**ToxRAP™ Curricula for K-9 Students**
Barry Schlegel, EdD, CIH
UMDNJ – School of Public Health
335 George Street
Liberty Plaza, Suite 2200
New Brunswick, NJ 08901
732-235-9085
schlegba@umdnj.edu

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(Toxicology, Risk Assessment and Pollution)

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**ToxRAP™ Features**

- Teaches an environmental health risk assessment framework (anticipation, recognition, evaluation and control) over approximately three weeks
- Uses real-life case studies where students become health hazard detectives who solve environmental health problems

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**ToxRAP™ Framework**

I. State the Health Problem (health problem recognition)
II. Do an Investigation
   A. Investigate the Hazard (hazard identification)
   B. Investigate the People Who are Exposed to the Hazard (exposure assessment)
III. Reach a Conclusion (risk characterization)
IV. Figure Out How to Control the Hazard

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**ToxRAP™ Objectives**

- Improve students’ basic science, math, health and language arts skills and address education standards
- Encourage students’ interest in environmental health careers like industry hygiene and toxicology
- Expand students’ critical thinking, problem solving, and decision making skills
- Demonstrate the value of this instructional approach for improving science education and students’ understanding of the process of scientific inquiry

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**ToxRAP™ Maps**

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**ToxRAP™ Instructional Methods**

- Problem-based activities
- Games and simulations
- Cooperative group activities
- Role plays
- Graphing and mapping
- Scientific measurements and experiments
- Interpreting data
- Math calculations

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UMDNJ – School of Public Health ◆ EOHSI Resource Center ◆ 335 George Street, Liberty Plaza Suite 2200
New Brunswick, NJ 08901 ◆ (732) 235-4988 ◆ FAX (732) 235-4960 ◆ e-mail: rc@eohsi.rutgers.edu
Original ToxRAP™ Modules

- Grades K-3: The Case of the Green Feathers
  - Chick Chock™ awakens from a nap sneezing and covered with green dust. (Hazard ????)

- Grades 3-6: What is Wrong with the Johnson Family?
  - The Johnson family is experiencing unexplained health problems. (Hazard ????)

- Grades 6-9: Mystery Illness Strikes the Sanchez Household
  - The Sanchez family is getting sick and their dog dies. (Hazard ????)

ToxRAP™ Spanish Versions

- Spanish-Bilingual – Designed for teachers who speak English and teach in Spanish-bilingual or English as a Second Language (ESL) classrooms
- All-Spanish – Designed for use in Spanish-speaking countries

ToxRAP™ Expanded Versions

- SUC₂ES₂ – Students Understanding Critical Connections between the Environment, Society and Self
  - Seven year grant from NIEHS to expand ToxRAP™ from 3 weeks to 10 weeks in the Woodbridge Township School District in grades 2, 5 and 7
  - Goals are to demonstrate translatable model for developing curricula that use environmental health as an integrated theme for teaching and improve student performance in standardized tests

ToxRAP™ Expanded Versions

- Example of 2nd grade test question in SUC₂ES₂ pretest – posttest evaluation
  - Joe, Sally and Sam went to their friend’s house to go swimming in their outdoor pool. They forgot to put on sunblock lotion. Joe went swimming for one hour, Sally went swimming for two hours, and Sam went swimming for three hours. What caused Sam to be more sunburned than Sally and Joe? Explain why.

ToxRAP™ Expanded Versions

- SUC₂ES₂ Pretest – Posttest Evaluation (Overall)

<table>
<thead>
<tr>
<th>2nd Grade</th>
<th>Group</th>
<th>Pretest Mean Score</th>
<th>Posttest Mean Score</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002</td>
<td>Treatment (N=12)</td>
<td>41%</td>
<td>75%</td>
<td>34%*</td>
</tr>
<tr>
<td></td>
<td>Control (N=11)</td>
<td>39%</td>
<td>45%</td>
<td>6%*</td>
</tr>
<tr>
<td>2003</td>
<td>Treatment (N=20)</td>
<td>37%</td>
<td>71%</td>
<td>34%*</td>
</tr>
<tr>
<td></td>
<td>Control (N=23)</td>
<td>40%</td>
<td>49%</td>
<td>9%*</td>
</tr>
</tbody>
</table>

* p < .05 between Treatment and Control teachers using Mann Whitney U Test

ToxRAP™ Expanded Versions

- SUC₂ES₂ Pretest – Posttest Evaluation (Attitude)

% agreeing to the question: “The more I know about science, the more I can solve environmental health problems.”

<table>
<thead>
<tr>
<th>2nd Grade</th>
<th>Group</th>
<th>Pretest Mean Score</th>
<th>Posttest Mean Score</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td>Treatment (N=20)</td>
<td>72%</td>
<td>83%</td>
<td>11%*</td>
</tr>
<tr>
<td></td>
<td>Control (N=23)</td>
<td>68%</td>
<td>68%</td>
<td>0%*</td>
</tr>
</tbody>
</table>

* p < .05 between Treatment and Control teachers using Mann Whitney U Test
ToxRAP™ Supplement
The Case of the WTC Dust

Lesson One: What’s in the Dust?
1. Students become industrial hygienists who work for CleanUp the Environment, Inc.
2. They receive a letter from the Admiral Building Owner’s Association requesting an evaluation of their building potentially contaminated with WTC dust. The building had recently been renovated and residents were scheduled to move back in.
3. Then, students review the potential hazards in the WTC dust and construction dust.

Lesson Two: The Admiral Building and Its Residents
4. Students meet the residents of the Admiral Building and learn about their concerns.
5. The Admiral Building is located just outside the EPA Cleanup Zone.

Lesson Three: Sampling Plans
6. Students are given a budget and floor plans. Then, they develop and defend their sampling plan.

Lesson Four: Collecting and Analyzing Dust Samples
7. Students sample dust on hard surfaces, dust in carpet, describe dust characteristics under a microscope and measure dust pH.

Lesson Five: Evaluating the Sampling Results
8. Students receive the following sampling results:
   ♦ Fiber Glass (5% to 40%) – possible carcinogen
   ♦ Crystalline silica (<1% to 10%) – possible carcinogen
   ♦ pH (7 to 12)
   ♦ No detectable asbestos, PCBs, dioxins and mercury
   ♦ Lead below standard

9. Then, students use the ToxRAP™ Map to reach a conclusion about the health risk.
ToxRAP™ Supplement
The Case of the WTC Dust

Lesson Six: Owners’ Association Meeting

10. Students role play the following groups: residents, renovation contractor, consultants (IHs), government and press. They are given 3 cleanup options and costs.
11. They must decide these questions: What cleanup option will they use and who should pay for it?

ToxRAP™ Website

- Developing 3 activities on pilot Website using MPEG-4 technology for teachers, students and their parents
  - Adventures in Pine Cone Park
  - Sail the Circulatory System
  - Toxic Mansion

ToxRAP™ Impact

- Approximately 4,831 teachers trained (to date)
- Includes 23 states, Puerto Rico and Guam

ToxRAP™ Future Plans

- Expand the ToxRAP™ Website to include more activities
- Develop additional modules for schools including a high school version of ToxRAP™
- Develop an adult version for community groups and healthcare professionals
- Conduct additional evaluations of the effectiveness of ToxRAP™ as an educational approach to improving science education

Special Thanks

- The major funding agencies: National Institute of Environmental Health Sciences (NIEHS), Environmental Protection Agency (EPA), and Agency for Toxic Substances and Disease Registry (ATSDR)
- The many school teachers and school administrators who helped develop and pilot-test the curricula