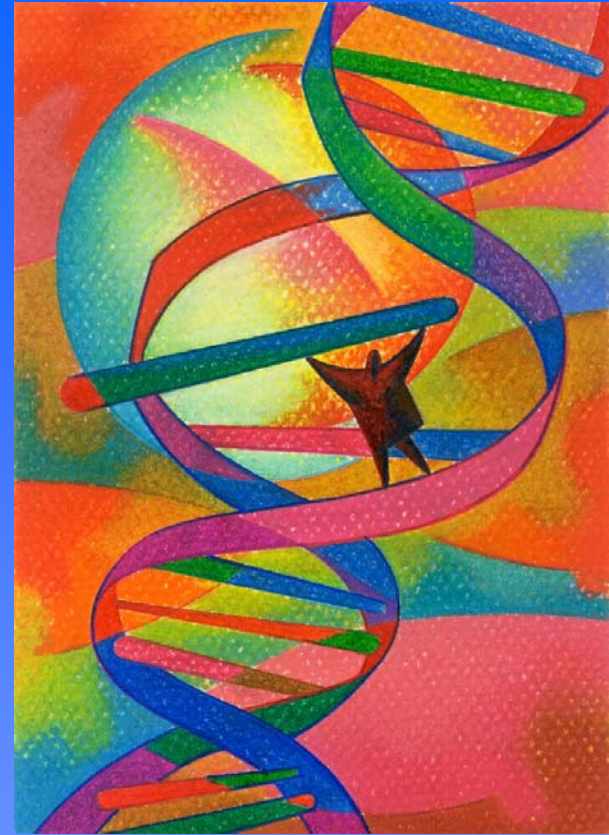


# Genetics to Genomics: Changing the Health of Today's Youth Through Science and Behavior



Mary Teachout, MAT  
Genomics Educator  
Michigan Department of  
Community Health  
teachoutm@mi.gov

# Timeline

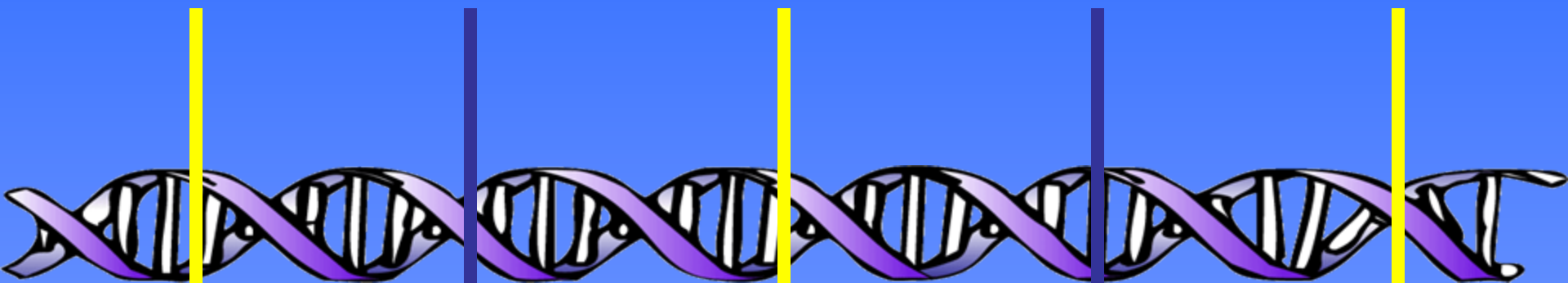
2000-2002

2003

2004

April 2005

2005-2006



*Needs  
Assessment*

*State Plan*

*Frontiers in  
Genetics*

*Presentation to  
Math and Science  
Center Directors*

*Genetics to  
Genomics*

# Needs Assessment for Michigan's State Genetics Plan\*

- 75% stated a need to learn more about the implications of the Human Genome Project
- 91% stated their students or parents have mentioned a topic related to genetics over the last semester
- 77% saw their role as facilitating discussion about the impact of genetics on individuals (health and disease prevention)
- 68% felt the biggest impact in helping to increase the level of genetic literacy can be made by teachers and professors

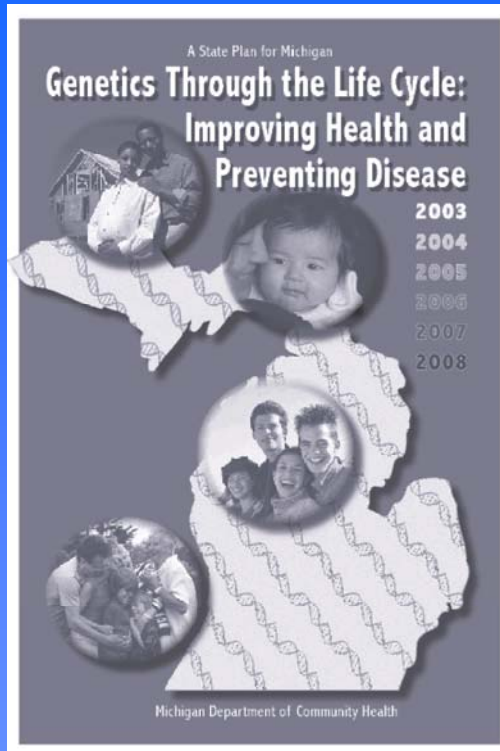
\* Genetics Needs Assessment, 2000-02 (MDCH)

