Reflecting with Standards - Novice Views on Teaching Practice

A Pilot Study of Non-Teachers’ Ability to Integrate Teaching Standards Into Observations of Three Math Instruction Examples

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Spring 2002
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Abstract

The purpose of this pilot study is to validate the effectiveness of embedding teaching standards in reflection prompts. Does this approach improve the quantity and depth of reflection commentary for novice pre-service teachers? What must be in place to ensure that novice teachers are effectively internalizing the teaching standards? These questions are paramount in the design of a web-based, electronic portfolio workspace for pre-service teachers.

This pilot study analyzed the observations of 10 non-teachers who viewed and commented on three short video clips from the TIMSS study. Two approaches to presenting novices with teaching standards were explored, using the NCTM 1991 standards for “The Teachers’ Role in Discourse”. Evaluating the ideas expressed in the novice’s written observations, this study found that embedding teaching standards into reflection worksheets was far superior to simply providing the teaching standards as a standalone reference sheet.

This study also showed that embedded scaffolding is critical to focusing the novice’s reflections and observations, as the positive gains vanish when the scaffolding is subsequently removed.
Introduction

Many states are now requiring that Teacher Pre-Service Education Programs certify that the novice teachers graduate with a specified level of proficiency relative to state teaching standards. Is it sufficient to simply make the pre-service teachers aware of the standards? Most programs include discussions about the standards, but it is important for the teachers themselves to internalize the meaning of the standards and articulate the standards as they reflect on their teaching practice.

One way to increase awareness of teaching standards and to certify proficiency, is to ask pre-service teachers to create a summative portfolio of their teaching practice. This is measured against the standards, and in some cases, is required for certification and graduation. Some teaching institutions are beginning to use electronic portfolios as a way to capture this evidence.

For electronic portfolios to successfully support learning, however, the system (technology and people) must provide reflection support to the learner. As Helen Barrett (University of Alaska) wisely points out, “... a portfolio without goals (or standards) and reflections is just a multimedia presentation, or a fancy electronic resume.... [By] including reflection, direction (goal-setting), and connection (dialog with others about the portfolio), a teacher creates a foundation for powerful professional development.”

In the Stanford Teacher Education Program (STEP), numerous hours are spent observing the practice of other teachers (live and in video cases), and reflecting on personal student-teaching experiences. Although the pre-service teachers are introduced to teaching standards, it is important to consider whether the standards are having their intended effect. Under what conditions do novices begin to effectively internalize teaching standards in their observation and reflection of teaching practices?

This question is paramount in the design of a web-based, electronic portfolio workspace for pre-service teachers. What affordances and interactions must be included to ensure that novice teachers are effectively internalizing the teaching standards?

One such design, entitled my.STEP.Stanford, integrates the teaching standards in the web-based reflection worksheets that students use when depositing electronic artifacts into their electronic binders. In this system, the

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2 http://ldt.stanford.edu/~jvanides/eportfolio
Teaching Standards are side-by-side with the artifacts themselves. In addition, the reflection forms include scaffolding in the form of examples and prompts.

The purpose of this pilot study is to validate the effectiveness of embedding teaching standards in reflection prompts. Does this approach improve the quantity and depth of reflection commentary? Will the written reflections be more focused on concepts related to the teaching standards?

The Learning Tool – my.STEP.stanford

my.STEP.Stanford is a conceptual design for a personalized, web-based Electronic Portfolio Workspace that provides pre-service teachers in the Stanford Teacher Education Program (STEP) with an effective way to reflect upon and share their teaching and learning experiences. The ePortfolio Workspace creates an easy way to store and organize examples of teaching practices and instantly publish a secure, interactive web-space for discussion and timely feedback between STEP students and faculty.

The design not only facilitates storing and organizing multimedia artifacts that demonstrate teaching proficiency, but it also promotes reflective thinking, facilitates collaboration with STEP peers and supervisors, and simplifies the creation of an electronic portfolio.

