Chapter 1

The Program

What is SCIENCoundErs?

The SCIENCoundErs outreach program is a collaboration between the Institute for Chemical Education (ICE) and the Boys and Girls Clubs (B&GC) of Dane County that was established in collaboration with the UW–Madison Nanoscale Science and Engineering Center (NSEC). Established in 2005 to help build a pipeline of STEM students from underrepresented groups, the aim of SCIENCoundErs is to inspire and excite a diverse audience of future scientists and engineers. This goal is accomplished by presenting hands-on science and engineering activities to children from 4th through 8th grade in an after-school science club setting. SCIENCoundErs also serves as an opportunity for undergraduate students, graduate students, and postdoctoral fellows to do their own service learning by acting as student mentors to the children.

Program Goals

- To affect the children who attend SCIENCoundErs by improving their:
  - Attitudes towards science/scientists.
  - Perceptions of their scientific ability.
  - Ability to communicate science.
  - Understanding of content prescribed by the National Science Education Standards.
- To establish and maintain positive relationships between institutions of higher education, the B&GC or whichever organization hosts the club, and local science industries.
- To expand the program statewide and nationwide.
Lesson Design

The SCIENCountErs lessons and lesson topics that help us reach these goals are designed to:

- Meet both Wisconsin State Science Education and National Science Education Standards.
- Make use of inexpensive and easily obtained materials.
- Be highly hands-on and inquiry based.
- Cover a wide range of science and engineering disciplines by making each lesson part of a thematic unit based on a particular concept from those fields.
- Teach techniques and instruments regularly used for a particular scientific concept.

Why The Boys and Girls Clubs of America?

The B&GC provides a good setting for the program to achieve its goals because the site itself shares similar goals. Their mission is: “To enable all young people, especially those who need us most, to reach their full potential as productive, caring, responsible citizens.” Another reason the B&GC was chosen was that more than half of their members are from minority families, which is our demographic target.

The B&GC can also provide help for the program’s expansion nationwide, since they have locations in all 50 states, Puerto Rico and the Virgin Islands, as well as on domestic and international military bases.

How does it work in Madison, WI?

The children of the Boys and Girls Clubs of Dane County attend SCIENCountErs for a one-hour session once a week to participate in hands-on, inquiry-based activities. The children work at their own pace and interest level, while UW Madison student mentors guide them. Mentor participation in the program varies from a minimum of one semester to several years, which allows mentors to build relationships with the children and serve as positive role models. The children to mentor ratio is about 4-5 children to one mentor.

Roles in the program:

- **Program Director:** This person is in charge of overseeing the operations and implementation of the program in the B&GC. He or she may also develop new activities or thematic units for the program.
- **Program Coordinator:** This person is in charge of preparing the activities beforehand and running them in the B&GC. He or she will also be responsible in preparing the mentors for the activities.
- **Mentors:** A mentor is the scientist role model that the children will follow while doing the activity. He or she will guide the B&GC children through the activity by
asking questions, suggesting activities, and providing information, feedback and encouragement.

**Pedagogical Model**

In order to accomplish the program’s objectives we created a pedagogical model that has goals of regular attendance, encouragement of attention and discipline, and promotion of learning. This model has evolved throughout the years in order to include several strategies that improve upon these goals.

The UW-Madison staff learned that in order for the program to be successful we needed to have a dedicated director to prepare the activities and maintain a good relationship with the B&GC. We also found out that a staff member from the B&GC needs to be present at all times in the room in order to avoid any discipline problems with the children. The children tend to be more interested in the lessons if they establish a good relationship with their student mentor, so building child-mentor relationships is key.

The UW staff also found that lessons were more successful when the children were given choices of activities. This children-guided lesson style made the program more appealing, thereby increasing program’s regular attendance. This evolution gave rise to the current model.

