

# Wonderwise 4-H: The Trial Testing Process

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## *Wonderwise Women in Science Learning Kits*

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## Wonderwise 4-H: The Trial Testing Process

### Introduction and Description of Project:

Wonderwise 4-H is a three year, NSF-funded project that expands upon the previous Wonderwise Women in Science projects to encompass an informal science audience as well as the original formal classroom audience. This series of learning kits feature women scientists and are targeted toward upper elementary level students. Each kit includes a video, CD-ROM, and activities that focus on a particular woman scientist and her work. The Wonderwise 4-H project broadened the scope of the earlier work and included three primary goals: 1) to revise the six existing kits to make them more appropriate and accessible to the informal 4-H audience, 2) to develop three new kits modeled after the existing kits, and 3) to disseminate all nine Wonderwise kits to 4-H leaders and staff for use with youth in the 10 state participating region.

This evaluation summary describes the process of trial testing during the development of the three new kits. While it generally followed the pattern of trial testing that occurred with the development of the original kits, there were several important differences that emerged. These differences and how they came about are documented here as part of the evaluation process.

### Audiences:

This evaluation report is directed toward three primary audiences:

- The Wonderwise 4-H Project Co-Directors, Judy Diamond and Beth Birnstihl,
- The National Science Foundation, the funding agency for Wonderwise 4-H
- Other developers of science kits or curricula

Trial testing is done to help ensure that a new science curriculum will be effective with a broad audience and usable by diverse teachers with a wide range of skills. This report is designed to provide a descriptive summary of the trial testing process. With the difficulties and benefits of this process illuminated, it provides an important record of a key process in kit development for the Project Co-Directors. In addition, it forms part of the whole evaluation report package that will be submitted to the funding agency near the completion date of the project. Finally, for other curriculum developers who write activities that they hope will be used in educational settings, it provides an example of how one popular set of kits were trial tested to ensure their utility, usability, and feasibility for use by instructors in informal educational settings.

The trial testing used for the three kits developed for Wonderwise 4-H was modeled on the trial testing used in the development of the original, award-winning Wonderwise Women in Science kits.

### **Evaluation Questions:**

Three primary questions guided the creation of this evaluation report:

1. What was the process of trial testing?
2. How was the process altered and improved over time?
3. What were the benefits and limitations of this process?

### **Methods**

The three project staff members, including one of the Project Co-Directors, who were most involved in the actual trial testing were consulted to provide the information about the process. In addition to these informal information-gathering interviews, documents resulting from the trial testing were reviewed.

### **Limitations of the Evaluation**

This evaluation was written after the trial testing process was completed, so no real-time observations or interviews of the events were possible. While the written records of the trial testing classes contribute important data about the process as it was happening, it is primarily the interviews with the participants that tell the full story and sequence of events. As with any human reflection on the past, these records are subject to lapses in memory. However, because of the multiple sources of this information, the data collected is deemed reliable.

### **Description of Trial Testing Process**

The different steps used in the kit development, including the trial testing process, are used to organize this section sequentially. This report format provides both the context for the trial testing and the approximate chronological sequence involved in each kit's development. Although there were differences across the three kits, the steps remained mostly uniform, with some modifications, due either to kit idiosyncrasies or attempts at improving the process in some way.

Three Wonderwise 4-H Kits were developed during this grant funding period:

- Vet Detective

- Space Geologist
- Genetic Counselor

Every kit contains five activities, each of which takes about 30 to 60 minutes for students to complete. The activities for a single kit were all developed in tandem, and trial tested in tandem as well. Some required more development work than others, for a variety of reasons. Some activities are readily understood, with little specialized scientific knowledge necessary. Others include more advanced scientific concepts, necessitating introductory material prior to the actual activity. Some activities require few materials, while others include more equipment and materials. The gist and purpose of some activities are readily grasped, while others are more complex. Consequently, while the sequence of kit development steps was uniform, the treatment of each activity varied somewhat within each kit.

The development of every kit included the following steps:

1. *Brainstorming*
2. *Initial Draft of Activities Written and Informally Trial Tested by Curriculum Developer*
3. *Formal Trial Testing Completed by Project Staff*
4. *Second Draft (Revision of First Draft) Written by Curriculum Developer*
5. *More Formal Trial Testing Completed by Project Staff*
6. *Final Draft Completed*

Each of these steps are described in more detail below.