Reflection is supported a variety of ways, most notably when electronic artifacts are “dragged and dropped” into electronic binders. This helps the learner capture their thinking about the object and catalog it for future reference.
A key feature of the design is the distinction between private reflections (stored in an binder called “Private Diary”) and artifact information that is accessible to “invited guests”. The Private Diary is a sequential journal of thoughts, and entries cannot be shared (only cut and pasted into sharable threaded discussions).

Reflection is also focused on the teaching standards. A “teaching standards” self-assessment worksheet is available at all times, allowing the learner to relate teaching artifacts directly to the teaching standards. This also assists the student
in the creation of the summative Portfolio, since the correlation and tabulation of standards is semi-automated, making it easier to confirm proficiency toward the Teaching Standards.

Reflecting on Teaching Standards
Use the form below to think about your progress toward satisfying the Teaching Standards for your program. To use the rating system, consider the quality of the work you are reviewing:

- not applicable
- I still feel like a novice at this!
- I see demonstrable evidence that I'm mostly meeting this standard (intermediate)
- I believe this work is exemplary and fulfills this standard

Standard One: Engage and support all students in learning
(Want examples? See the STEP Gallery. Not sure how to write a reflection? See the Reflection Examples Library.)

- 5 -
General Description of the Experiment

This experiment compares two approaches to “using teaching standards for reflection”, and compares these two experimental groups to a control group that does not have ready access to the standards at all. For all three conditions, non-teachers are a proxy for novice participants in teacher education programs.

Each group of observers are asked to compare and contrast the teaching practices of 3 math teachers by watching short video clips (~3 minutes in duration) from the Third International Mathematics and Science Study (TIMSS) on the teaching of mathematics. The video clips are from a U.S. classroom, and Japanese classroom and a German classroom. Each clip shows a math classroom, approximately early high school (geometry related), engaged in a math lesson. The lessons are not identical, but each clip is representative of the different approaches to teaching and learning.

The videos are watched in pairs, so as to provide contrasting cases on which to comment. The observers take notes while observing the videos, then compose a narrative message in which they compare and contrast the teaching practices they observed. Participants answer a four part questionnaire:

- Part 1 - General questions about their teaching experience
- Part 2 - Observations re: US and Japanese video clips
- Part 3 - Observations re: US and German video clips
- Part 4 - Observations re: German and Japanese video clips

There were two experimental groups, each of which were shown a page from the National Council of Teachers of Mathematics (NCTM) standards. They were both shown the 7 components of “The Teachers’ Role in Discourse”. However, the intervention was slightly different. In one case, the intervention was simply a piece of paper from the NCTM website, with the 7 components of Standard #2 listed for their reference. For the other experimental group, the 7 components of Standard #2 were rephrased as questions, thus embedding the standards in the reflection questionnaire.

The participants were randomly assigned to one of three test groups:

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4 [http://standards.nctm.org/Previous/ProfStds/TeachMath2.htm](http://standards.nctm.org/Previous/ProfStds/TeachMath2.htm), 1991 Professional Standards, “The Teachers’ Role in Discourse”
1. Control Group – these observers wrote their narratives without access to or familiarity with the NCTM standard #2. The questionnaire they filled out was an open-ended, “compare and contrast” exercise (see Appendix B)

2. Experimental Group “s” – these observers were given a written description of NCTM standard #2 (see Appendix A) for their reference and use during Part 3 only. They used the same questionnaire as the control group (see Appendix B)

3. Experimental Group “ss” – these observers were shown the written description of NCTM standard #2 for reference (Appendix A), but then used a questionnaire where Part 3 was structured with specific questions based on the 7 components of Standard #2 (see Appendix C). This approach most closely approximates the web-based scaffolding provided in the my.STEP.Stanford design

This experimental framework is summarized in the following table:

<table>
<thead>
<tr>
<th></th>
<th>Control Group</th>
<th>Experimental Group #1</th>
<th>Experimental Group #2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Part 1</strong></td>
<td>Record personal information about teaching experience and training</td>
<td>(standards “handout” for reference)</td>
<td>(standards embedded in reflection questionnaire)</td>
</tr>
<tr>
<td><strong>Part 2</strong></td>
<td>Compare and Contrast US &amp; Japanese Classrooms</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Part 3</strong></td>
<td>Compare and Contrast US &amp; German Classrooms</td>
<td>Compare and Contrast US &amp; German Classrooms; NCTM standard #2 available for reference</td>
<td>Compare and Contrast US &amp; German Classrooms, answering 7 specific questions based on NCTM standard #2</td>
</tr>
<tr>
<td><strong>Part 4</strong></td>
<td>Compare and Contrast German &amp; Japanese Classrooms</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

This sequential framework created a way to evaluate and compare the impact that the two types of scaffolding interventions had on the recorded observations, and provided a view of the “retention effect” when the scaffolding was removed for Part 4.

