachers would find support for their statistics teaching.

(from left): Martha Aliaga, ASA Past-President Mary Ellen Bock, and Katherine Halvorsen during the Meeting Within a Meeting at the 2007 JSM in Salt Lake City, Utah

Salt Lake City, 2007

The first MWM was held in conjunction with the 2007 JSM in Salt Lake City, Utah. The one-day pilot program focused on Utah middle school mathematics and science teachers but included teachers from six additional states and Canada. The follow-up program was sponsored by an ASA Strategic Initiative and by the Utah Chapter. The Chapter maintained contact between the Utah teachers who attended MWM through meetings and classroom visits during the 2007-2008 academic year. The ASA provided technical support for webinars for all participating teachers.

Content for MWM 2007 included the American Statistical Association's *Guidelines for Assessment and Instruction in Statistics Education in Grades Pre K-12* http://www.amstat.org/education/gaise, the Utah State Standards for teaching statistics, methods for collecting, organizing, analyzing, and reporting conclusions from grade-appropriate statistical investigations, lesson plan development, and methods for assessing student learning. The Utah State Office of Education approved MWM as a professional development course which provided one-credit hour for participating Utah teachers. Teachers attending MWM from outside Utah were given a certificate of participation from ASA. MWM participants also received complimentary passes to attend JSM Statistics Education sessions the day following MWM. The committee also wanted to establish connections between the Utah teachers and members of ASA's Utah Chapter. Thus, chapter members could act as resources for teachers in the future. In addition, a follow-up program was planned that would include webinar meetings between the teacher participants and Utah Chapter members.

Participants have a laugh during the 2008 Meeting Within a Meeting in Denver, Colorado.

Katherine Halvorsen, MWM Program Chair, and **Rebecca Nichols,** ASA's Assistant Director, K-16 Education Programs, planned the MWM program, invited speakers, created the website, advertised the workshop to schools and to ASA members and chapters, developed the application and evaluation procedures, managed the logistics of setting up the conference in Salt Lake City, and arranged for complementary copies of the GAISE Report which were donated by the ASA/NCTM Joint Committee. Pearson Learning donated copies of the *Teacher's Guide for Statistics in the Connected Mathematics 2 Series*. **Martha Aliaga,** ASA Director of Programs, provided guidance, as did members of the Advisory Committee on Teacher Enhancement (ACTE) and the ASA/NCTM Joint Committee. MWM presenters included: *GAISE* report authors **Chris Franklin, Gary Kader, Jerry Moreno,** and **Roxy Peck**; a member of the ASA/NCTM Joint Committee, **Henry Kranendonk**; Utah AP Statistics teachers **Ember Storrs** and **Tracey Meade**; curriculum and assessment specialists at the Utah State Office of Education **Diane Suddreth** and **Paul Bernhardt**; statistics educators **Paul Fields** and **Katherine Halvorsen**; and a career panel organized by the ASA Committee on Career Development that included **Janet Myhre, Arnold Goodman, Sarah Kogut** and **Daniel Jeske**. Additionally, ASA President **Mary Ellen Bock**, ASA Executive Director **William B. Smith**, and incoming ASA Executive Director **Ron Wasserstein** welcomed the attendees. **Paul Fields** planned and managed the follow-up activities in Salt Lake City.

Table 1: Place of Residence as Reported on Applications of MWM Participants

Residence	Number of Participants	Percent
Utah	12	54.5
Idaho	3	13.6
New Mexico	2	9.1
Canada	1	4.5
Colorado	1	4.5
Iowa	1	4.5
Maryland	1	4.5
Nevada	1	4.5
Total	22	99.7

Table 2: Grades Participants Expect to Teach in Fall, 2007 as Reported on Evaluation Forms

Grade	Number of Participants	Percent
6-9	9	45
9-12	7	35
6-12	2	10
K-8	1	5
Not teaching	1	5
Total	20	100

Participation

Twenty-eight people completed the MWM application process which included completing the online application form, sending a letter from their school district indicating support for their application, and returning their acceptance/housing form. Prior to MWM, five conference participants withdrew their applications and three more did not attend on the day of the conference. One participant was replaced from the waiting list, and an unregistered participant arrived on the day of the conference. The final count of participants was 22, with only five men. Twenty participants completed program evaluation forms.

Table 1 shows the geographic distribution of the participants, and Table 2 shows the distribution of the grades taught. The information in Table 1 was taken from the application forms (n=22). Table 2 summarizes information provided by the participants on the course evaluation forms (n=20). Note that about half the participants teach in middle schools and the rest teach in high schools. Two participants, a test developer for ACT and an employee of the Utah State Office of Education, are not classroom teachers.

