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Getting the Word Out: Teaching Middle-School Children about Cardiovascular Disease

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Abstract

Cardiovascular disease (CVD) has roots in childhood; since CVD begins *early*, a clear strong case for *early* education focused on CVD primary prevention exists. Scientists are not traditionally involved in disseminating health knowledge into public education. Similarly, public school teachers typically do not have access to biomedical research that may increase their students' health science literacy. One way to bridge the 'cultural' gap between researchers and school teachers is to form science education partnerships. In order for such partnerships to be successful, teams of scientists and teachers must 'translate' biomedical research into plain language appropriate for students.

In this article, we briefly review the need for improving health literacy, especially through school-based programs, and describe work with one model scientist/teacher partnership, the Teacher Enrichment Initiatives. Examples of cardiovascular research 'translated' into plain language lessons for middle school students are provided and practical considerations for researchers pursuing a science education partnership are delineated.

Keywords

Health education; science educations; atherosclerosis; adolescents; cardiovascular risk scores; cardiovascular health education; teacher professional development

The core challenge for health scientists and educators in the United States is to translate the knowledge gained from research into improved health for the public. Even though there have been large gains in prevention and treatment of cardiovascular disease since the 1980s, the

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growing trends in obesity and type 2 diabetes threaten to reverse these improvements (1). Landmark investigations, like the Bogalusa Heart Study (1) and others, have demonstrated that precursors of cardiovascular risk appear in childhood and may impact adult health.

“I’ve been beating this drum for over twenty years and the message isn’t being heard,” comments Dr. Henry McGill, one of the Principal Investigators on the Pathobiological Determinants of Atherosclerosis in Youth (PDAY) study. His sentiments echo the hard work needed to get important cardiovascular research results to affected people or those at risk; methods to effectively disseminate and incorporate health knowledge into public education and practice are not traditionally thought of as skills required of health scientists.

Biomedical research often eludes consumers most in need of the results. Informing the broader public about research findings has been a longstanding challenge (2). For cardiovascular disease, the research community was startled in 1953 by evidence that atherosclerosis, a disease primarily of older adults, was found in *young* Korean War veterans (3). Over the ensuing five decades, confirmatory research amassed (4,5), but remained primarily ensconced within the peer-reviewed literature. Many research findings are slow to reach the public (6); educators, parents, and adolescents are consumers in need of such information, but typically are not exposed to biomedical journals. In this article, we briefly review the need for improving health literacy, especially through school-based programs, and describe work with one model program, the Teacher Enrichment Initiatives (TEI) at the University of Texas Health Science Center at San Antonio (UTHSCSA).

Inadequate Health Literacy – Scope of the Problem

Nearly one-half of US adults cannot understand or act upon general health information. (7). This is a disturbing statistic because health literacy is fundamental to disease prevention. Since most health care professionals do not have the training or time to improve health literacy in their practices (8), where can consumers turn for reliable information? The Internet, broadcast, and print media provide a wealth of information; however, users are on their own and must have good critical appraisal skills to interpret its complexity and quality (2). An alternative approach is to supply schools with effective health literacy activities that can begin early. When health messages need to be aimed at adolescents, health professionals must enlist those most in contact with the intended audience (6), the communities of schools with their teachers, parents, and students.

Schools as Venues to Improve Health Science Literacy

Important issues find their way into the schools (9). As the leading cause of death in America, cardiovascular diseases (CVD), specifically atherosclerosis, have their roots in childhood. CVD begins in youth, progresses as a result of lifestyle choices, (4,10,11), and can be predicted by easily obtained risk scores (3,12). Early awareness and monitoring are important tools to prevent atherosclerosis from developing. However, once established, atherosclerosis regression can lead to reductions in CVD events, (e.g. 13,14). Because CVD begins *early*, a clear and strong case for *early* CVD education exists.

Formal education is strongly associated with scientific literacy (2) and health outcomes (8). The Joint Committee on National Health Standards recognized that schools could be effective venues to cultivate health literacy skills. The Committee’s National Health Education Standards provide a framework to help public schools detail what K-12 students should know and do as health-literate citizens (15). To date, these standards have not been widely implemented (8).