432 surveys sent to middle and high school educators, **168 responses**

# How Can MDCH Help?



- Provide in-service training opportunities or conferences about human genetic disease, syndromes, birth defects and how this correlates to the state benchmarks
- Maintain a centralized genetics education/resource information center
- Provide literature or other classroom materials to supplement curriculum
- Disseminate a printed newsletter or other communication with updates on medical/public health genetic issues and resources



## Goal One:

Increase *genetic literacy* in the State of Michigan.

### Objective:

Integrate human genetics into curricula throughout the educational system.

“*Genetic literacy* implies the ability to understand, interpret and apply genetic information to health and lifestyle decisions and to the ethical, legal and social issues faced by individuals and society.”

-State Genetics Plan, p. 13

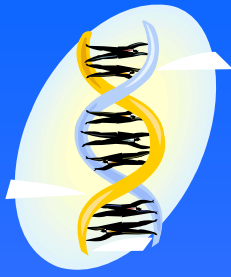
# Frontiers in Genetics



- Held at **Michigan State University** in the Fall of 2004
- 3 weekends of continuing education for interested secondary education teachers
  - Workshop session: Cancer as a Genetic Disorder
- Patterned after established and popular MSU program “Frontiers in Science”

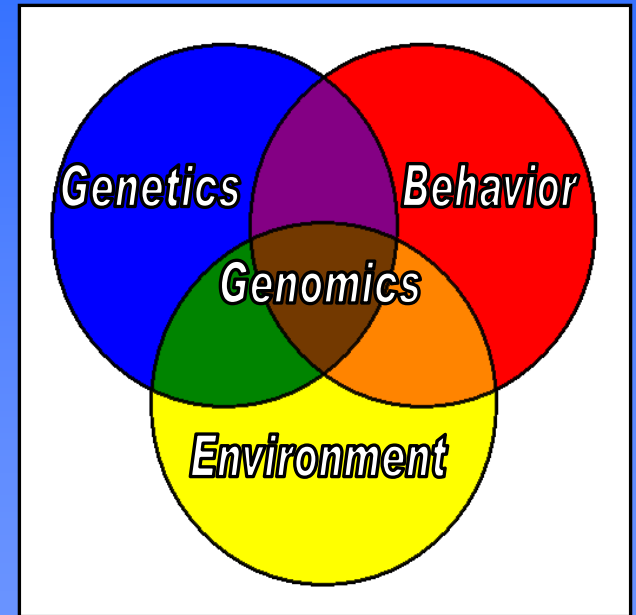
# Frontiers in Genetics

- Update background knowledge in genetics and genomics
- Incorporate new genomics concepts into the curricula
- Disseminate current educational resources on genomics
- Communicate with leading genetic researchers
- Connect curriculum to current research
- Provide teaching strategies for existing genomics classroom activities



# Genetics to Genomics Project Goals

- To encourage biology and health science teachers to progress from teaching single gene disorders to introducing their students to genomics and its implications for health
- To increase awareness in teachers and students that behavioral choices made early in life are important for chronic disease prevention



# How To Get It Out There?

- Presentation to state Mathematics and Science Centers Network Directors in April 2005



## Mission Statement

These centers provide leadership, curriculum support, professional development, and student services to educators in local school districts. The centers also serve as a resource clearinghouse for educational materials and information, and work to foster community involvement in the areas of mathematics and science. The Mathematics and Science Centers Network supports the delivery of high quality mathematics and science education for the students of Michigan.

[www.mscenters.org](http://www.mscenters.org)

# What Happened?

- 33 Centers around the state providing support to teachers
- 24 of the directors expressed interest in providing these workshops at their center

# Workshop Content

## The 3 R's

» Reachable

» Relevant

» Rigorous

Web based

[www.MIGeneticsConnection.org/Genomics](http://www.MIGeneticsConnection.org/Genomics)

# What Did The Participants Do?

- Workshops varied in length – 3 hours to a whole day
- Introduction
  - What is Genetics vs. Genomics?
  - Public Health perspective as the WHY
- Workshops consisted of different activities based on time allotted and audience
- Maintained Emphasis on teachers **DOING** the activities themselves and being able to discuss and work through.