Participant Evaluations

The participants evaluated each speaker, the overall program, and the food. They also answered questions regarding program content and the follow-up program. Their assessment of the day was very positive. The participants rated the overall program 3.7 out of 4 points. Some of the comments included, "This was a fantastic day;" "I really enjoyed the variety of presenters, the many styles and emphases of each person's topic;" and "I enjoyed the meetings very much. Thanks for the opportunity."

Lesson planning was important to the participants. Thirteen of the twenty evaluation forms had this item marked as the one the participant would have liked to spend more time discussing. One participant commented that planning lessons and assessing students were topics that were too dry to hear about at the end of a long day. Other topics participants wanted to see added to the program included more hands-on activities, statistics projects, methods for data collection, use of technology to teach statistics, more application to science standards, resources for experiments, labs, and data sets, and more information about how to integrate the material we taught them into their classrooms.

Nine of the 20 evaluators said the Utah state standards should be dropped from the program, an understandable result given that 10 of the 22 participants do not teach in Utah. The participants' primary concern was that there was too much material for the time available. Six of the 20 evaluations mentioned fatigue during the day or wished for more depth on fewer topics, or more time for MWM.

Instructor Evaluations

The instructors spoke with one voice when they said that overall the program was a success. One instructor mentioned how much she appreciated the regular updates Rebecca Nichols sent to the instructors, and that overall the experience was very positive. Another instructor mentioned the fantastic effort on everyone's part to provide an excellent initial MWM. All of the instructors said we had too much content for the time available in the MWM program.

Summarizing the First Workshop

Our first MWM program was a great success, and we planned to build on that. We intend to keep the GAISE recommendations the central focus of the MWM program and to reduce our emphasis on local state standards to make the program more relevant to all participants. Nearly half the participants in 2007 came from states other than Utah, and we will have a similarly diverse group of participants at JSM 2008 in Denver.

MWM in Denver, 2008

A two-day format was planned for the next MWM in Denver. The first day would include a workshop for K-4 teachers and one for 9-12 teachers. The second day would be a single work-

A Meeting Within a Meeting during JSM in Denver, 2008.

shop for 5-8 teachers. The 5-8 teachers were invited to observe either the K-4 or the 9-12 workshop and the K-4 and high school teachers could observe the 5-8 workshop. Teachers also had the option of attending Statistics Education presentations at JSM on the second day of their program. With members of the ASA Colorado Chapter, all participants were invited to a dinner and panel discussion on careers in statistics presented by the ASA Committee on Career Development. The workshops and dinner were held at Metropolitan State College of Denver through the assistance of faculty member, Nels Grevstad.

The K-4 workshop focused on *GAISE* Level A activities, the 5-8 workshop on Level B, and 9-12 on Level C. Jerry Moreno planned and organized the K-4 workshop that includes data collection and analysis activities, probability activities, and poster and project activities. Katherine Halvorsen planned and organized the 5-8 and 9-12 workshops. The 9-12 workshop aimed to help non AP Statistics teachers introduce statistics concepts into their traditional math courses. The program included activities on formulating questions for class activities and projects, on randomizing selection and allocation, using Fathom to teach statistical concepts, and using dynamic graphics to teach regression and hypothesis testing. The middle school workshop focused on the distinctions between one- and two-variable statistics, as well as the distinctions between categorical and numerical data. Participants explored the types of displays and summaries that are appropriate for each kind of data. The workshop concluded with a discussion of lesson planning and assessment.

A follow-up program will be planned and managed by the Colorado-Wyoming Chapter of ASA, with assistance to be provided by Chapter members along with Rebecca Nichols at ASA.

Future Plans for MWM

The committee is looking forward to JSM 2009 in Washington, DC. Do you know K-12 mathematics or science teachers who are interested in enhancing their understanding and teaching of statistics within their mathematics and science curriculums? If you do, please encourage them to apply to attend MWM in 2009. The application process will begin in March 2009 and further information about the workshops will be available at *www.amstat.org/education/mwm.*

Free ASA Resources for K-12 Teachers

Guidelines for Assessment and Instruction in Statistics Education (GAISE) Report: A Pre-K–12 Curriculum Framework *www.amstat.org/education/gaise*

Statistics Education Webinars for K-12 Teachers *www.amstat.org/education/k12webinars*

ASA Poster and Project Competitions *http://www.amstat.org/education/index.cfm?fuseaction=poster1*

Other Web sites Useful for Teachers of Statistics

http://www.amstat.org/education/index.cfm?fuseaction=usefulsitesk-8

http://www.amstat.org/education/index.cfm?fuseaction=usefulsites9-12

Careers in Statistics *www.amstat.org/careers*

Other Statistics Education Resources *http://www.amstat.org/education*