1. *Brainstorming*

Because the scientists were selected and their research interests known long before any of the actual kit work was completed, some ideas for kit activities were already on the drawing board by the time the first official brainstorming sessions were initiated. The activities being brainstormed were for both CD-based activities and activities that would be in the printed activity guide. Since the activities, video, and CD-ROM needed to be coordinated in content, any video footage that was already filmed at the time of the initial kit activity brainstorming session was viewed by the members of the brainstorming team to see what kinds of activities would be supported by it. However, in the case of Space Geologist, some of this brainstorming and decision-making about the activities was already complete by the time much of the video was being filmed. Consequently, in this case, the activities chosen for the kit influenced some of the filming. While many ideas were considered during the brainstorming sessions, the activity ideas that were ultimately chosen conformed to the following criteria:

- All the activities used only everyday materials that were easily obtained. No specialty, expensive, or difficult to find items were required.
- At least one of the five activities closely mirrored the scientist's actual work depicted in the video. In other words, some of the scientist's work that was shown in the video was closely replicated in one of the activities.
- None of the activities required extensive preparation on the part of the teacher or leader.
- None of the activities required a strong science background or knowledge on the part of the teacher or leader. In other words, someone with no familiarity with that science discipline could easily pick up and lead the activity.
- Each activity could stand alone without the video, but was related to the video.
- The series of five activities in each kit built successively and sequentially upon each other, yet were independent to the extent that any activity could be pulled out and used alone.

Every brainstorming session involved three key staff: the museum-based Project Co-Director who had led the development of the original kits, and the two education facilitators on staff at the museum. An appropriate content expert was also included at this stage, and this person helped to identify what key ideas would be important to convey to children about that science topic. In addition, depending on the kit and topic, additional participants were sometimes included. For Vet Detective, a 4-H animal specialist was included in the brainstorming session to help ensure appropriate content. For the Genetic Counselor kit, the scientist herself participated in some of the brainstorming, as did some other Wonderwise staff members who were involved in the video creation and editing. Because of the more difficult science concepts involved in the Genetics kit, the activity development was somewhat more complex. Genetics is not a topic that is typically taught at this age level and it is a relatively new field, so there were no existing curricular materials to draw from. Because the featured scientist herself provides outreach education to children, she had ideas about what was appropriate and feasible to include.

2. *Initial Draft of Activities Written and Informally Trial Tested by Curriculum Developer*

These ideas for kit activities in their rough form were then forwarded to the curriculum writer, an experienced science activity developer. In addition to the ideas

from the Wonderwise 4-H team, the curriculum writer also often had suggestions for possible activities. Using these varied ideas, the curriculum writer fleshed out, combined, and edited these concepts to create the rough version of activity instructions, usually in consultation with the museum-based project co-director. These written rough drafts of the five activities were then sent to the project co-director, who reviewed them with one of the education facilitators on the Wonderwise team. After this review, the most attractive and workable ideas were sent to the Curriculum Writer, who put them in a first draft form.

The curriculum writer would always do some informal trial testing with children to test the feasibility of the activities. Then she would complete the first complete draft of the set of actual activity guides, including background information, instructions, tools and materials needed, estimates of time needed, and other details to enable their use with youth. This finalized draft version was then sent to the education facilitator for trial testing. Because some of the artwork and other details were unfinished, sometimes the curriculum writer would send along actual materials to ensure that the education facilitator who was trial testing would know exactly what had been envisioned.

3. *Formal Trial Testing Completed by Project Staff*

One education facilitator would lead a group of youth through the activity while the other education facilitator observed and took copious notes about the interaction using a simple recording form developed for the first phase of Wonderwise Women in Science trial testing. Typically, one or two passes for each of the five activities were completed during this phase. See the tables below for details on the specific initial trial testing done for each activity from each kit.

