I. Introduction
Science outreach activities with middle school students are fully consistent with the increased emphasis on attracting students into the STEM (Science, Technology, Engineering, and Math) disciplines. Vanderbilt Student Volunteers for Science (VSVS) has been active in science outreach to Nashville middle schools since 1994. Objectives of VSVS are to (a) provide middle-school students enriched science instruction through hands-on experiments, (b) offer Vanderbilt students a chance to “make a difference” through community service, (c) provide role models for school children, and (d) stimulate interest in teaching as a profession.

In VSVS we focus on middle school students (4th-8th grade), because (1) students in middle school are beginning to form their attitudes about science, and (2) teachers in middle school often find it difficult to design substantive hands-on science activities for their students.

Since 1994 VSVS has reached over 92,000 children in 1,700 Metro Nashville school classrooms. This year (2016-2017) marks the 11th consecutive year that there have been over 600 VSVS volunteers, and the second year that there have been over 900. Fall 2016 and Spring 2017 semesters each had over 620 volunteers.

VSVS members spend about 15 hours each semester presenting four different science lessons to Metro students. These lessons include hands-on experiments and are designed to correlate with Tennessee state curriculum standards and end-of-year exams.

An important part of our science outreach program is the partnerships we form with the middle school teachers. These partnerships not only promote a collaborative effort toward enhanced science instruction through inquiry-based activities, they also provide other benefits. For example, the college students serve as role models to the school children, showing the importance of academic achievement and the role of a college education. The college students find their lives enriched by their contact with school children, and they appreciate how their efforts affect the academic lives of the school children. We believe these experiences will foster future involvement of Vanderbilt students as parents and community leaders and will help them recognize the importance of teachers and public schools.

The members of the VSVS student board each committed 1 hour per week helping in the lab and training teams on the lessons. Board members hold titled positions with specific duties allocated to ensure that VSVS runs smoothly. The growth and popularity of VSVS is due primarily to the dedication of this board.

Our website, http://studentorgs.vanderbilt.edu/vsvs/, is accessible to the public at large. The website includes complete text and training tips for our more than 130 lessons. YouTube videos have been added for the lessons that are regularly used in the classrooms.
During the 2016-17 school year VSVS employed 23 student undergraduate workers to refurbish the experiment kits.

II. Highlights for 2016-17 Academic Year.

1. **VSVS Membership during the 2016-17 School Year.**
In the 2016-17 academic year, **921 students** participated in VSVS, many of them (44%) for both semesters. This is the largest number of volunteers VSVS has had. These volunteers represented all classes from freshmen through graduate, including engineering, science, and non-science majors. Figure 1 shows the growth of VSVS since its inception in 1994 and Figures 2 and 3 show the distribution of students. Figure 4 shows the number of students who participated in one or both semesters. Graduate school volunteers have increased in numbers. Both semesters each had over **620 volunteers**, enabling VSVS to send out over 145 teams each semester.

![Figure 1](image.png)
2016-17 Volunteers by School

- A&S: 64%
- Engineering: 26%
- Graduate: 5%
- Peabody: 5%
- Blair: 0%

Figure 2

2016-17 Volunteers by Year

- Freshman: 33%
- Sophomore: 29%
- Junior: 21%
- Senior: 12%
- Graduate: 5%

Figure 3

2016-17 Volunteers by Semester

- One Semester: 56%
- Both Semesters: 44%

Figure 4
2. **Volunteers in the Classroom**

A. **Classroom visits reach over 4500 students**

Teams of three to five volunteers brought hands-on, inquiry-based science activities to over 4500 middle school students during the school year. These activities were specifically designed to correlate with the Metro science curriculum. VSVS teams went into:

- 11 different schools
- 150 different classrooms during their regular class time and partnered with 47 different teachers

The middle schools included East Literature Magnet, H.G. Hill, Head Magnet, JT Moore, John Early, McKissack, Meigs Magnet, Nashville International School (a K-7 private school for Islamic students), Rose Park and West End. One Metro Special Education class also received a team, and the Next Steps class at Vanderbilt met once a month.

B. **After-School Program visits reached about 150 students**

Teams also went to after-school programs at Rose Park, Head Magnet (2), John Early, Safe Haven, and Preston Taylor Ministries.

The table below shows the diversity in the schools visited by VSVS teams.