Nationwide, most K-12 schools require health education, however, the scope and sequence of coursework is not well defined or coordinated (8). As students advance from grade to grade, the number of schools requiring health education is inconsistent [33% in kindergarten, 44% in 5th grade, 10% in 9th grade, and only 2% in 12th grade (8)]. This inconsistency logically impedes scaffolding the knowledge and skills required for quality health education.

Although school health education can provide an efficient way to initiate positive changes in adolescent attitudes and behaviors (8), health education is, in reality, a low priority. Students actually receive little or no quality health instruction (16). For example, in Texas, the Texas Administrative Code delineates the Texas Essential Knowledge and Skills for Health – the standards to which K-12 students are held. However, health education is part of the enrichment curriculum, rather than the foundation academic curriculum (e.g., mathematics), and is not linked to high stakes testing. Enrichment coursework, particularly health, may or may not be found within each Texas school. In fact, in Texas, only one-half credit of Health is linked to graduation requirements.

An alternative strategy to infuse health and CVD education into classrooms is to train academic content teachers (e.g., science) in health topics (17). For example, reading, math, and language teachers may use health related content as examples to teach their topics. Within the TEI Program, a guiding vision is that ‘every teacher is a health teacher.’ When adequately trained, these core academic instructors can contribute to school-wide campus health education programs. School districts encourage teachers to utilize shared approaches for cross-curricular connections within each campus. Thus, by working with local schools, forming partnerships between researchers and teachers, and translating research into forms suitable for students, niches can be found for infusing quality health instruction.

Lifecourse View of Health

Integrating health science into K-12 schools requires careful attention to the scope and sequence of information. Specific goals aimed at producing healthy adults must be aligned with stages of adolescent development (6,18). Lifestyle choices play major roles in the development or prevention of disease, so a lifecourse view of health has merit in educating adolescents about CVD. Lifecourse models are popular in epidemiology, psychology, and sociology, because they promote the view that health results from direct and indirect influences that begin early in life. Since individuals who, early on, feel they can control life events have better health and educational outcomes (19), it follows that attempts to establish health promoting behaviors must also begin early in life. Learning about health in an interdisciplinary way helps students retain and apply the information in real world situations across the lifespan (8,20).

TEI Program information indicates that middle school students envision their futures much more positively than they do the future of their parents and other elders (18). This positive view, and the changes students observe in others, was rarely associated with any group of illnesses, including CVD. The lack of association in adolescent minds between health and future outcomes provides opportunities for health promotion education with a lifecourse perspective. A controlled study of TEI Program materials demonstrated that their use could positively impact student images of elders (21). To improve health science literacy will require similar educational research to test new curricula in schools and measure what works.

Value in Partnering Biomedical Researchers and Classroom Teachers

Schools are important arenas for constructing health literacy skills in students, but they cannot undertake this task alone. Most public school teachers do not have the background or access to current biomedical journals to effectively bring relevant research into their classrooms (6).

Partnerships can bridge the ‘cultural’ gaps between the communities of medical and health scientists and public school teachers, (e.g. 2,8,22). These partnerships create an atmosphere where advanced academic language can be translated into plain language forms suitable for students.

A critical research need exists to investigate causal models that explain associations among health literacy acquisition, schools, and health systems (8). Programs that support such research (Table 1) bring scientific and educational communities together (23) with the public in a variety of ways and hold much promise for future collaborations. The Teacher Enrichment Initiatives (TEI) at the University of Texas Health Science Center at San Antonio (UTHSCSA) is a specific example of a health science education program funded by the National Institutes of Health (NIH).

Teacher Enrichment Initiatives (TEI)

Established in 1993 and funded to date by philanthropy and NIH grants, the UTHSCSA TEI program is an innovative, interdisciplinary partnership between UTHSCSA researchers and educators from multiple school districts in San Antonio, TX. The TEI project has produced a set of freely available, classroom-ready instructional materials that promote healthy lifestyle choices to reduce the risk of disease *and* improve math, science, and health education at the middle school level. The TEI materials are aligned with state and national science education standards.