**Space Geologist Kit**

Presenter: Education Facilitator

Observer: Leader from each group

Activity	Date	Type of group	Location	Grade	Total # of Students	Female	Male
Crater Maker	3/7/01	Club	Home	5 <sup>th</sup>	8	6	2
Digging Into the Past	3/27/01	Club	Community site	6 <sup>th</sup> , 7 <sup>th</sup>	8	4	4
Photo Geology	3/28/01	Club	Community site	6 <sup>th</sup> , 7 <sup>th</sup>	4		4
Big Time Tour	4/6/01	Club	Home	6 <sup>th</sup> , 7 <sup>th</sup>	7	7	
Splat	4/10/01	Home	Church	4 <sup>th</sup> – 9 <sup>th</sup>	26	13	13

		school					
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**Vet Detective Kit**

Presenter: Education Facilitator

Observer: Other Education Facilitator

Activity	Date	Type of group	Location	Grade	Total # of Students	Female	Male
Meet Tolani	9/11/01	After school	School	4 <sup>th</sup> -5 <sup>th</sup>	7	5	2
Vital Signs	9/11/01	After school	School	4 <sup>th</sup> -5 <sup>th</sup>	5	4	1
Rumination	9/12/01	After school	Recreation Center	3 <sup>rd</sup> -6 <sup>th</sup>	10	4	6
Bison Behavior	9/17/01	After school	School	4 <sup>th</sup> -6 <sup>th</sup>	6	3	3
Disease Detective	9/17/01	After school	School	4 <sup>th</sup> -6 <sup>th</sup>	6	3	3

Presenter: Education Facilitator

Observer: Other Education Facilitator

Activity	Date	Type of group	Location	Grade	Total # of Students	Female	Male
Meet Tolani	9/20/01	Classroom	School	4 <sup>th</sup>	19	7	12
Vital Signs	9/20/01	Classroom	School	5 <sup>th</sup>	20	8	12
Rumination	9/24/01	Classroom	School	6 <sup>th</sup>	21	9	12
Bison Behavior	9/24/01	Classroom	School	4 <sup>th</sup>	19	8	11
Disease Detective	9/24/01	Classroom	School	6 <sup>th</sup>	25	15	10

**Genetic Counselor**

Presenter: Education Facilitator

Observer: Other Education Facilitator

Activity	Date	Type of group	Location	Grade	Total # of Students	Female	Male
Meet Cathy	5/24/02	Club	Museum	2,3,4,6 <sup>th</sup>	4	2	2
Alike and Different	5/9/02	After school	School	3,4,5 <sup>th</sup>	9	2	7
What Sort?	5/24/02	Club	Museum	2,3,4,6 <sup>th</sup>	4	2	2
Mating Game	5/21/02	Home school	Church	2,3,4,6 <sup>th</sup>	14	9	7
Inside DNA	5/21/02	Club	Church	3,5,6 <sup>th</sup>	4	2	2

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With the original kits, the roles of activity leader and observer were traded between a classroom teacher and the museum education facilitator during the trial testing. For the development of these three kits, it was hoped that 4-H leaders would be involved in a similar way to how teachers were involved in the previous trial-testing. However, for a variety of reasons, including the need for close adherence to the written activities and for constructive criticism, the two museum education facilitators became the sole trial testing team.

The trial testing produced considerable information about where modifications were needed. For example, it was noted where students asked questions or did inappropriate things and where materials or information was missing or needed to be modified. Typically, substantial rewriting of the activities resulted from this trial testing. Two education facilitators and the project co-director reviewed all the activities in detail, and made detailed notes about changes that needed to be made. All comments were sent back to the curriculum writer.

4. *Second Draft (Revision of First Draft) Written by Curriculum Developer*

The curriculum writer then incorporated these comments and edits from the trial-testing into the next draft of the activities. Any questions or issues were resolved through conversations with the project co-director or education facilitator. This second draft included most of the necessary supporting artwork, all of which was completed by the developer so it would be consistent throughout the activity booklet.

5. *More Formal Trial Testing Completed by Project Staff*

This second draft then underwent another complete pass of trial testing with youth. Again, this used the 4-H trial testing form and typically involved both of the education facilitators, one as the leader of the activities and the other as the formal observer. Notes and comments about needed changes were marked on the activity guides and reviewed and discussed in detail with the co-director before being sent on to the curriculum writer for final revisions.