<table>
<thead>
<tr>
<th>Middle Schools</th>
<th># classrooms visited by VSVS teams</th>
<th>% Female</th>
<th>% Black</th>
<th>% White</th>
<th>% Hispanic</th>
<th>% Asian</th>
<th>% FRLP</th>
<th>% ELL</th>
<th>% Special Education</th>
</tr>
</thead>
<tbody>
<tr>
<td>John Early Paideia Magnet Middle</td>
<td>22</td>
<td>51</td>
<td>84</td>
<td>9</td>
<td>4</td>
<td>2</td>
<td>80</td>
<td>2</td>
<td>17</td>
</tr>
<tr>
<td>East Literature Magnet</td>
<td>5</td>
<td>83</td>
<td>12</td>
<td>4</td>
<td>1</td>
<td>62</td>
<td>0</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>Head Middle Magnet</td>
<td>25</td>
<td>48</td>
<td>57</td>
<td>30</td>
<td>5</td>
<td>8</td>
<td>41</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>H.G. Hill Middle</td>
<td>12</td>
<td>45</td>
<td>25</td>
<td>46</td>
<td>19</td>
<td>9</td>
<td>72</td>
<td>13</td>
<td>15</td>
</tr>
<tr>
<td>McKissack Middle</td>
<td>3</td>
<td>84</td>
<td>8</td>
<td>8</td>
<td>0</td>
<td>95</td>
<td>5</td>
<td>22</td>
<td></td>
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<tr>
<td>Meigs Magnet</td>
<td>13</td>
<td>55</td>
<td>20</td>
<td>60</td>
<td>5</td>
<td>9</td>
<td>25</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>Nashville International School</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>J.T. Moore Middle</td>
<td>22</td>
<td>47</td>
<td>35</td>
<td>55</td>
<td>5</td>
<td>5</td>
<td>38</td>
<td>3</td>
<td>17</td>
</tr>
<tr>
<td>Rose Park Math Science Magnet</td>
<td>18</td>
<td>49</td>
<td>56</td>
<td>32</td>
<td>10</td>
<td>2</td>
<td>58</td>
<td>2</td>
<td>5</td>
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<tr>
<td>Special Ed</td>
<td>1</td>
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<td></td>
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<td></td>
<td></td>
<td>100</td>
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<tr>
<td>West End Middle</td>
<td>20</td>
<td>51</td>
<td>39</td>
<td>50</td>
<td>6</td>
<td>4</td>
<td>41</td>
<td>4</td>
<td>17</td>
</tr>
</tbody>
</table>

FRLP = Free and reduced lunch
ELL = English language learners
SE = Special Ed
3. A major break-through in assigning the 600+ students to teams was achieved this Spring semester. **Undergraduate student Tristan Griggs successfully wrote a program that helped assign volunteers to 150 teams.** Previously this assignment process had been hand-done by Pat Tellinghuisen and taken 10-14 days. The computer program promises to reduce that time to 7 days.

4. VSVS has continued its collaboration with VINSE (Vanderbilt Institute of Nanoscale Science and Engineering). **VSVS and VINSE offer a STEM outreach program to rural counties for grades 6th-8th.** The VSVS program has developed middle-school lessons that fit in Tennessee Curriculum Standards. Each hands-on science lesson includes background materials, a prepared presentation for teacher/students, all materials for the hands-on activity and student worksheets that can be copied and modified. Our mission is to take these materials to rural middle Tennessee Schools. Participating teachers in each grade select up to 4 lessons for the fall curriculum and up to 4 lessons for the spring. Kits are returned to Vanderbilt at the end of each semester to be refurbished. Teachers are required to attend a one-day training session at Vanderbilt in the fall and in the spring to train on each of the lessons selected for their classroom. Since starting in 2012 we have worked with 108 teachers in 7 counties (Bedford, Giles, Dickson, Lawrence, Macon, Robertson and Rutherford) and have distributed supplies for over 21,000 rural middle school students. This year we prepared 199 kits for 33 teachers and 3595 students in 137 rural classrooms. Training was held in July 2016 for some new teachers.

5. VSVS has continued with its program at the **Vanderbilt Children’s Hospital (VCH).** In 2010 VSVS students began working with the Vanderbilt Children’s Hospital School Program, in which patients are tutored to help them keep up with their schoolwork while they are in the hospital. A total of 16 VSVS members go into patients’ rooms or clinics and teach science experiments. VSVS lessons and kits are modified to meet the needs of the hospital setting. Tina Woods, VCH school director, commented, “The addition of the VSVS members and their experiments to the Monroe Carell Jr. Children’s Hospital School Program has been phenomenal. Parents have shared their appreciation for the academic enrichment their children have received, and patients always want to know the details about each new experiment. Thanks for all the pleasure and academic support you share with our patients!”

The videotaping of VSVS lessons in the Vanderbilt Children’s Hospital Seacrest studio means that more patients and their families are exposed to STEM topics. The lessons can be viewed (live) in all patient’s rooms, and patients can also attend the lesson in the studio, as well as ask questions from their rooms.

6. **GAANN (Graduate Assistantship in Area of National Need) students** fulfilled their service requirements through participation in VSVS. VSVS continues to be write letters of support for grant applications from research faculty.