The Institute of Medicine (IOM) called for health to be imbedded into math, social studies, science, and reading (8). This has been a long standing design principle for TEI lessons that are then infused into existing school curriculum. TEI curricular materials fit across all disciplines and don’t replace curricular requirements, but provide health-based examples to effectively teach required elements. The TEI Program serves as a venue for teachers and scientists to work together to translate complex, biomedical research into engaging lessons appropriate for middle school students.

Collaborative Efforts

Since 1993, forty teachers (20 science, 4 mathematics, 9 reading/language arts, 6 social studies, and 1 special education) have been involved in writing the TEI materials. A pool of volunteer UTHSCSA researchers grew from four to sixty-eight individuals representing multiple disciplines including Cardiology, Epidemiology, Pathology, Physiology, Public Health, and Statistics. Together, this group has created over 350 interdisciplinary learning activities grounded in health promotion and disease prevention. Researchers presented their current research in interactive seminars to the school teachers, provided academic resources, laboratory access, and mentored teachers in their acquisition of science content knowledge. Teachers have presented real-world instructional problems to the scientists, extracted key elements from research for inclusion in curricular pieces, and advised researchers on lesson scaffolding and management techniques. Teachers spend their summers in training at the UTHSCSA, researchers visit classrooms and parent-teacher meetings. This on-going interaction builds relationships that result in increased respect and appreciation for the unique roles and talents each individual brings to the group’s tasks.

The TEI Program’s Rationale for Working with Middle Schools

The developmental stage of middle school students, the critical bridge that middle school education provides for high school, and the opportunities for germane interdisciplinary curriculum design and testing provide the rationale for the TEI Program’s focus on grade 6–8. Young adolescents are at a developmental stage where they are especially receptive to

information about themselves and are more independent in their decision-making (6,21). A time of change, physically, socially, emotionally, and intellectually, adolescence is also a time of growth, learning, and exploration. Living in and for the present with little thought toward the future, adolescents need health promoting education to develop lifelong critical thinking and decision-making skills that may enhance their quality-of-life as they grow older (24). Providing such education during this critical time period may have added benefits by tackling health-damaging behavior while it is less firmly entrenched (6).

Adolescents view professionals as experts and they value doctors, mentors, and school staff (25). These individuals become role models who can effect changes through observational learning (26). Early positive classroom experiences can help shape student expectations, attitudes, and experiences regarding health information, thus affecting personal health schema that are fluid over time and act as a filter to process and store health information (2).

From an educational perspective, adolescents experience increased skills in abstract reasoning, hypothetical reasoning, and decision-making (6,20). This provides opportunities to introduce complex health concepts using appropriate instructional methodology. The broad, interdisciplinary approach to health education promoted by the IOM (8) is especially well-positioned in middle schools with interdisciplinary teaming in place (9). Another benefit of developing educational materials for middle school students is that they are written at the recommended reading level for the general public (8th grade) (2) and may be used in a broader range of settings. Over 300 studies spanning three decades documented mismatches between the general public's reading level and educational materials produced by health professionals (19).

The TEI curriculum is deliberately designed so that groundwork laid in middle school may be adapted, reinforced, and expanded at the high school level. Laying the foundation for high school biology, chemistry, and physics, middle school science ties together the unifying themes across the grade levels, bridging elementary and high school sciences. It is developed with careful attention to scaffolding of knowledge and skills so that students construct understanding in layers of increasing complexity (27).