To measure the impact, the written narratives that were submitted by the observers were parsed into “idea units”. The idea units were classified into two basic categories, either “topics that related to NCTM standard #2” or “other topics”. Both the overall quantity of NCTM-relevant idea units, and the proportion of NCTM-relevant idea units as a percent of the total, were tallied. The “other” topics were also tallied.
**Detailed Experimental Method**

**Participants**

All of the participants were adults with various backgrounds, but all had college educations. None of the participants have had formal training in “teaching”, though several had experience as teachers in informal settings (e.g.: Sunday School, music lessons, mentoring).

There were a total of 10 participants in this pilot study. Two were in the control group (no intervention), four were in experimental group #1 (NCTM handout reference guide), and four were in experimental group #2 (NCTM standards embedded in questionnaire).

**Materials**

- Three quicktime movie clips borrowed from the TIMSS study, showing a sample of math instruction from the U.S., Japan, and Germany. The clips were approximately 3 minutes in length each. Each clip provided audio and subtitles in English.
- The video clips were played for the observers on a laptop computer in a relaxed (usually home) setting.
- Blank paper and pens were provided for note-taking during the video observations.
- A printed copy of NCTM Teaching Standard #2 “The Teachers’ Role in Discourse” was viewed by both experimental groups (see Appendix A).
- An open-ended 4-part questionnaire was given to the control group and to experimental group #1 (see Appendix B).
- A similar, 4-part questionnaire was given to control group #2, but Part 3 was replaced with 7 specific questions that related to the NCTM standards (see Appendix C).

**Procedure**

All observers were given the same background information:

“I am conducting a pilot study on the ways that non-teachers view teaching practice. You will view 3 video clips from the TIMSS study, each of which is a short 3 minute example of a classroom that was filmed during the TIMSS study, one from the U.S., one from Japan, and one from Germany.”
“You will watch the videos as pairs, in order to compare and contrast what you see in the video clips. You may take notes while you watch the video, and you may pause or replay the video if you would like. After you are finished with a pair of videos, you will be asked to write a narrative to me, as though you are sending me an email that summarizes what you observed.

“To start, please fill out Part 1, and let me know a little bit about yourself and whether or not you have any teaching experience. All the information you provide me will be anonymous. Any questions?”

After filling out Part 1, the observers turned to Part 2, read the question, and then watched the videos, starting with the U.S. clip. After viewing the Japanese clip, they wrote their narrative “email”.

At the beginning of Part 3, the two experimental groups were shown the printed copy of the NCTM standards for “The Teachers’ Role in Discourse”.

“Before you begin Part 3, I want to show you something. This is a list of teaching standards from the National Council of Teachers of Mathematics (NCTM). They have a LOT of standards, but I have selected the seven standards that relate to The Teachers’ Role in Discourse. Please take a look at the 7 standards and let me know if you have any questions.”

They read the seven bullets, and then experimental group #1 was told:

“You may refer to these standards while you watch and write about your observations of the German and US videos you are comparing.”

The experimental group #1 then retained the handout for the duration of Part 3, for reference as needed.

Experimental group #2 was told:

“You will notice that these standards have been rephrased as questions for you to answer in Part 3.”

Experimental group #2 did not retain the handout for reference, but rather focused on answering the questions that had the standards embedded in them.

Coding

The written transcripts were pasted into a spreadsheet, parsed so that each key “idea” being articulated was in its own row. These “idea units” were then categorized according to the topic being mentioned. One group of topics were the
7 components of NCTM standard #2, and the other group of topics were the “other” observations that were common to these novice observers. Idea units were categorized in a topic whether the observation was a “positive example” or “negative example”, so long as it was on topic.