# Chronic Disease

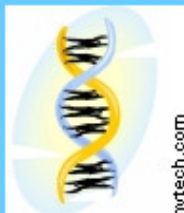
## Curriculum highlights:

- Heart Disease
- Cancer (specifically skin cancer)
- Diabetes
- Osteoporosis

# Hands-On Was the Key

- 45 sequenced activities
- Majority of the content from existing resources
- Experienced teacher consultant used own activities to fill in the gaps





# FROM GENETICS TO GENOMICS FOR TEACHERS

(under construction)

[Home](#)

[MIGenetics  
Connection](#)

[Family History](#)

[Multifactorial Traits](#)

[Genetic Variation](#)

[Additional Resources](#)

As teachers you have the task of designing curriculum that reflects the advancements in science as well as the needs of your students. This requires time for you to update your own knowledge in your field as well as translating that knowledge for your students while addressing the Michigan Benchmarks and the "3 Rs."

1. Relevant - curriculum that relates to the real world for your students
2. Rigorous - curriculum that challenges every student so they all can reach their potential
3. Reachable - curriculum that includes carefully sequenced tasks so each student can work to reach their potential

You may be frustrated because you have a very full plate with little or no time to address this issue. This website is designed to support you and help you save time as you make the transition from *Genetics to Genomics*, hoping to make an impossible task, possible.

**But, "what is *genomics*", you ask, "and why would I want to make the transition from genetics?"**

Genomics is a "spin-off" from the [Human Genome Project](#). Instead of looking at one gene at a time, isolated from the environment, genomics looks at many genes, how they interact with each other and how they are affected by their environment.

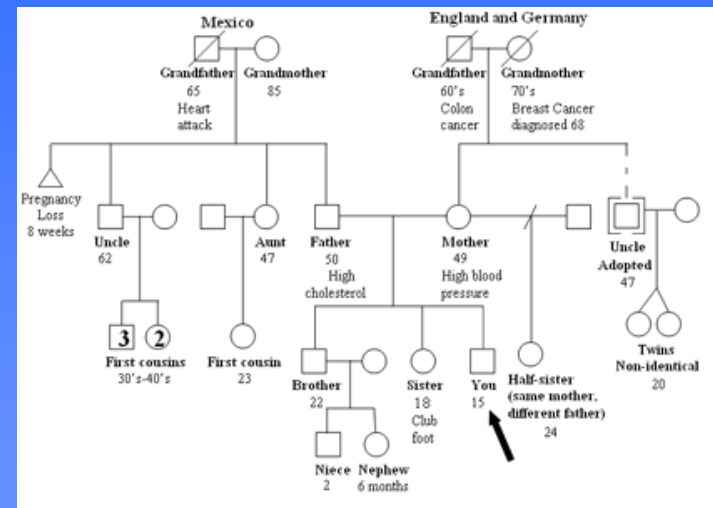
**"Why would we want to move in this direction, it sounds complicated?"** [www.MIGeneticsConnection.org/genomics](http://www.MIGeneticsConnection.org/genomics)

Most of our traits are controlled by multiple genes that interact with each other as well as the environment (Very few genes actually function in isolation). These would include traits that vary slightly from individual to individual such as height and hair color, as well as chronic disorders like [heart disease](#), [cancer](#), and [diabetes](#). These common chronic conditions will affect all of us or our families at some time. As scientists learn more about chronic conditions they will be better at diagnosing, treating, and preventing these common problems that are caused by multiple factors, not single genes. It has been said, "Ignorance about health has been called the 'silent epidemic.'" Fortunately, we can use the same concepts (or Benchmarks) we currently

# Family Health History

## ➤ Genomics at the organism level

- Pedigrees – The Ultimate Challenge (I am My Own Grandpa)
- Patterns of Inheritance
- Chronic Disease and Family History (does not follow pattern of inheritance previously learned)
- “What is your Risk for Disease” using the Harvard Disease Risk web site



# Multifactorial Traits

- Genomics at the cellular and gene level
  - Are You Susceptible?
  - 3 Gene Cell Cycle/Cancer Model
  - Sun exposure and skin cancer





# Genetic Variation

- Genomics at the molecular level (DNA, proteins and mutations)
- The Genetic Science Learning Center, University of Utah
- Alternative Splicing: Getting more than one protein from a gene
- Mutate a DNA sentence
- Microarray – Wet Lab (DNA sequencing activity) and Computer activity (University of Utah)

# ***ADDITIONAL RESOURCES***

[Home](#)

[MIGenetics  
Connection](#)

[Family History](#)

[Multifactorial Traits](#)

[Genetic Variation](#)

[Additional Resources](#)

*Is It in Your Genes?* by Philip R. Reilly  
[Book](#) and [companion website](#)

NIH Curriculum Supplements  
(they are free and support inquiry, highly recommended)  
<http://science-education.nih.gov/supplements>

*Educational Materials from the National Human Genome Research Institute*  
Educational materials about genetics and genomics for students, teachers and the general public  
<http://www.genome.gov/Education/>

Human Genome Project Education Kit  
<http://www.genome.gov/Pages/EducationKit/>

[Human Genome Landmarks Poster: Chromosome Viewer](#)  
Order your free poster on line or view each chromosome and its genes by just clicking on it.