Effective Teaching Strategies Essential for Curriculum Development

Teachers in the TEI Program apply what they know about effective classroom teaching to the design of the curriculum they help develop. These teachers view students as active learners able to construct meaning with increasing levels of sophistication as cognitive development and experience increase. They recognize that both in-depth and global views are needed for increased understanding and therefore apply a variety of teaching techniques to achieve it (20). Constructivist teaching methods exemplify learner-centered environments and have made an impact on education reform, including the National Science Education Standards (27,28). Constructivist educators recognize play and self-directed learning as essential to cognitive development and incorporate these elements into their teaching (29). Pure constructivist teaching requires educators to assume the role of facilitators who encourage students to construct new knowledge from experiences and reframe existing understanding (29). When specific learning objectives must be met, however, students potentially leave the learning experience with misconceptions. It is incumbent upon the teacher to provide learning environments where student explorations can take place *and* misconceptions are eliminated. Thus, both learner- and knowledge-centered instruction have a place in effective learning environments (20). TEI collaborators design curricular components with manageable content for students and classroom management techniques for teachers. Providing interdisciplinary choices, teachers present health information in a range of contexts at a challenging level to keep students stimulated. This process allows more flexible transfer of learning into real world

situations (20). Students have the capacity to process complex health related materials and have fun once they gain experience with these teaching strategies.

Curriculum Design

Each unit of study consists of lessons and activities and follows a similar format: lesson sequence, focus, overview and objectives; relevant educational standards; prior knowledge required; and specific learning activities (Figure 1 and Figure 2; Table 2).

Each activity provides a teacher and student section. The teacher section contains information needed to teach the lesson. Such information may include science content; teaching methodologies and classroom management ideas; guidelines for the conduct of the activity; and lesson masters for student roles or other necessary ancillaries. Student sections provide background reading, illustrations for setting up experimental or game components, student data pages, and processing out sections. Processing out sections help students review and reflect upon the activity and describe the concepts as they understand them. Processing out provides a discussion forum where the class determines if there are any remaining misconceptions or unanswered burning questions.

The TEI curriculum unit, *Inflamm-O-Wars: Silent Battles within Your Cardiovascular System*, helps students explore the structure and function of the cardiovascular system as well as the consequences of disease processes through a series of 6 lessons and 11 activities (Table 2). This unit moves students from a historical perspective of cardiology advances through basic physics principles in blood vessel structure and function, into a study of atherosclerotic progression and regression. Table 2 lists the content of each lesson and by moving from one to the other demonstrates the scope and sequence for the entire unit. In Lesson Four, *Inflamm-O-Stories: Progression and Regression of Atherosclerosis*, students use images from the Pathobiological Determinants of Atherosclerosis in Youth (PDAY) funded by the National Heart, Lung, and Blood Institute (NCT00005679) (4). Photomicrographs provide a mechanism for students to observe the effects of atherosclerosis on the coronary artery lumen. Then, using a unit-square grid, students “measure,” then infer, the effects of atherosclerotic stenoses on blood flow (Figure 1). As the lesson progresses, the activities draw on the expertise of scientists and graphic artists’ renditions of the left descending coronary artery and its volcanic build up of plaque leading to a rupture and cardiac demise in a set of *Dire Progress* cards. In a model of constructivist methodology, students sequence the cards without prior instruction based on the critical attributes they observe; using only *their* vocabulary/labels for the elements in the cards, students describe what they think is happening and where it is happening. Processing out with a prepared slide show, the teacher helps students validate their sequence and add scientific terminology to their descriptions. Lesson Five imbeds biomedical research (3,4) to include calculation of an atherosclerosis risk factor score and playing the *Inflamm-O-Wars* game (Figure 2). Students don the character of one of ten fictitious adolescents, such as *Pete Platelet* or *Keisha Adventitia*, to regress from or progress towards a coronary event. Students complete an *Atherosclerosis Risk Score* for their character, play the game, and track score changes by collecting *Atherotoids* along the way as they endeavor to avoid the *Rupture Zone*.

Each *Inflamm-O-Wars* lesson incorporates elements from cardiovascular research. Each moves students from a comfortable skill or knowledge level through a dissonant experience. From this dissonant experience, students derive meaning as they construct understanding during hands-on play and processing out through discussion and reflection with teachers and peers.