The “other” topics were:

<table>
<thead>
<tr>
<th>Pacing</th>
<th>Interpersonal style/social context</th>
<th>Collaboration</th>
<th>Discussion goals</th>
<th>Memorization; declarative “facts”; “the answer”</th>
<th>Procedural</th>
<th>Conceptualizing</th>
<th>Pedagogy (Teaching approach)</th>
<th>Instructor’s role</th>
<th>Effectiveness</th>
<th>Other</th>
</tr>
</thead>
</table>

The “NCTM Standard #2” topics were:

<table>
<thead>
<tr>
<th>Posing questions and tasks that elicit, engage, and challenge each student’s thinking</th>
<th>Listening carefully to students’ ideas</th>
<th>Asking students to clarify and justify their ideas orally and in writing</th>
<th>Deciding which to pursue in depth from among the ideas that student bring up during a classroom</th>
<th>Deciding when and how to attach mathematical notation and language to students’ ideas</th>
<th>Deciding when to provide information, when to clarify an issue, when to model, when to lead, and when to let a student struggle</th>
<th>Encouraging each student to participate</th>
</tr>
</thead>
</table>

If an idea unit referred to any of the topics, a numeral “1” was entered into the spreadsheet in that column. For each response section, Part 2, Part 3, and Part 4, the idea units’ topics were tallied. Of particular interest were:

- The total number of NCTM relevant idea units in each Part
- The proportion of NCTM relevant idea units, as a percent of the total number of idea units in each Part
- The change in idea units from Part 2 (baseline) to Part 3 (with intervention)
The change in idea units from Part 3 (with intervention) to Part 4 (intervention removed). Removing the scaffolding would shed light on the novice’s ability to retain use the standards for reflection after only minimal exposure to them.

Results

In general, the results of this pilot study showed a significant difference between the two interventions, with the standards embedded in the questionnaire generating significantly higher proportions and overall quantity of relevant idea units. There was surprisingly little difference between observers who had access to the standards as handouts and observers who had NO exposure to the standards.

Chart #1 shows the QUANTITY of NCTM-relevant idea units for each observer, separated by each Part of the questionnaire. Of particular note is the large difference in the “verbosity” of the observers who received the reflection worksheet with embedded standards. This group of participants averaged about 8 times more idea units in Part 3 of the questionnaire. Experimental group #2 also had the lowest relative standard deviation of the three groups.

<table>
<thead>
<tr>
<th>sample</th>
<th>sample size</th>
<th>n-1</th>
<th>confidence</th>
<th>t</th>
<th>average</th>
<th>sample std</th>
<th>rsd</th>
<th>min</th>
<th>max</th>
</tr>
</thead>
<tbody>
<tr>
<td>intervention #1</td>
<td>4</td>
<td>3</td>
<td>80%</td>
<td>1.638</td>
<td>2.5</td>
<td>1.3</td>
<td>52%</td>
<td>1.4</td>
<td>3.6</td>
</tr>
<tr>
<td>no intervention</td>
<td>2</td>
<td>1</td>
<td>80%</td>
<td>3.078</td>
<td>2.0</td>
<td>1.4</td>
<td>71%</td>
<td>-1.1</td>
<td>5.1</td>
</tr>
<tr>
<td>intervention #2</td>
<td>4</td>
<td>3</td>
<td>80%</td>
<td>1.638</td>
<td>16.8</td>
<td>4.3</td>
<td>26%</td>
<td>13.3</td>
<td>20.2</td>
</tr>
</tbody>
</table>

A T-test (80% confidence) showed that there was no distinguishable difference in the average “verbosity” of those who received intervention #1 compared to the control group.

Chart #2 shows the PROPORTION of NCTM-relevant idea units for each observer, separated by each Part of the questionnaire. Again, the intervention given to experimental group #2 resulted in a higher proportion of relevant idea units (percent of NCTM-relevant idea units as a percent of the total number of idea units). This measure eliminates the “verbosity factor”. The average proportion of relevant idea units for experimental group #2 was 2 times higher than experimental group #1, and 4 times higher than the control group.