7. Lessons are constantly being updated to fit the Metro curriculum and requests from teachers. **The new lessons** introduced this year include The Science of Magic, Polymer Balls,
Electrochemistry, Wheat Germ DNA, Food Contamination, and Juice Power. Several undergraduate students helped write and test these new lessons.

8. VSVS continues its collaborations with other Vanderbilt University programs

   **a. Next Steps Program.**
   A team of 6 VSVS members taught science lessons to 12 Next Step’s students once a month during the academic year. The Next Steps program is for academically challenged students who have graduated from high school, and who want a college experience. It is rewarding to see the progress these students make during the years they attend Vanderbilt. This year’s cohort was the first in the new 4-year program.

   **b. Vanderbilt Diabetes Clinic**
   25 VSVS members ran 2 booths with experiments on Iron in Cereal and Slime for both elementary and middle school children attending the Middle Tennessee Diabetes Day.

9. VSVS collaborations with other Vanderbilt student outreach organizations included

   **a. Vanderbilt Fall service day:** 51 students volunteered 3 hours on a Saturday morning to help fill dropper bottles and containers with chemicals to be used by the rural schools served by VSVS and VINSE.

   **b. MLK service Day:** 25 volunteers helped put together VSVS materials for use in the Spring semester.

   **c. ASB (Alternative Spring Break):** 3 Teams took 10 VSVS kits to 3 ASB site.

   **d. ACS (American Chemical Society) Affiliates** used several VSVS kits during Chemistry week.

   **e. MRS (Materials Research Society) used VSVS kits for some of their Outreach events.**

   **f. BSA (Black Student Association), Vanderbilt Pride Festival, Dance Marathon, SPEAR (Students Promoting Environmental Awareness and Responsibility) all used VSVS materials for their events.**

10. In other outreach activities:

   **a.** 45 volunteers signed up for an afternoon of 12 different science activities with over 120 Head Magnet students at their Science Festival. Another 25 volunteers attended the school’s carnival and did 6 different experiments.

   **b.** 25 volunteers presented 8 different activities to over 100 students and parents at the Rose Park Pi (science and math) night.

   **c.** Helped judge middle school science fair projects at Head Magnet school

   **d.** VSVS members volunteered at the Adventure Science Museum at their Chemistry week (VSVS volunteers with Vanderbilt ACS affiliates), Nano day, Engineering Day, and Creepie Crawly Day.

11. VSVS materials and lessons were provided to Vanderbilt faculty for use in their children’s schools and for students in the Nashville community.
12. VSVS continues to provide kits to **Metro teachers who do not have VSVS teams**, and who can access our lessons through our web site, and to Vanderbilt faculty members. Several **Williamson and Wilson County** teachers also use VSVS kits.

III. **VSVS is Recognized Outside the Vanderbilt Community.**

- VSVS was awarded a **Predator’s grant** to fund the purchase and implementation of Lego WeDo’s curriculum in elementary afterschool programs in the 2017-18 year.

- The entry to the **2011 NIH K-12 LAB Challenge, “Protecting Skin from Ultraviolet Light.”** won an award and is posted on web site [http://science.education.nih.gov/NIHLabChallenge.nsf/](http://science.education.nih.gov/NIHLabChallenge.nsf/) Comments from Cindy Allen, on behalf of the LAB Challenge Working Group, included “Yours was the only entry team composed of a faculty member, an emeritus professor, and an undergraduate out of our pool of 110 entries, which was such a treat for us. Also, raising awareness about UV light is so timely! Thanks so much for taking the time to enter and for your creativity.”

- In October 2010, Dr. Mel Joesten, co-founder of VSVS and Vanderbilt University Emeritus Professor of Chemistry, received the American Chemical Society Salute to Excellence Award for his contributions to science education. His award lecture was **“Vanderbilt Student Volunteers for Science – A Dream Come True.”**


- Other universities continue to enquire about starting VSVS-type organizations, in response to our web document, “Starting a(n) SVS” link. Davidson College is the latest, with their DSVS group. TN-SCORE administrators from Knoxville met with Pat Tellinghuisen to discuss why VSVS is so successful.

- VSVS lessons were presented at National Science Teacher’s Association’s meeting in Nashville in November 2005 and in Houston in November 2007, TSTA conference in November 2007, and the NMSA conference at Indianapolis in November 2009.

- Pat Tellinghuisen presented workshops on VSVS lessons at MNPS (2008) and Williamson Co. in-service days for middle school teachers (2004, 2008) and for summer workshops for Center for Science Outreach (2000-2010).

- Pat Tellinghuisen trained over 100 teachers from rural schools on the lessons they use in their classrooms during the year. Training has taken place during the summer every year since the collaboration with VINSE started in 2012.

IV. **Funding**

We gratefully acknowledge support for VSVS programs by Vanderbilt University, Vanderbilt Chemistry Department, VINSE, and the Tennessee Space Grant Consortium.