Each *Inflamm-O-Wars* activity meets dozens of Texas educational standards for health, science, mathematics, social studies, and language arts (“Administrivia” pages with listings of these standards can be found at

<http://teachhealthk-12.uthscsa.edu/curriculum/cardiovascular>). The TEI curriculum also supports the National Heart Lung and Blood Institutes' (NHLBI) vision to "effectively communicate advances to the public"(23). This is accomplished by translating NHLBI research findings into forms that educate the public about prevention and treatment of heart, lung, blood, and sleep disorders with an emphasis on their prevention. The TEI Program promotes Healthy People 2010 goals, including instruction about risks associated with reduced physical activity, tobacco use, and overweight and obesity (three of the ten leading health indicators). TEI curriculum also supports Health People 2010 Focus Area 11 [(Health Communication), Objective 11-2 (Improving Health Literacy) and 11-4 (Finding Websites Disclosing Quality Health-related Information)] and Focus Area 12 (Promoting Efforts to Reduce the Impact of Heart Disease and Stroke through Education and Prevention) (30).

Evaluation Efforts

Assessment should inform student thinking and teacher instruction. In such a model learning and assessment become part of the same process (29). Collecting evaluation data in the form of pre/post knowledge tests has been a long-term activity of the TEI Program. As activities from the *Inflamm-O-Wars* Unit were developed, teachers and TEI staff generated test items to bank for lesson evaluation. Three *Inflamm-O-Wars* activities have pre/post knowledge tests available and have been piloted with San Antonio middle school students. Results of preliminary testing are described in Table 3. In all three examples, there was a 20% effect size in improvement in student knowledge – the iterative process of evaluating test items, curriculum content, and lesson instruction should lead to improved knowledge outcomes.

An element of evaluation provides students the opportunity to provide feedback to their teachers and the TEI Program about the activities. The TEI collects "Activity Report Cards" from students who pilot the learning materials. Students suggest ways to improve activities, tell us what they liked or disliked, and give the activities an A to F letter grade. Their responses have helped guide adjustments to activity layouts, instructional formatting and clarity. Overall, students report enjoying the activities and learn real-world information they can use. After playing the *Inflamm-O-Wars* game, a middle school student wrote: "I learned that if you exercise and keep a healthy diet you could decrease your chance of getting athroscloroses (sic)."

These data are used to inform test revisions, activity revisions, teacher instructional strategies, teach pedagogical growth, teacher professional development, and program components. Such data keep the TEI project responsive to the needs of our partner schools, teachers, and students. Our preliminary data indicate that our curricular materials do help advance student knowledge and skills in health science literacy.

Potential Impact Health Education Program

Given the mobility in American society and the challenges of ascertaining long term outcomes for students exposed to teaching materials and activities in grades 6–8, it is difficult to quantify the impact of public school health education programs. The TEI Program remains focused on teacher professional development. For every teacher who gains new skills and becomes more effective in the classroom, between 100–120 students are affected each year. Over the career of a teacher, thousands of students potentially benefit from that person's knowledge and pedagogical skills. By working with teachers, the TEI Program seeks to leverage their educational skills across generations of students.

Website

The TEI program has maintained a website since 2001 (<http://teachhealthk-12.uthscsa.edu>). This website contains all the freely available teaching materials and evaluation information. Additional information about the projects, newsletters, pre/post knowledge tests, teacher adaptations, and a unique search engine that helps teachers find activities correlated to their instructional needs, also appear on the website. As the TEI materials are promoted and we become more adept at designing attractive online materials, website usage increases to its current level of 80,000 page views a month. It takes time to build the infrastructure to support an active and responsive website, and time to make its presence known in the educational community.

In a controlled study conducted in 2000–2003, we investigated what type of support teachers needed in order to implement new curricular materials school wide (31). Schools were grouped into control (received TEI workshop training and website access) or intervention (received TEI workshop training, website access, **and** TEI staff in-school support). Classroom utilization was tracked over three school years. The results were clear cut; having a website, by itself, is insufficient - teachers need personal support from TEI staff in order to effectively disseminate and use the materials in the classroom (Figure 3). The figure shows that classroom use of the teaching materials increased nearly 10-fold by the end of the third year in the intervention schools (where staff support was provided) compared to the control schools. While individual teachers may well be adept at downloading materials from a website and incorporating them into his or her instruction, it is another task to garner campus-wide support to infuse health topics into the day-to-day conduct of classroom instruction.

