Improving practice with target inquiry: high school chemistry teacher professional development that works

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Supplementary Data
Reformed Teaching Observation Protocol (RTOP)

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Evaluation Facilitation Group (EFG)  
Technical Report No. IN00-1

Arizona Collaborative for Excellence in the Preparation of Teachers  
Arizona State University

I. BACKGROUND INFORMATION

Name of teacher ___________________________________________  Announced Observation?  ________________________________  
(yes, no, or explain)

Location of class ___________________________________________  (district, school, room)

Years of Teaching ___________________________  Teaching Certification ___________________________

Subject observed ___________________________  Grade level ___________________________

Observer ___________________________  Date of observation ___________________________

Start time ___________________________  End time ___________________________

II. CONTEXTUAL BACKGROUND AND ACTIVITIES

In the space provided below please give a brief description of the lesson observed, the classroom setting in which the lesson took place (space, seating arrangements, etc.), and any relevant details about the students (number, gender, ethnicity) and teacher that you think are important. Use diagrams if they seem appropriate.

<table>
<thead>
<tr>
<th>Category</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lesson Design and Implementation</td>
<td></td>
</tr>
<tr>
<td>Content</td>
<td></td>
</tr>
<tr>
<td>Classroom Culture</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
</tr>
</tbody>
</table>
### III. LESSON DESIGN AND IMPLEMENTATION

1. The instructional strategies and activities respected students' prior knowledge and the preconceptions inherent therein.
   0 = Never Occurred  
   1 = Rarely Occurred  
   2 = Sometimes Occurred  
   3 = Often Occurred  
   4 = Always Occurred  
   1 = teacher refers to prior knowledge  
   4 = teacher solicits prior knowledge (pre-test, questions, etc.) or lesson is developed to build on prior knowledge (from other lessons)

2. The lesson was designed to engage students as members of a learning community.
   0 = Never Occurred  
   1 = Rarely Occurred  
   2 = Sometimes Occurred  
   3 = Often Occurred  
   4 = Always Occurred  
   4 = must have student-student, teacher-student, and students present answers before teacher discusses
   3 = not enough student-student development of ideas; teacher presents answers; some student-student interactions
   2 = good teacher-student interactions but no student-student
   0 = all teacher centered

3. In this lesson, student exploration preceded formal presentation.
   0 = Never Occurred  
   1 = Rarely Occurred  
   2 = Sometimes Occurred  
   3 = Often Occurred  
   4 = Always Occurred  
   4 = students explore without teacher telling them what to expect
   2 = teacher gives away what will happen
   0 = students watch demo and then instructor explains

4. This lesson encouraged students to seek and value alternative modes of investigation or of problem solving.
   0 = Never Occurred  
   1 = Rarely Occurred  
   2 = Sometimes Occurred  
   3 = Often Occurred  
   4 = Always Occurred  
   4 = students told to investigate but not told how
   2 = students told to investigate but encouraged/told to do things in a certain way

5. The focus and direction of the lesson was often determined by ideas originating with students.
   0 = Never Occurred  
   1 = Rarely Occurred  
   2 = Sometimes Occurred  
   3 = Often Occurred  
   4 = Always Occurred  
   4 = students generate problem and how to solve it
   3 = instructor defines problem but does not tell students how to solve
   2 = teacher sets agenda and directs observations

### IV. CONTENT

**Propositional Knowledge**

6. The lesson involved fundamental concepts of the subject.
   0 = Never Occurred  
   1 = Rarely Occurred  
   2 = Sometimes Occurred  
   3 = Often Occurred  
   4 = Always Occurred  
   4 = based on the benchmarks

7. The lesson promoted strongly coherent conceptual understanding.
   0 = Never Occurred  
   1 = Rarely Occurred  
   2 = Sometimes Occurred  
   3 = Often Occurred  
   4 = Always Occurred  
   4 = students must connect to previous context or define patterns, must develop concept, there must be student-student, student-teacher and whole group interactions
   3 = missing one of the above types of interactions
   2 = focus on phenomena description and little concept building
   1 = teacher makes connections to previous topics for students

8. The teacher had a solid grasp of the subject matter content inherent in the lesson.
   0 = Never Occurred  
   1 = Rarely Occurred  
   2 = Sometimes Occurred  
   3 = Often Occurred  
   4 = Always Occurred  
   4 = no misconceptions/able to answer most questions

9. Elements of abstraction (i.e., symbolic representations, theory building) were encouraged when it was important to do so.
   0 = Never Occurred  
   1 = Rarely Occurred  
   2 = Sometimes Occurred  
   3 = Often Occurred  
   4 = Always Occurred  
   4 = good use of diagrams, particular representation, diagram; focuses attention on key elements; makes generalization or work towards theory development
   3 = same as above but without theory development or generalizations
   2 = some use of diagrams etc.; no theory development

10. Connections with other content disciplines and/or real world phenomena were explored and valued.
    0 = Never Occurred  
    1 = Rarely Occurred  
    2 = Sometimes Occurred  
    3 = Often Occurred  
    4 = Always Occurred  
    4 = working with everyday materials and explicit and significant connections to other disciplines or everyday phenomena
    3 = explicit and significant connections to other disciplines or everyday phenomena
    2 = some connections to other disciplines or everyday phenomena
    1 = passing mention of connection to other disciplines or everyday phenomena
Procedural Knowledge

11. Students used a variety of means (models, drawings, graphs, concrete materials, manipulatives, etc.) to represent phenomena.

