

## Identifying Changes in Teacher Practice: The Addition of an Online Journal in a Mixed Methods Study

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### Abstract

Since 2012, a professional development program has operated in central Ohio in conjunction with these camps to provide 120 hours of contact time to high school science teachers. As a result, there is a wealth of anecdotal and qualitative evidence demonstrating that this program has resulted in changes in teacher practice. Teachers who have participated in the program for multiple years in particular have shown a marked increase in their use of exploratory classroom activities in lieu of demos and are more likely to employ guided inquiry pedagogy. In addition, a journaling activity has been developed to analyze the progression and type of changes in teacher practice across the academic year. These journaling activities are filled out roughly once per week and ask whether specific activities occurred during a specific lesson. By tracking this information longitudinally and comparing the results between the treatment and comparison groups of high school teachers, it is hoped that the study can better identify *how* and *when* changes in teacher practice are occurring. This activity will also be correlated with the Survey of Enacted Curriculum (SEC), Reformed Teacher Observation Protocol (RTOP), and focus groups among participating teachers. This analysis is currently in process during the 16- 17 academic year. As part of the presentation, the author will outline the methodology and instruments being used and seek comments, questions, and suggestions from fellow researchers.

### Keywords

Materials Science, High School, Teacher Professional Development, PD

### Introduction

The *Materials Science in the High School Classroom* program was initiated in 2012, and provides extensive (120+ hours annually) professional development (PD) to high school teachers in Ohio. This program prepares them to incorporate materials science curriculum, extensive use of hands-on activities, and guided inquiry pedagogy into their classrooms. For our purposes, we define teacher practices as the behaviors teachers engage in to plan, deliver, and reflect on their teaching. Improvement in teacher practices is being defined by changes in the frequency and nature of the teachers use of guided-inquiry and active learning activities, which are correlated to increases in student's content knowledge and capacity for scientific thinking (National Research Council, 2007 & 2010). Anecdotal reports by the teachers credit the program with changing their teaching practice (Polasik, et al, 2016). In 2015 – 2016 the research arm of the program was strengthened to evaluate the effectiveness of the program. Data on teacher practice was collected using the Survey of Enacted curriculum (SEC) and the Reformed Teacher Observation Protocol (RTOP). The SEC is a self-reported survey delivered online that is commonly used to evaluate teacher practice for the preceding year and measure changes (Council of Chief State School Officers, 2001). The RTOP measures the extent to which a teacher uses student-centered,

engaged learning practices (Sawada, et al, 2002). Both the SEC and RTOP are administered pre- and post- academic year (approximately October and May). This data was still insufficient to demonstrate that the program was responsible for the perceived changes in teacher practice, and it did not indicate the ways in which these changes were made by the teachers. Thus, the research plan for the 2016 – 2017 academic year includes collecting weekly journals from the class targeted by the PD. This journal activity is informed by the same pedagogy as the RTOP, but collects periodic and regular self-reported data.

This report focuses on preliminary results and analyses on the results from the RTOP observations done near the start of the academic year and the first half-year’s results of the journaling activity. A simple “common sense” attempt at scoring the journal activities in a way that would seem to best align with the RTOP scores is described. Despite the limited data, it is believed that this analysis will provide insight on the critical limitations and confounding factors of using a journaling activity to measure teacher practice.

**Methodology and Preliminary Results**

Teacher observations using the RTOP were conducted in October and November of 2016 for 10 teachers in the PD treatment group. RTOP scores are reported by sub-topic. Each of 25 items is weighted equally, and a straight sum is typically reported for the entire RTOP analysis with subsection scores out of 20. For our analysis, the average score in each subsection was recorded for each teacher in order to better align the RTOP subscores with the rubric for the journal activities.

All 20 teachers in the treatment group submitted journals of individual lessons for the final 10 weeks of the semester, starting on 10/1/16. 85% of the teachers submitted at least 6 journal responses. The journal activity asked teachers to report whether or not different activities on the part of the teacher and the students took place during a lesson, but did not ask them to grade the degree to which those activities occurred. Each of 6 teacher activities (A – F in Table 1) and 8 student behaviors (s – z in Table 1) were correlated to 3 RTOP categories. A rubric was then applied to relate the number of teacher or student activities to a score ranging from 0 – 4. This analysis is summarized in Table 2. Each journal was then coded using this method to give it a score, and the average of these scores was tabulated. In this way, the average score from the 5 dimensions of each RTOP score was related to a global average of the journal activities. These scores are shown in Figure 1.