A T-test (80% confidence) showed that the difference in experimental group #2’s average is statistically significant, while the averages of the control group and experimental group #1 are indistinguishable.
With regard to the retention or “internalization” of the teaching standards, both experimental groups failed to continue to generate NCTM-relevant idea units after the interventions were removed for Step4. A T-test (80% confidence) of the averages showed that all the confidence intervals overlapped, making the differences statistically indistinguishable:

<table>
<thead>
<tr>
<th>sample</th>
<th>sample size</th>
<th>n-1</th>
<th>confidence</th>
<th>t</th>
<th>average</th>
<th>sample std</th>
<th>rsd</th>
<th>min</th>
<th>max</th>
</tr>
</thead>
<tbody>
<tr>
<td>intervention #1</td>
<td>4</td>
<td>3</td>
<td>80%</td>
<td>1.638</td>
<td>35%</td>
<td>22%</td>
<td>64%</td>
<td>16%</td>
<td>53%</td>
</tr>
<tr>
<td>no intervention</td>
<td>2</td>
<td>1</td>
<td>80%</td>
<td>3.078</td>
<td>20%</td>
<td>15%</td>
<td>76%</td>
<td>-13%</td>
<td>52%</td>
</tr>
<tr>
<td>intervention #2</td>
<td>4</td>
<td>3</td>
<td>80%</td>
<td>1.638</td>
<td>81%</td>
<td>11%</td>
<td>13%</td>
<td>72%</td>
<td>90%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>sample</th>
<th>sample size</th>
<th>n-1</th>
<th>confidence</th>
<th>t</th>
<th>average</th>
<th>sample std</th>
<th>rsd</th>
<th>min</th>
<th>max</th>
</tr>
</thead>
<tbody>
<tr>
<td>intervention #1</td>
<td>4</td>
<td>3</td>
<td>80%</td>
<td>1.638</td>
<td>5%</td>
<td>18%</td>
<td>344%</td>
<td>-9%</td>
<td>20%</td>
</tr>
<tr>
<td>no intervention</td>
<td>2</td>
<td>1</td>
<td>80%</td>
<td>3.078</td>
<td>6%</td>
<td>31%</td>
<td>492%</td>
<td>-62%</td>
<td>74%</td>
</tr>
<tr>
<td>intervention #2</td>
<td>4</td>
<td>3</td>
<td>80%</td>
<td>1.638</td>
<td>-30%</td>
<td>26%</td>
<td>-87%</td>
<td>-52%</td>
<td>-9%</td>
</tr>
</tbody>
</table>
Data Summary Charts

Chart #1: Quantity of Relevant Idea Units
Observers 1-4 used NCTM ref sheet for step2, 5-6 had no NCTM stds, and 7-10 had NCTM stds embedded in step3 questionnaire.
Chart #2: Relevant Idea Units as a Percent of Total Idea Units

Observers 1-4 used NCTM ref sheet for step2, 5-6 had no NCTM stds, and 7-10 had NCTM stds embedded in step3 questionnaire.
Interpretation and Discussion

Referring back to the purpose of this pilot study, the data does appear to validate the effectiveness of embedding teaching standards in reflection prompts. This type of scaffolding intervention improved the quantity and relative proportion of NCTM-relevant idea units in the reflection commentary. The written reflections were, in fact, more focused on concepts related to the teaching standards.

Not surprisingly, the simpler intervention (the NCTM handout) had little impact on these “novices”. In fact, the impact was indistinguishable from the idea units generated by the control group. This was not surprising, too, in that the participants were often observed placing the paper reference material off to the side while they wrote their responses. The words were out of reach and out of sight... and out of mind.

As for retention and “internalization” of the teaching standards for improved reflection, only 3 of 10 participants showed an increase in the proportion of relevant idea units from Part 3 to Part 4. One of these was in the control group, so there may be some “practice effect” unrelated to the intervention. Further study and a larger participant pool would help to clarify this effect.

One surprise finding is that the idea units expressed by Experimental Group #2, in answer to the structured questions in Part 3, were not necessarily a direct match to the question. Despite this discrepancy, this group still generated more relevant idea units. This may be an indication of a primitive understanding of the standards, or simply a mismatch between the structure of the questions and the structure of their thinking about the observations. Regardless, the embedded scaffolding appeared to be effective.