4 = students articulate findings and/or make connections to everyday phenomena and students use multiple representations
3 = students use multiple representations but teacher summarizes findings or students use multiple representations but do not develop concepts or make connections
2 = students make predictions, estimations and/or hypotheses and devised means for testing them
0 = students make observations without making predictions/developing hypothesis first

12. Students were actively engaged in thought-provoking activity that often involved the critical assessment of procedures.

4 = students develop procedure for investigation and students make refinement to procedure based on observations/results or design further studies to clarify questions prompted by observations/results
3 = students develop procedure for investigation
2 = students actively involved in activity but no thought about how to conduct investigation or why
0 = students not actively engaged

13. Students were reflective about their learning.

4 = Students must develop concept/theory and provide rationale for their conclusions; most students participate. A debate/discussion of different theories would indicate this level.
3 = students involved in development of concept/theory but do not provide rationale or answer questions like: How do you know this? How can we be sure?
2 = no theory development and few students express findings/explanation.
0 = no student ideas presented

14. Intellectual rigor, constructive criticism, and the challenging of ideas were valued.

4 = Students must negotiate ideas as a whole group; majority of students involved in discussion.
3 = Students negotiate ideas in small groups but no full group discussion.
2 = Some ideas presented but no competing ideas offered.
0 = No student ideas presented

V. CLASSROOM CULTURE

Communicative Interactions

16. Students were involved in the communication of their ideas to others using a variety of means and media.

4 = Communication involves student-student, student-teacher, and whole group discussions.
3 = Communication within small groups and student-teacher but no whole group discussions; or some in group and some between group but significant teacher explanation.
2 = The teacher's questions triggered divergent modes of thinking.
0 = Most of the lesson was student talk

17. The teacher's questions triggered divergent modes of thinking.

4 = Divergent set up - allows students to explore multiple solutions/options; teacher does not guide towards answer but asks questions to make students think about options.
3 = Divergent set up; teacher poses questions to group as whole but not to individuals or small groups.
2 = Divergent set up but instructor encourages direct towards one answer.
1 = Any questions posed to students must score a 1

18. There was a high proportion of student talk and a significant amount of it occurred between and among students.

4 = most of the lesson was student talk
2 = significant amount of teacher talk in development of key ideas

19. Student questions and comments often determined the focus and direction of classroom discourse.

4 = student driven design and students decide what question/problem to investigate or how to investigate a question/problem.
3 = instructor sets question/problem to investigate and materials but students decide how to use materials; teacher allows students questions to direct class discussion but instructor sets agenda
2 = students ask questions and teacher responds

20. There was a climate of respect for what others had to say.

4 = substantial exchange between individual students, group of students, as a whole and between student and instructor; students display comfort in offering ideas or debating ideas; many students involved in discussion
3 = exchanges in small groups with little/no whole group discussion; teacher closes down some student investigations by explicitly pointing them in another direction
2 = teacher solicits student ideas and accepts comments but no debate about ideas

4
### Student/Teacher Relationships

#### 21. Active participation of students was encouraged and valued.

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Students involved in constructing concepts/theory and final construction of key ideas</td>
</tr>
<tr>
<td>3</td>
<td>Students involved in constructing concepts/theory but teacher presents final construction of key ideas</td>
</tr>
<tr>
<td>2</td>
<td>Students encouraged to describe phenomena but no theory development; teacher presents key ideas first before asking for student input</td>
</tr>
<tr>
<td>1</td>
<td>If students were asked to answer questions/participate you must score 2</td>
</tr>
</tbody>
</table>

#### 22. Students were encouraged to generate conjectures, alternative solution strategies, and ways of interpreting evidence.

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Students directed their investigations and discussed results as a group</td>
</tr>
<tr>
<td>3</td>
<td>Students directed their investigations but did not discuss results as a whole group</td>
</tr>
<tr>
<td>1</td>
<td>Answer was student derived but teacher directed towards one correct answer</td>
</tr>
</tbody>
</table>

#### 23. In general the teacher was patient with students.

<table>
<thead>
<tr>
<th>Score</th>
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</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Students are allowed to explore</td>
</tr>
<tr>
<td>3</td>
<td>Teacher explicitly redirects some of the direction students choose to explore</td>
</tr>
<tr>
<td>1</td>
<td>Teachers allows some wait time after question</td>
</tr>
</tbody>
</table>

#### 24. The teacher acted as a resource person, working to support and enhance student investigations.

<table>
<thead>
<tr>
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<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Teacher supports student discussions but does not direct</td>
</tr>
<tr>
<td>3</td>
<td>Teacher interacts with students but does a lot of directing and answers questions rather than helping students find answers on their own</td>
</tr>
</tbody>
</table>

#### 25. The metaphor “teacher as listener” was very characteristic of this classroom.

<table>
<thead>
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</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Teacher does not dominate group interactions</td>
</tr>
<tr>
<td>3</td>
<td>Teacher interacts with groups but provides too much direction</td>
</tr>
</tbody>
</table>