Practical Considerations for Health Scientists Interested in Education Partnerships

Over the past 14 years, the TEI Program has learned many practical lessons from our experiences within the UTHSCSA and working with multiple school districts. Biomedical researchers who collaborate with school teachers will find this a uniquely rewarding growth experience. As with all growth, there are some challenges to overcome. We provide the following five considerations to anyone venturing into partnership with schools districts and their teachers: 1) secure institutional support, 2) know your intended audience, 3) establish recruitment and application policies, 4) design a rigorous, yet flexible program rich in biomedical sciences and teaching methodologies, and 5) secure funding for stipends, supplies, fees, and other research related costs.

1. Secure the support of your institution, whether in tangible ways (such as office space, access to classrooms and labs), or securing the volunteer services of your colleagues. Being able to work inside a research institution provides K-12 classroom teachers with a rich environment unlike anything they will have experienced. Work within your institutional structures to make sure details such as parking, library access, security and sanction checks are tended to prior to the teachers' arrival on campus. If funding allows for stipends to be paid to teachers, draft a 'Work for Hire' memorandum for each teacher that delineates the scope of work expected during the duration of your program. If conducting evaluation or education research, determine whether the project will be exempt from written informed consent.
2. Know your intended audience and regulations regarding external research and teacher professional development. Learn all you can about the school culture(s) within your partner school district. Questions to ask include:

- How will you identify and contact district personnel through which you must work to recruit teachers, collect data, obtain school and community information, and report progress?
- Are you open to new pedagogical strategies to ‘translate’ your academic language into plain language, and to help the teachers further translate for their students?
- What are school mobility or turn-over rates for teachers, students, and administrators? How will you adjust for this in your data collection?
- What kind of summer and after school obligations will teachers have that may conflict with your program plans?
- How or will you involve parents? Parents significantly underestimate the risk behaviors of their adolescents, so parent education and involvement are important (32).

3. Recruitment and interviewing strategies should be considered:

- Will the school district authorize you to go into the school to present the idea?
- Must you prepare flyers and provide information at the district level for dissemination, or can you obtain permission to deliver materials to individual schools?
- What kind of application process do you need?
- What kinds of teachers and how many will you need for your program? Although you are in biomedical research, you may still need language arts teachers or social studies teachers, for example.
- Who will be involved in interviewing and hiring the teacher participants for your program? What will be their roles?

4. Program design must be planned ahead including conduct of daily business. Teachers will need to know when and where to meet, and have a calendar/schedule in hand from day one. They will need maps or directions to meeting places and institutional resources. They will need general and specific expectations – monitored and unmonitored time. Other considerations include:

- Will the program involve seminars and guest speakers?
- Will teachers be conducting library and/or laboratory research?
- Will they need institutional health and safety certification or instruction?
- Will the program involve access to laboratories?

5. How will your fund your program? Questions to answer include:

- Do you have a clear vision that aligns with funding sources in your area and/or will you need to seek funding through entities such as the National Institutes of Health or National Science Foundation who support such educational endeavors (Table 2)?
- How will the management of educational grants differ from research grants to which scientists may be more accustomed?

Health science education programs extend the National of Institutes of Health Roadmap for Translational Research (33) into the important arena of preventative education, and help

support the missions of individual Institutes (e.g., NHLBI). It follows that such programs fulfill an important goal, have the potential to impact the health and health literacy of U.S. citizens, and should continue to be funded and expanded. At the core of these endeavors is the scientist/teacher partnership. Without this pairing, the most current and accurate scientific information cannot find its way expeditiously into our classrooms. Over time, these programs can translate and place essential information from biomedical research directly into the hands of those most able to influence young people as they begin forming attitudes and behaviors that impact their future quality of life. For health science literacy the message is clear, if you are “beating the drum” but the message isn’t heard in the community ... *find a school teacher*.