Overall, this pilot study is an encouraging affirmation of the design of my.STEP.Stanford, and serves as a guiding principle for future designs of professional development systems that intend to provide scaffolding for novice teachers as they learn to internalize professional teaching standards.

Next Steps

- conduct a larger study
- investigate the inter-rater reliability of the coding
- Explore ways to increase retention and bring the teachers to an internalized understanding of the standards (fade and simplify the scaffolding)
Appendix A – NCTM Standard #2
(http://www.nctm.org)
Appendix B – Response Sheet #1

Comparing Teaching Styles
A Study of How Non-Teachers View Teaching Practices

You will be viewing and commenting on 3 short video clips that demonstrate math teaching practices. You will be viewing the videos two at a time, and comparing and contrasting the teaching practices that are shown in the videos. For each pair of videos, you will write a “draft email” that you might send to a friend to describe what you observed.

Your profile and feedback will remain anonymous.

Thank you for your assistance in this study!

PART 1:
Personal profile questionnaire

2. Other than your own education, you spent any time in a public/private K-12 school classroom? (circle one)
   - None
   - Less than 5 days in the last year
   - 5-20 days in the last year
   - Weekly

3. Do you have any formal training in teaching? If so, please describe.
PART 2:
View the teaching movie segments from Japan and from the US. Compare and contrast the two approaches to teaching and learning. You may take notes in any form that you would like, but please write a draft “email” below to describe what you saw.
PART 3:
View the teaching movie segments from Germany and from the US. Compare and contrast the two approaches to teaching and learning. You may take notes in any form that you would like, but please write a draft “email” below to describe what you saw.
PART 4:
View the teaching movie segments from Japan and from Germany. Compare and contrast the two approaches to teaching and learning. You may take notes in any form that you would like, but please write a draft “email” below to describe what you saw.
Comparing Teaching Styles
A Study of How Non-Teachers View Teaching Practices
Participant #

You will be viewing and commenting on 3 short video clips that demonstrate math teaching practices. You will be viewing the videos two at a time, and comparing and contrasting the teaching practices that are shown in the videos. For each pair of videos, you will write a “draft email” that you might send to a friend to describe what you observed.

Your profile and feedback will remain anonymous.

Thank you for your assistance in this study!

PART1:
Personal profile questionnaire

  5. Other than your own education, have you spent any time in a public/private K-12 school classroom? (highlight one)
     - None
     - Less than 5 days in the last year
     - 5-20 days in the last year
     - Weekly

  6. Do you have any formal training in teaching? If so, please describe.
PART 2:
View the teaching movie segments from Japan and from the US. Compare and contrast the two approaches to teaching and learning. You may take notes in any form that you would like, but please write a draft “email” below to describe what you saw.
PART 3:
View the teaching movie segments from Germany and from the US. Compare and contrast the two approaches to teaching and learning. Before this activity, however, take a moment to read the NCTM standards for “The Teachers’ Role in Discourse”. You may take notes in any form that you would like, but after you’ve watched the videos, please compare and contrast what you observe specifically focusing on the seven questions below.

3.1) Describe and compare how the two teachers posed questions to their students.

3.2) Describe any evidence of the students being engaged and their thinking being challenged.

3.3) Describe and compare how the two teachers listened to their students’ ideas.

3.4) Compare the degree to which each teacher decided what to pursue in depth based on the ideas that students brought up during discussion.

3.5) Compare the degree to which each teacher decided when and how to attach mathematical notation to the students’ ideas.

3.6) Describe and compare how the two teachers decided when to provide information, clarify, model, lead, and when to let a student struggle.

3.7) Describe and compare how the teachers monitored participation, and the extent to which each student participated.
PART 4:
View the teaching movie segments from Japan and from Germany. Compare and contrast the two approaches to teaching and learning. You may take notes in any form that you would like, but please write a draft “email” below to describe what you saw.
Appendix D – Raw Data

(see http://ldt.stanford.edu/~jvanides/ED229D/PilotStudy.xls)