Bioinformatics and the Human Genome Project  
(Download this module at this site)  
<http://www.bsccs.org/page.asp?pageid=0|31|53|308|77&id=0|bioinformatics and the human genome project>

Other Genetics and Genomics Modules  
(they can be downloaded as PDF Files)  
[http://www.ornl.gov/sci/techresources/Human\\_Genome/education/education.shtml#downloads](http://www.ornl.gov/sci/techresources/Human_Genome/education/education.shtml#downloads)

# Resource Packet

- Given to each participant, includes:
  - Hard copies of workshop activities
  - US Surgeon General's Family History Initiative, print version
  - MDCH Family History and Your Health newsletters
  - UV Beads
  - Chronic disease information

# Audience Reached

- 14 workshops completed
- Approximately 150 teachers participated
- E-mail group established to keep in touch when new articles or activities become available

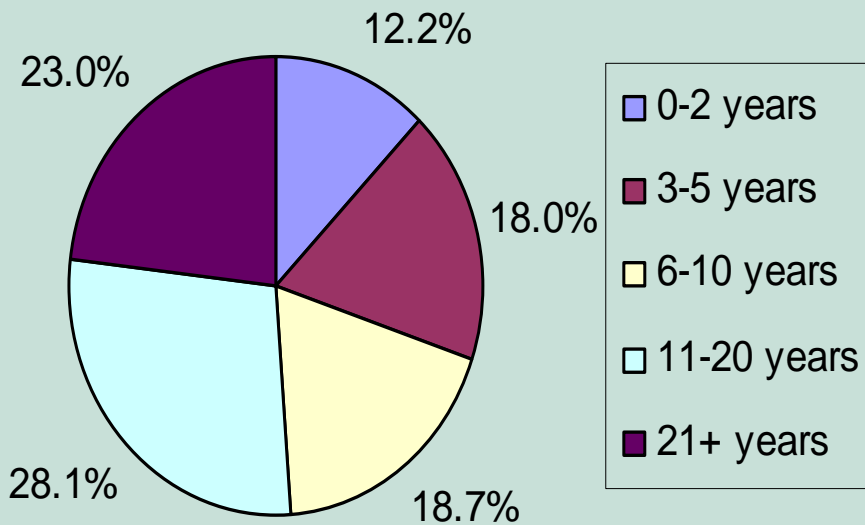
# Evaluations

- Pre and Post session evaluations
  - Demographic information
  - Participants' perception of genomics:
    - Knowledge
    - Interest
    - Confidence
    - Importance

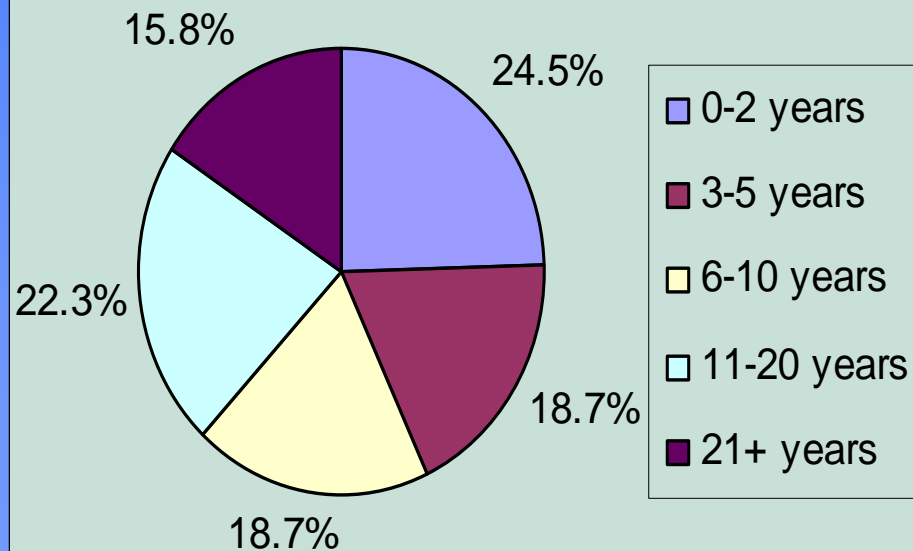


Family History  
Multifactorial trails  
Cancer Genetics  
Genetic Variation  
Microarray technology