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Figure 1. Sample pages from TEI *Clumps and Bumps: A Look at Atherosclerosis* activity
Students use a unit square grid to estimate the lumen area in coronary artery photomicrographs, thus they observe the effects of atherosclerosis on the coronary artery and infer the effects of stenosis on blood flow.

Figure 2. Images from TEI Inflamm-O-Wars Game

As students play the *Inflamm-O-Wars* game, they assume the character of a fictitious adolescent and are provided with personal and medical history of the character (A). On the game board (B), players regress from or progress towards a coronary event. Students determine a beginning *Atherosclerosis Risk Score* for their character (C), play the game, and track the changes in the risk score. Along the way, students collect *Atherotoids* as they endeavor to avoid the *Rupture Zone*. At the end, they calculate an ending atherosclerosis risk score.

Figure 3. Classroom use of the Teacher Enrichment Initiatives materials*

* Note: The data for this figure were reconfigured from Lichtenstein, et al, 2005 (31)

Table 1Examples of federal funding available for health science education partnerships

Funding Organization	Type of Program
National Institutes of Health	National Center for Research Resources Science Education Partnership Award National Heart Lung and Blood Institute Minority K-12 Initiative for Teachers and Students National Institute of Drug Abuse Science Education Drug Abuse Partnership Award National Institute of Allergy and Infectious Diseases NIAID Science Education Award National Institute on Alcohol Abuse Alcohol Education Project Grants National Institute of Environmental Health Sciences Environmental Health Sciences as an Integrative Context for Learning
National Science Foundation (NSF)	Math & Science Partnership Program (w/ DOE)
Department of Education (DOE)	National Department of Health & Human Services Joint Funding Decreasing Childhood Obesity Drug-Free Schools Math & Science Partnership Program (w/ NSF) State Departments of Education State Departments of Public Health

Table 2Activities, scope and sequence from *Inflamm-O-Wars: Silent Battles within Your Cardiovascular System*

Lesson	Activity Title
1	<i>From Humors to Harvey to Henry</i> provides students with a graphic organizer on which to arrange pertinent facts about a selected “heart” scientist or beliefs related to the cardiovascular system. Students identify the contributions of these people or ideas to cardiology and present their findings to peers.
2	<i>Cardio Kickers and Heart Bodies: The Heart Model</i> allows students to explore heart anatomy by using a shampoo bottle model. They identify the strengths of weaknesses of the model as it represents the structure and function of a closed circulatory system with a four-chambered ‘pump’.
3	<i>Tubular, Dude! Exploring Blood Vessels</i> helps students examine the physics of blood flow and vessel design. Activities include 3A: <i>Vessels by Design – Basic Vessel Anatomy</i> ; and 3C: <i>Am I Getting Anywhere? Physics of Blood Flow</i>
4	<i>Inflamm-O-Stories: Progression and Regression of Atherosclerosis</i> In Activity 4B: <i>Clumps and Bumps A Look at Atherosclerosis</i> students observe the effects of atherosclerosis on the coronary artery lumen (Figure1). In 4C <i>Dire Progress</i> , renditions of the left descending coronary artery and plaque buildup leading to a rupture are illustrated in a set of cards students observe and sequence.
5	<i>Risk Factors, Symptoms, Prevention</i> includes calculation of an atherosclerosis risk factor score in 5A: <i>The Atherozone: What’s the Risk?</i> In the next activity, students play the <i>Inflamm-O-Wars</i> game (Figure2).
6	<i>Let’s Talk! Socratic Conversations on Cardiovascular Risk Factors</i> provides guidelines for teachers to host a Socratic discussion around current cardiovascular news.

Table 3
Select cardiovascular pre/post test data collection 2006–2008

Activity Title	N	Pre Score	Post Score	Change Score	Effect Size r^2
Inflam-O-Wars Game	119	56%	73%	17%	0.21
Dire Progress: Stages of Atherosclerosis	106	61%	78%	17%	0.20
Vessels by Design: Basic Vessel Anatomy	14	38%	49%	11%	0.19

Note: All change scores significant at the 0.01 level. Data from 3 teachers (3 school districts).