**Space Geologist Kit**

Presenter: Education Facilitator

Observer: Other Education Facilitator

Activity	Date	Type of group	Location	Grade	Total # of Students	Female	Male
Splat	7/9/01	Bright Lights	School	4 <sup>th</sup> -6 <sup>th</sup>	14	11	3



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		class					
Crater Maker	7/10/01	Bright Lights class	School	4 <sup>th</sup> – 6 <sup>th</sup>	13	10	3
Digging Into the Past	7/13/01	Bright Lights class	School	4 <sup>th</sup> – 6 <sup>th</sup>	12	9	3
Vanishing Crater	7/11/01	Bright Lights class	School	4 <sup>th</sup> – 6 <sup>th</sup>	13	10	3
Big Time Tour	7/12/01	Bright Lights class	School	4 <sup>th</sup> -6 <sup>th</sup>	12	9	3

**Vet Detective Kit**

Presenter: Education facilitator

Observer: Scientist from the kit

Activity	Date	Type of group	Location	Grade	Total # of Students	Female	Male
Flight Zones	10/4/01	Classroom	School	6 <sup>th</sup>	58	26	32
Vital Signs	10/4/01	Classroom	School	6 <sup>th</sup>	18	8	10
Rumination	10/4/01	Classroom	School	6 <sup>th</sup>	22	13	9
Bison Behavior	10/4/01	Classroom	School	6 <sup>th</sup>	30	11	19
Disease Detective	10/4/01	Classroom	School	6 <sup>th</sup>	40	19	21

**Genetic Counselor**

Presenter: Museum Educator

Observer: Both Education Facilitators

Activity	Date	Type of group	Location	Grade	Total # of Students	Female	Male
Meet Cathy	9/3/02	After school	Church	3,4,5,6 <sup>th</sup>	5	2	3
Alike and Different	9/5/02	After school	Church	3,4,5,6 <sup>th</sup>	7	2	5
What Sort?	9/9/02	After school	Church	3,4,5,6 <sup>th</sup>	6	3	3
Mating Game	9/16/02	After school	Church	3,4,5,6 <sup>th</sup>	12	2	10
Inside DNA	9/10/02	After school	Church	3,4,5,6 <sup>th</sup>	10	2	8

Presenter: Teacher

Observer: Education facilitator

Activity	Date	Type of group	Location	Grade	Total # of Students	Female	Male
Meet Cathy	7/1/02	After school	Recreation Center	4,5,6 <sup>th</sup>	8	1	7
Alike and Different	7/1/02	After school	Recreation Center	4,5,6 <sup>th</sup>	8	1	7
What Sort?	7/8/02	After school	Recreation	5,6,7 <sup>th</sup>	7	3	5

			Center				
Mating Game	7/3/02	After school	Recreation Center	3,4,5,6 <sup>th</sup>	12	2	10
Inside DNA	7/10/02	After school	Recreation Center	4,5,6 <sup>th</sup>	8	1	5

#### 6. Final Draft Completed

The curriculum writer then incorporated all the final edits to create the final draft of the activity guide. These were polished with additional art and formatting consistent with the other kits.

With Genetic Counselor, a second set of trial testing was completed with a teacher leading the activities. This was done to ensure it was complete enough for teacher to use without additional information needed.

#### Description of Process Changes over Time

The trial testing methods used here were modeled after the trial testing that was used in the development of the original Wonderwise kits. However, those kits were trial-tested in a classroom setting rather than the informal settings used here, and the activities were led by teachers in those classrooms rather than by one of the museum education facilitators. The difference in setting of the trial testing was made because the focus of this project was informal education, in contrast to the focus of the earlier funded Wonderwise Kits, and the trial test audience needed to match the intended audience. The second difference, having the museum education facilitator lead the activities, was made for a less obvious reason. During the trial testing of the original kits, the observer of activities (also a museum education facilitator), noted that quite frequently the classroom teachers leading these draft activities would automatically and unconsciously make modifications to the activity in anticipation of student questions or difficulties. For example, they might provide additional explanation of the activity, or add or delete a portion of the instructions to students. Because the purpose of the trial testing was to test the curriculum *verbatim*, these changes, even when minor, made it difficult to truly test the activity as written. Trial testing requires strict adherence to the written activity to ensure that the way the activity is written works with students. Not every activity leader will be experienced or knowledgeable, so the activities needed to be able to stand on their own in any setting. Consequently, the experienced museum facilitator, who was able to adhere closely to the activity instructions, became the one person who led the draft activities during trial testing. This ensured that the trial testing met its intended purpose and led to the needed

changes to make the activities workable in virtually any setting with any instructor based on the strength of the written activities alone.