### How many years have you been teaching?



### How many years have you been teaching biology/health?

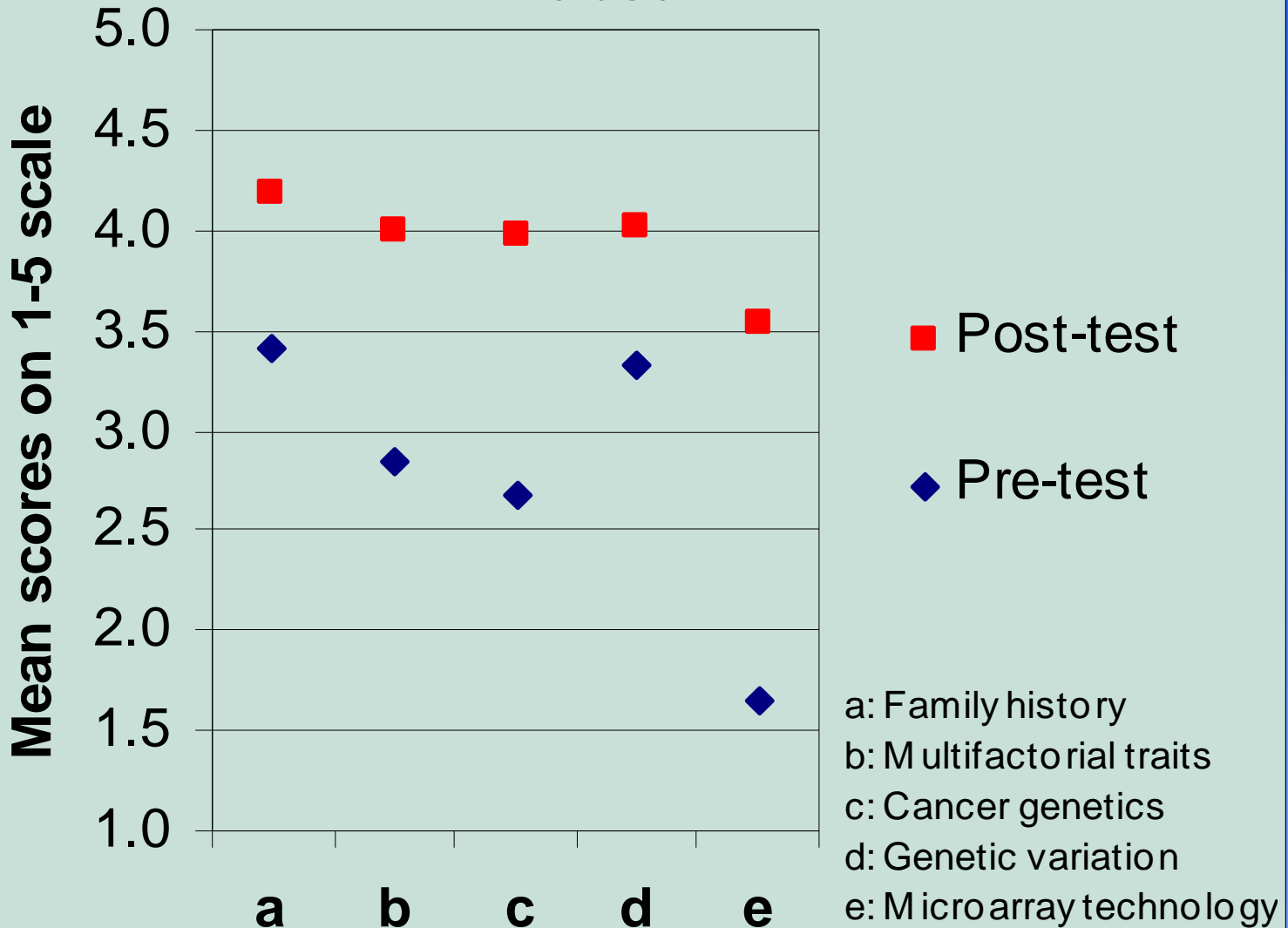


# Teachers' Responses

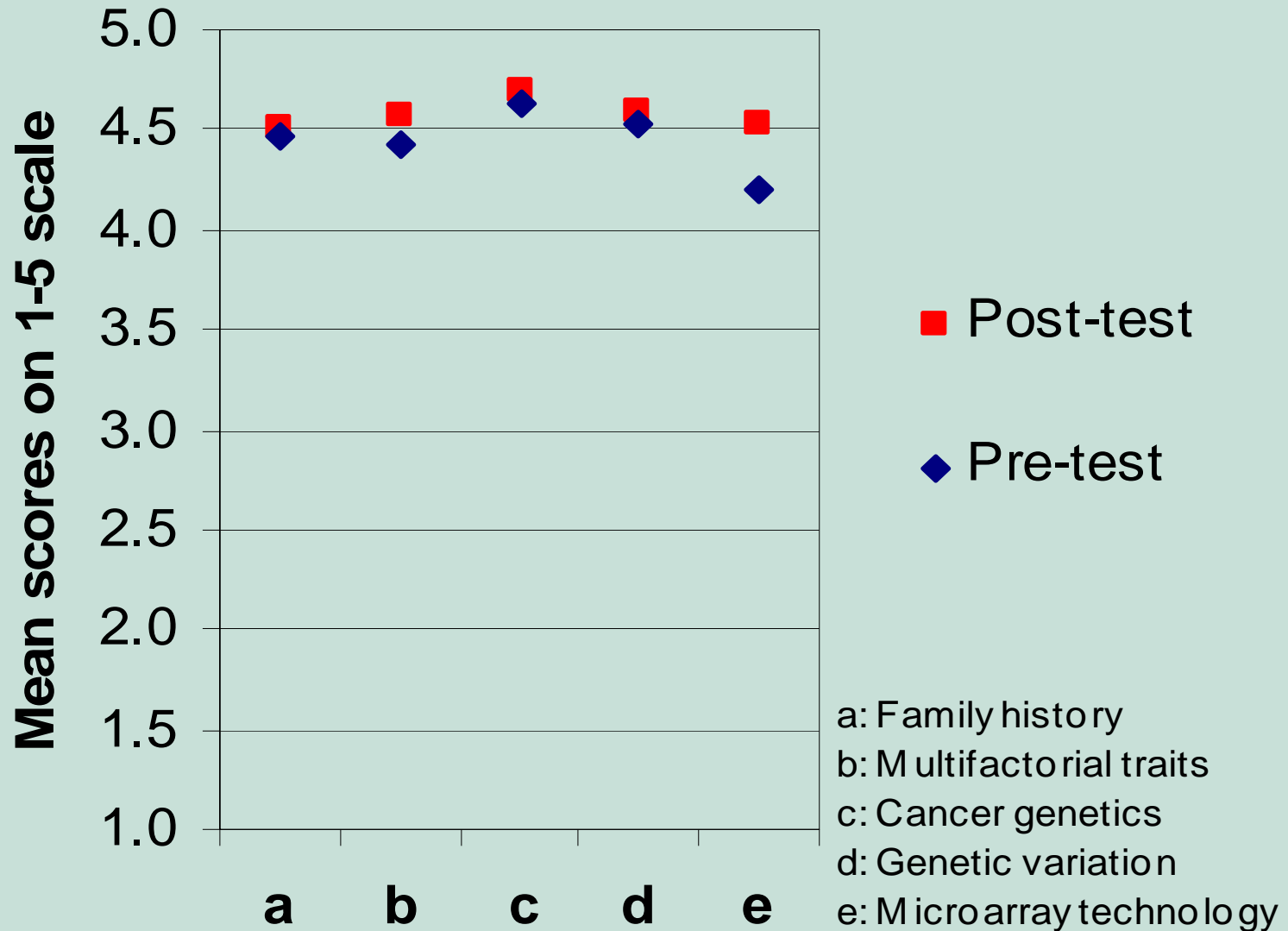
- Approximately 2-4 weeks to teach genetics during the school year
- Acquired knowledge mostly through workshops and conferences, undergraduate courses, or reading and studying on their own