### SCIENCountErs: Evolution

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<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Target Age group</strong></td>
<td>9-12th graders</td>
<td>1-8th graders</td>
<td>4-8th graders</td>
<td>4-8th graders</td>
</tr>
<tr>
<td><strong>Frequency of visits</strong></td>
<td>Bi-weekly</td>
<td>Bi-weekly for each club visited</td>
<td>Weekly for each club visited</td>
<td>Weekly for each club visited</td>
</tr>
<tr>
<td><strong>Number of clubs visited</strong></td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td><strong>Student-mentors</strong></td>
<td>Graduate students</td>
<td>Undergraduates</td>
<td>Undergraduates</td>
<td>Undergraduates &amp; Graduate students</td>
</tr>
<tr>
<td><strong>Record keeping-attendance</strong></td>
<td>None</td>
<td>None</td>
<td>Attendance for student mentors and children was taken per session</td>
<td>Attendance for student mentors and children was taken per session</td>
</tr>
<tr>
<td><strong>B&amp;GC staff member</strong></td>
<td>None</td>
<td>Present</td>
<td>Present</td>
<td>Present</td>
</tr>
<tr>
<td><strong>Number of student-mentors</strong></td>
<td>3</td>
<td>10-15</td>
<td>27</td>
<td>30+</td>
</tr>
<tr>
<td><strong>Average number of children per month</strong></td>
<td>3-5</td>
<td>10-15</td>
<td>~ 30 children</td>
<td>~ 30 children</td>
</tr>
<tr>
<td><strong>Lesson style</strong></td>
<td>Staff guided</td>
<td>Staff guided</td>
<td>Staff guided</td>
<td>Child Guided</td>
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<tr>
<td><strong>Thematic units</strong></td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Netbook computers</strong></td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Program Director</strong></td>
<td>Diane Nutbrown</td>
<td>Ken Robertson</td>
<td>Jenny Powell</td>
<td>Brittland DeKorver</td>
</tr>
</tbody>
</table>

Changes in the program were a result of formative evaluation based on feedback from B&GC staff and children, and UW volunteers.
The Current Model:
The current program model revolves around three key strategies:

1. **Accountability:** The lessons are child guided and there is assessment after the lesson. The assessments provide a level of accountability to the model. When lessons are child-guided the children pay more attention to what they are doing and they are even more interested in learning. In order to determine whether the lesson was successful the mentors and the coordinator should conduct an assessment at the end of the lesson.

2. **Record Keeping:** This system is composed of an attendance board and raffle tickets. The children take the attendance of each session on a poster board. Each child puts a sticker next to his or her name on the board on each day they attended the session. A raffle is done at the end of the semester with prizes to the children with the most attendance. This gave us the ability to keep an attendance record of all the sessions and it also provides motivation for the children to come in regularly.

3. **Repetition:** This strategy is the most important since it helps accomplish all the goals of this model. The lessons throughout the semester must revolve around a certain theme and include repetition of certain techniques. This practice creates predictable routine and good habits for the children to follow.
Activity Structure:

The SCIENCountErs program at UW-Madison provides 12 hours of instruction in weekly 1-hour sessions throughout one semester. Every semester the program focuses on a selected unit of study. These units can range from general chemistry to more application-focused units like food chemistry. Each hourly session covers a certain topic from that particular unit. For example, in Week 3 of the food chemistry unit, the children explore the chromatography of certain dyes in candy.

Each one-hour session is split into three parts: Registration, Lesson/Activity and Clean-up/Evaluation. A typical schedule for a session would be:

- First 5 minutes are dedicated to Registration
- 40-50 minutes are allotted for the Lesson/Activity
- Depending on the activity, the remaining time is used for Clean-up/assessment

Registration:

During the first five minutes the children are registered at a sign-up table. (See the “Attendance Board” example below) The registration table allows the coordinator to keep track of how many children go to the sessions regularly throughout the semester.