Another change implemented from the initial kit development was that the curriculum developer completed all the artwork used in the kits this time. Unlike with the first set of kits, which used a separate graphic design person and included art pieces from a variety of sources including clip art and other drawings, these three kits' activities were all designed by the curriculum developer. And, to make all the kits consistent, the revision of the original six kits also included changing the artwork so the curriculum developer went back and redid all the art for the earlier six kits to make them uniform.

The reason for this change was so that the curriculum developer could respond to specific requests such as illustrating how a task was done. For example, if a physical task was difficult or hard to explain in words, a simple drawing could illustrate the different tasks each member of the group needed to do, or how the necessary materials were made or would look like when finished. For example, the DNA model in the Genetics kit was difficult to explain, but easy to understand when illustrated. Since the curriculum developer was the one who created, it also made sense for her to illustrate it. Integrating the art made the process go more smoothly, and required fewer steps to achieve the goal.

### **Interpretation and Discussion**

Developing curricula is a time-consuming and complex task. While a teacher can sit down and write an activity to use in her classroom in a half-hour or so, developing an activity that virtually anyone can use, that contains important and accurate science content and that is a hands-on, enjoyable learning experience for both instructors and youth is a much more difficult undertaking. With the Wonderwise kit-based activities, which aspire to incorporate all of those positive qualities, the trial testing became a crucial step in the development process.

Several key factors contributed to the trial testing process. First, the people actually conducting the trial testing were experienced education facilitators. They both had extensive teaching experience, and also had some experience with curriculum development. They had a clear idea of the task required, and developed a strong working relationship that allowed them to focus on the curriculum as the object to change. Having experienced professionals involved at every level, from the curriculum developer to the trial-testers, led to an easier and more productive process.

Originally, it was intended that 4-H leaders and others involved in 4-H would provide significant input to the process of kit development, from identifying scientists to developing

activities, to trial testing the kits. However, in reality, because the 4-Hers had had little previous experience with the Wonderwise Kits or the development of the original kits, when confronted with the kits, they appeared to embrace the concept wholeheartedly, and then had difficulty identifying specific details that could be improved. They participated in the trial-testing of the original kits and provided feedback about them to make them more amenable to the informal setting. However, when asked to provide a critique of a new activity, it became clear that it was not a role well-suited to the 4-H leaders, but was a role more appropriate for the education facilitators, who have specific skills in this area.

Consequently, there was not as much input from the 4-H staff as was hoped for. While exclusion of 4-H staff in this aspect of the project might have led to reduced buy-in, the intensive involvement of 4-Hers in workshops, and participation and communication within their own states seems to have mitigated any problems along this line. Another possible drawback of lack of 4-H involvement in trial testing is the creation of activities that were not as suitable or attractive to the 4-H leaders as could otherwise have been the case. While it would have made the process more inefficient, it may have been worthwhile to include one or two 4-H staff more significantly in the development process. Again, however, because the activities have been very well received and widely used by 4-H staff, this change might have made little noticeable difference in the reception of the final product.

Similarly, streamlining the creation of the activity booklets by having all the artwork created by the curriculum developer made the process go more smoothly, but resulted in a few potential drawbacks. The art became more narrow, not as diverse or detailed as some of the earlier artwork that was featured in the kit activity booklets. Using a single style meant not being able to draw upon the best examples or illustrations. However, the activity booklets do all feature the same “look” and create a uniform set of 9 kits.

While time-consuming, the Wonderwise kits were ultimately developed in a timely manner and delivered on schedule, so reducing the inefficiencies paid off. All the kits have been positively received so far, and have been found to be useful not only in informal settings but also traditional classrooms.

## **Summary**

The trial testing of the final three kits in the Wonderwise Women in Science series was a rigorous and arduous process. Several changes from the trial testing of the earlier kits were instituted, primarily for reasons of efficiency and efficacy. These changes were beneficial and enabled the kits to be completed in a timely manner, and appear to have had little negative impact

on the kit topics or design. Overall, the trial testing was a key step in the successful development of the activities for these kits.