Teacher Behavior	Student Behavior
A. Lecture	s) Gathering data
B. Asked questions to guide/redirect student thinking	t) Analyzing data
C. Asked questions to probe student thinking	u) Drawing conclusions
D. Provided students with data	v) Engaging in discussions with peers
E. Provided students with opportunities to gather data	w) Made predictions, estimations, and/or hypotheses
F. Encouraged to generate conjectures, alternative solutions/strategies, and/or consider different ways of interpreting evidence	x) Asking questions of peers and/or teacher
	y) Used mathematics
	z) Chose which data to collect

*Table 1: Detailed information on the relevant portion of the journal activity. A – F are teacher activities indicative of guided inquiry and reformed teaching. Activities s – z are elements student behavior that are expected to be present in such a class.*

<b>RTOP</b>	<b>Journal</b>	<b>0</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
		<i>Number of items checked</i>				
<b><u>Procedural Knowledge</u></b> Evaluates kinds of processes students are asked by the teacher to use during the lesson	B, C, D, F	0	1	2	3	4
<b><u>Communicative Interactions</u></b> Evaluates nature of communication between students and between the students and teacher. “Lessons where teachers characteristically speak and students listen are not reformed”	B, C, F v, x	0	2	3	4	5
<b><u>Student / Teacher Relationships</u></b> Evaluates active participation of students, their engagement in generating conjectures and interact with the content, and the degree to which the metaphor “teacher as listener” is characteristic of the classroom.	B, C, E, F s, t, u, v, z	0	2	5	7	9

Table 2: Three subsections of the RTOP measure the presence and quality of various teacher and student activities. Each of these aspects of reformed teaching were then matched to the characteristics of the journal activity using the detailed scale. For example, the presence of reformed communicative Interactions would be include activities B, C, and F on the part of the teacher and activities v and x on the part of the student (as detailed in Table 1). A score of 2/4 on the journal activity for communicative interactions would correspond to 3 of these 5 possible items being present.

There is no clear alignment between the journaling activity and the RTOP tools using this approach, despite the fact that both instruments seek to measure the degree to which a teacher’s methodology is aligned with our working definition of improved teacher practice. This is not unexpected, however, because there are a number of differences between the two measurement tools. The purpose of this preliminary analysis was to determine whether anything can be learned by looking at the ways that the scores do not line up and to allow this information to inform end-of-year analyses.

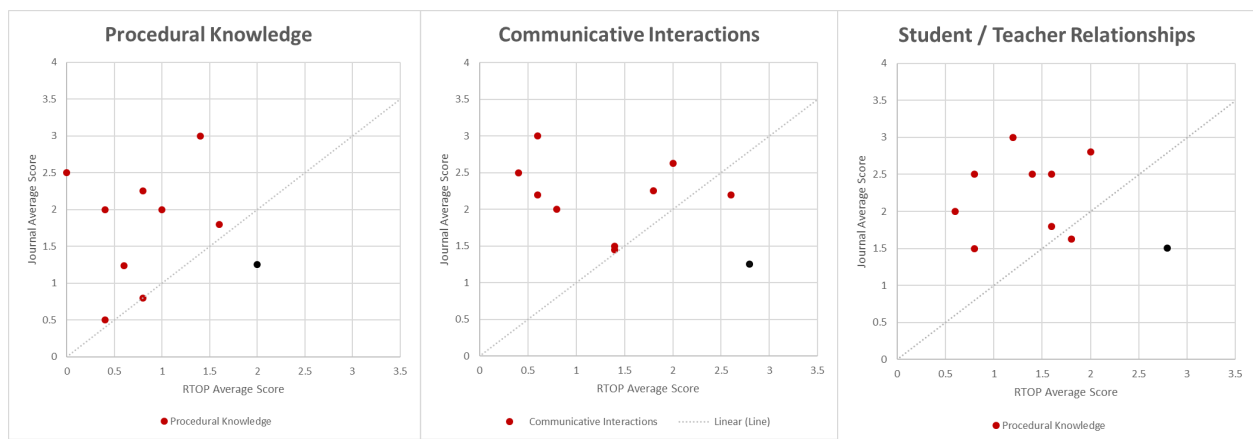


Figure 1: RTOP average scores (x – axis) vs. composite Journal average scores (y axis).

### Conclusions and Future Work

This preliminary analysis indicates key sources of misalignment that need to be evaluated to better understand the interrelationship of the two tools. *The teachers doing the self-evaluation likely have different understandings of the listed teacher and student behaviors.* It is likely

students “engaging in discussions with peers” will occur differently in different classrooms, and the teachers may have different standards for whether or not this is occurring. To evaluate how this is varying between teachers, the teachers will be asked to fill out a more detailed journal activity for the same lesson that an observer will be conducting the RTOP in April 2017. This will include a scale of 1 – 4 for each teacher and student behavior. We will also ask some teachers to fill out a journal activity for a class they are observing. *It is also possible that the teachers have a bias of self-reflection*, and thus are ranking themselves higher than a trained RTOP observer would. In the spring semester, teachers will be asked to fill out a journal activity before and after observing a video of their lesson. At the end of the year, the teachers will submit a post-year SEC, and the accuracy of this holistic self-report of the course for the academic year will be compared to the results of a year’s worth of journaling activities.

The results of this preliminary analysis have informed key decisions for additional qualitative analyses that will be conducted in spring 2017 in conjunction with the post-year RTOP and SEC analyses. The program is also collecting information about teachers’ content knowledge, beliefs, and self-efficacy at the start and end of the academic year. These analyses will help determine whether the journal activity can be related to key aspects of the RTOP or SEC and inform refinements in the journal for the 2017 – 2018 academic year. While any correlations found are likely to be tenuous, these results will lead to additional research questions that can be incorporated in the 2017 – 2018 program year.

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