This table is also used as a way to motivate the children to attend regularly by linking a prize system to attendance. The child whose attendance record is perfect or higher than the other children receives a grand prize. A raffle is also used for motivation by awarding one ticket per week attended, and then doing a raffle at the last session for various prizes.

Attendance Board:

<table>
<thead>
<tr>
<th>Name</th>
<th>09/10</th>
<th>09/17</th>
<th>09/24</th>
<th>10/1</th>
<th>10/8</th>
<th>10/15</th>
<th>10/22</th>
<th>10/29</th>
<th>11/5</th>
<th>11/12</th>
<th>11/26</th>
<th>11/3</th>
</tr>
</thead>
<tbody>
<tr>
<td>John Doe</td>
<td>+</td>
<td>+</td>
<td></td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jane Doe</td>
<td>+</td>
<td>+</td>
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</table>
Lesson/Activity

The lesson block is used for the day’s lesson and the subsequent activity. The instructor takes 10 minutes to give a brief overview of what the topic is and what the children will be exploring in the activity. Once the instructor ends the pre-activity discussion, the children start the activity. Although some of the children are able to work by themselves, others need considerable direction. That is where the undergrad and graduate student mentors come into play.

The student mentors should be familiar with the activity beforehand and be able to guide their assigned children throughout the activity. The lessons section of this manual contains all the material needed to prepare the mentors, plus some suggestions for the coordinator on how to run the activity. This section also contains suggested activities for each of the lesson plans, in case the children finish early.

Clean-up/Assessment and Prizes

Once the lesson/activity time is up, the children are prompted to start cleaning up. Cleaning up after the activity helps to teach the children the important lesson of responsibility. The Mentors supervise their children while they clean up, helping them if the occasion merits it.

Once the children are finished cleaning up they go to the instructor for evaluation. As a way to motivate assessment, a prize is given after the child successfully answers one of the assessment questions. If the child answers the question incorrectly or only partly correctly, the instructor then clears up any misconceptions about the topic and then awards the prize. It is very important to make notes of the children’s responses since they can give you a good measurement of how effective the lesson is.
Chapter 2

Program Set-Up

Timeline:

Six Months Before:

1. Contact the B&GC for the first time and propose to do the program at their site.
   
a. Try to reserve session times and classroom space on the club in this first meeting since the club offers many programs and your best times might be booked by the time SCIENCountErs starts.
   
b. Schedule a follow up meeting two weeks before SCIENCountErs starts.

Two Months Before:

2. Organize the lesson plans and gather the materials needed for each of them. (Non-perishables.)
   
a. Divide the materials by the week session and put the materials used in more than one week on a separate space for easy access.

One Month Before:

3. Recruit mentors (See Mentor Recruitment section for more information).
   
a. Reserve transportation for future sessions for the mentors if applicable.
   
b. Organize the schedule of the weekly sessions each student-mentor will go to. (In case you have a lot of student mentors, alternate them every week.)
   
c. In case you are coordinating SCIENCountErs in more than one B&GC, assign a specific club to each student-mentor so they can consistently go to the same club.

Two weeks before:

4. Go to the follow up meeting that you previously scheduled (see item 1 above).
   
a. Get familiar with the layout, staff, and atmosphere of the club.
   
b. Confirm the times of the sessions with the director; this is done just in case there is a sudden change of plans.

One week before each session:

5. Send to the volunteers the lesson plans the week before so that they can get familiar with the lesson that the children will be going through. Make sure to do this every week before a session.
The week of and after:

6. Carry out the lessons as planned and make sure you have all the materials needed (Including perishables) and enough mentors before each session.

Communications with the site:

A key part of setting up the program is persuading the local B&GC or other organization to let you run the program on their after-school site. In order to do that a strong communication between the coordinator and the site staff is needed. The following guidelines that the UW Madison staff follows when communicating with the B&GC of Dane County.