N=139

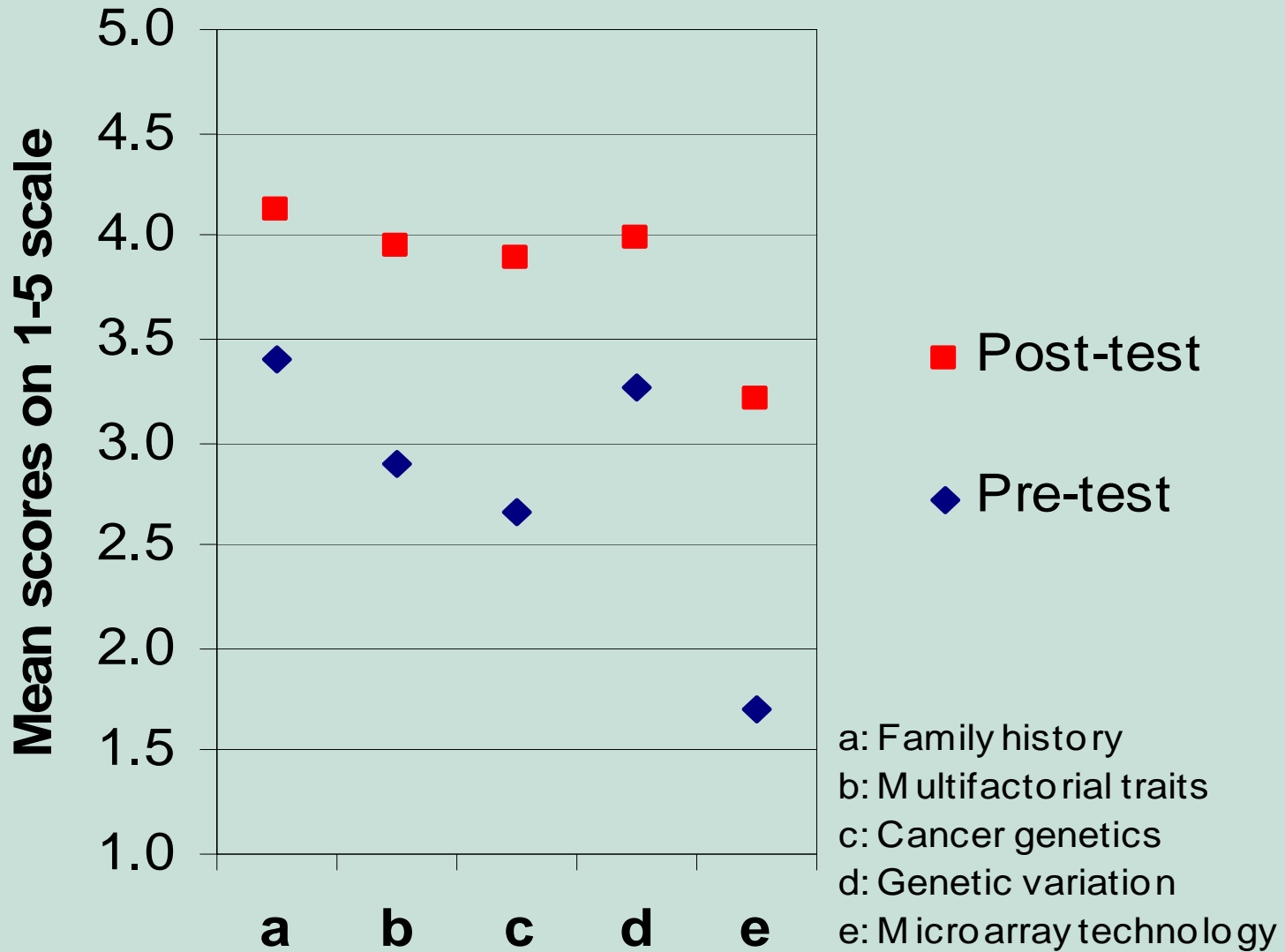
## How knowledgeable do you feel about:



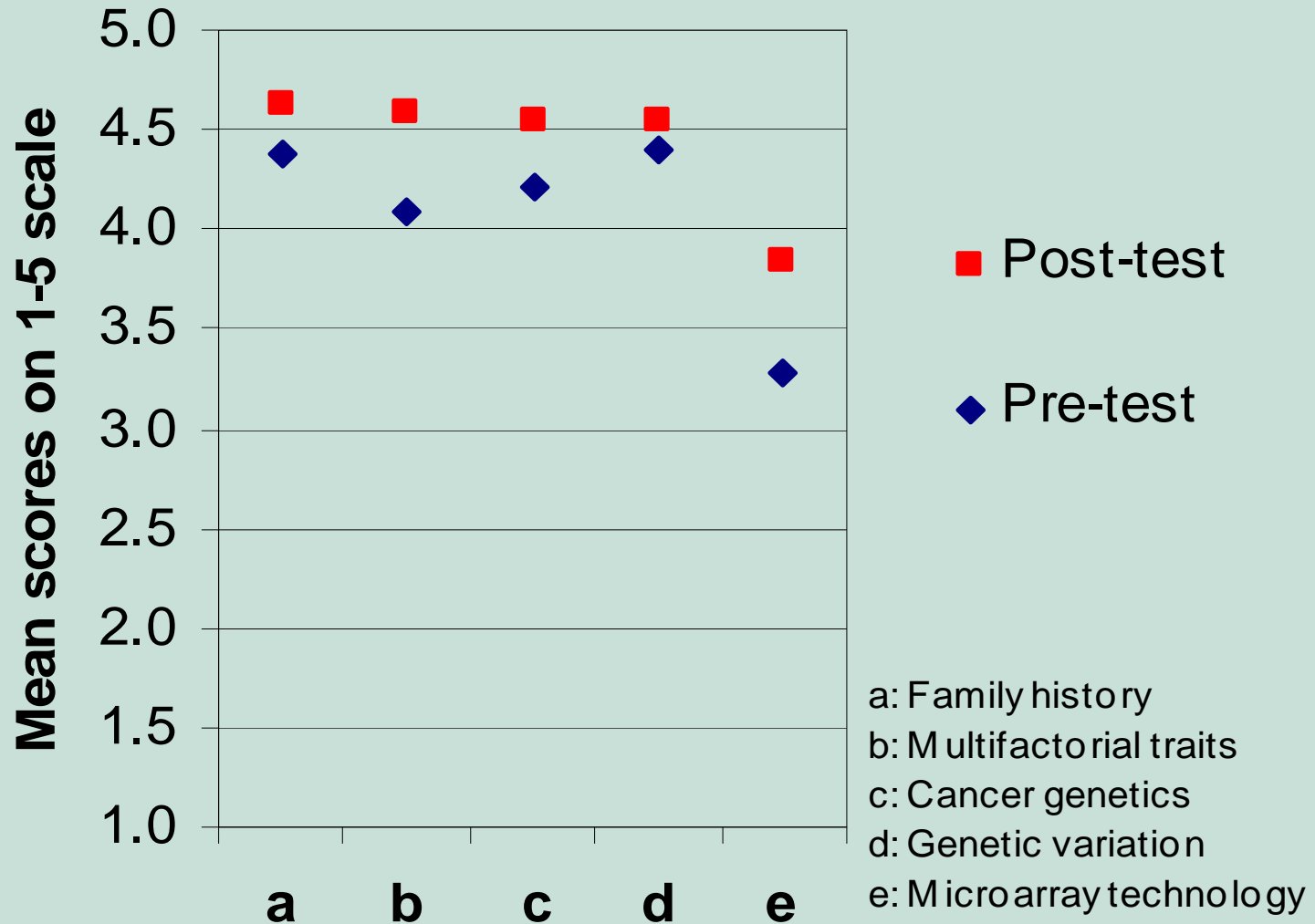
## How interested are you in learning more about:



## How confident are you in teaching:



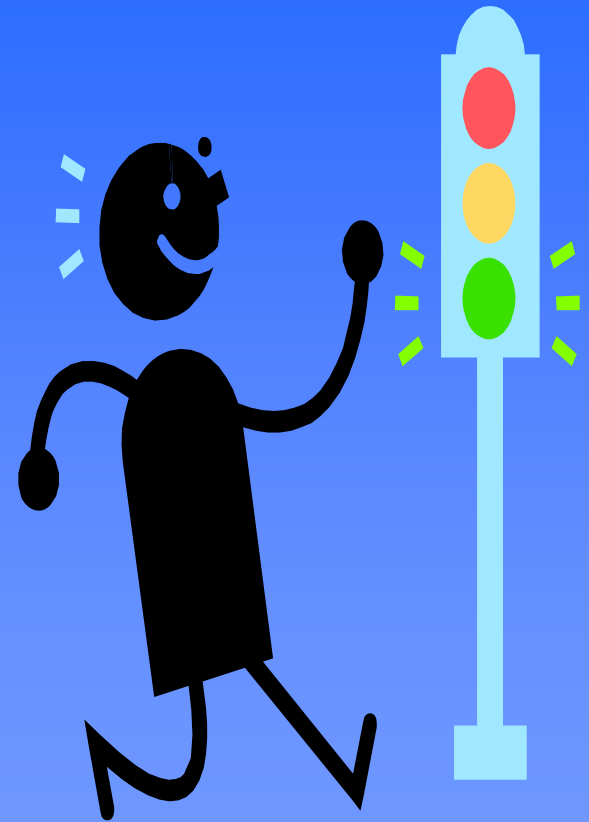
## How important would it be to include the following in your curriculum:



# What Teachers Liked

96% rated workshop as excellent or near excellent

- Hands-on activities
- Resources
- Web based
- Free stuff 😊
- Microarrays
- Cancer Genetics
- Ready to go activities



## What could be improved?

- **Time** – Many teachers wanted a whole day workshop to do more activities
- Some thought **Microarrays** were too advanced
- Most not relevant for middle school teachers
- Most surveys indicated “none” or “nothing”

# Other Teacher Comments

- “I like the way of looking at the genome rather than individual genes”
- “Just the kind of cutting edge stuff we teachers need!”
- “Thank you for keeping it fast paced, taking our questions and actually walking us through one or more activities for each level.”
- “I can't really think of anything least useful- but I could have used some chocolate.” 😊



# Follow up Survey

- 13 responses
- Questions were open-ended for better feedback
- Dissemination of materials
- Future workshops?
- Information requested:
  - Utilization of the website
  - Ease of use
  - What was liked best
  - Incorporation into current curriculum
  - Suggestions for improvement
  - Student response to materials

# Teachers' Responses

- 61% had utilized the website
- 66% had used any of the materials/information from the website
  - Felt website was easy to use and appreciated the up-to-date information
- Most felt the students responded positively to the materials and seemed to enjoy the activities