• **Initial Meeting:** Contact and meet with the site’s director to...
  Discuss with him or her what SCIENCountErs is. Go over the goals of the program and the benefits that it provides for the children that were mentioned on Chapter 1: The Program.
  If the director seems interested, determine the best day and time to offer SCIENCountErs * (take into consideration travel time, meeting and clean up time, commitments you have prior to or after SCIENCountErs, etc.)*
  Provide contact information to the program's director, include e-mail and phone number, and get director’s phone number, and e-mail address.

• **Follow up:** During the planning stages, get in touch with the director to ask questions about the policies of the site and classroom space. If possible, visit the program site prior to the first session to observe the site and become familiar with the staff, resources and children.
  
  **Example questions you could ask about the classroom space:**
  Where in the site can SCIENCountErs meet? How large is the space?
  What storage space is available? (There are some experiments that require drying overnight.)
  Is the space available in advance for prep and set-up?
  What is the availability of sinks and resources for clean up?
  Will this space be shared with other activities?
  What outside play space, equipment and opportunities are available? (Some activities require the children to go outside.)

  **Example questions you could ask about the policies of the site:**
  Do the mentors require background checks by the B&GC before attending?
  Can a B&GC staff member be present at all times?
  Do the children get to choose which activities they go to every day or do they have to commit to the one they chose the first day?
Does the site have theme weeks or special events that SCIENCountErs activities can support or that might affect SCIENCountErs negatively?

Coordinate how arrivals and departures from SCIENCountErs are to be handled.

What policy should SCIENCountErs follow in case of changes to the schedule or cancellations?

• **Maintain communications:** After the programs is up and running through the semester, contact the director from time to time to give him or her status updates about how SCIENCountErs is doing; he or she will appreciate it and will be more likely to consider this program for the future. Also ask the director to give you any sort of feedback from the staff or children about the program so that you can provide adjustments if needed throughout the semester.

**Mentor Recruitment:**

One of the key roles in SCIENCountErs is the mentors, who serve as role models for the children and provide guidance in the lessons. The SCIENCountErs program in UW-Madison recruits undergrads and graduate students to voluntarily serve as mentors. You shouldn’t limit yourself to just these two groups of students because there are other volunteer organizations out there that can also provide potential mentors.

The number of volunteers that you recruit will depend on the number of children you can have on your designated site space. The idea is to have one mentor per four to five children. If you have too many volunteers for the job, you can always alternate a few mentors per week or keep some in reserve in case of scheduling conflicts. We have provided some advertisements, brochures, and posters to use as recruitment tools for your search of mentors.

No matter which tool you use, you must explain why the SCIENCountErs program is worthy of a potential volunteer’s time. Explain to them not only what the program is but also the benefits of serving as a mentor. This experience as a mentor not only provides an opportunity to do good, but also serves as additional experience for those interested in careers that require volunteer work in order to advance. This opportunity is also good for students who may have a scholarship or a fellowship with an outreach component assigned to it that they may need to complete at some point of their career.

Once you have recruited your mentors make sure you keep in contact with them and let them know you are available to answer any question about the program. Make sure you provide them with their schedule of the semester and if needed, provide them with any paperwork needed for background checks. In appendix I there is a photocopy of the poster to be used in Madison as a recruitment tool. You can modify it as need be.
SCIENCountErs Mentor Expectations:

One of the ways SCIENCountErs promotes scientific learning in the children is by building relationships between the children and the mentors. The mentors will guide the children through the activity but the real focus of their jobs is to establish that rapport with the children, thus becoming scientific role models for the children. Ideally the mentor becomes a co-investigator throughout the activity and explores the science behind it with the children so that they don't feel that they are being taught but rather feel that they are making discoveries with their role model. This provides the basis for forming relationships, which motivates the children to start thinking of science as something fun and not just as another class in school.

Before the mentors can start to engage the children it is important that they know what is expected of them during the sessions. Located in appendix 1 of this handout is a handout for the mentors of SCIENCountErs.