

Astronomy Education Review

Volume 3, Mar 2004 - Oct 2004

Issue 1

What Do Teachers See in an "Exemplary" Astronomy Video?

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Received: 02/03/04, Revised: 07/09/04, Posted: 08/02/04

The Astronomy Education Review, Issue 1, Volume 3:1-6, 2004

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Abstract

This study explores the use of video presentation of exemplary astronomy teaching as a teacher professional development tool. A qualitative/quantitative hybrid design was used to collect data on the video elements that 11 preservice and 11 experienced elementary teachers attended to as they observed such videos. Results suggest that teachers rarely recognize the exemplary practice presented to them as being "exemplary." Furthermore, teaching experience significantly influences how a teacher interprets exemplary practice vignettes. There is some evidence to suggest that instructing teachers to seek out exemplary practice aids them in attending to the underlying functions of the methodology presented.

Problems impeding the professional development of teachers--distance, cost, time, and shortage of presenters--are shrinking with the use of the Internet as a tool for telecommunications (Russell & Sabatini 2001; Herbert 1999; Marx et al. 1998) and the use of video technology (Smith 1994). The the Ontario Institute for Studies in Education at the University of Toronto (OISE/UT) Astronomy Project (<http://oise.utoronto.ca/~ewoodruff/>) is a working prototype of a Web site dedicated to teacher development in astronomy education. The site provides resources and makes opportunities for discourse available among teachers, education researchers, and an expert astronomer. The project is led by Dr. John Percy, a professor of astronomy at the University of Toronto, and Dr. Earl Woodruff, a professor, cognitive scientist, and teacher educator at OISE/UT.

Future plans for OISE/UT Astronomy Project Web site include online access to digitized video vignettes of astronomy teaching (Chandra et al. 2001). An obvious advantage to providing online video is its just-in-time character of professional development. Folk wisdom suggests that exposing teachers to video models of exemplary practice is a more powerful and efficient form of professional development than text alone. Indeed, a number of scholars advocate exactly that approach (Smith & Diaz 2002; McCurry 2000), particularly if these videos are supplemented with external support, such as prior exposure to and instruction on the subject matter addressed in the video (Tippins, Nichols, & Dana 1999), listening to an expert commentary explaining what is occurring in each video event (Chaney-Cullen & Duffy 1999), participating in a group discussion of the video vignette (Copeland & Decker 1996), and reflective discussion with colleagues focusing on problem solving within their own teaching practices (Smith 1994). Other scholars not only advocate that video models of exemplary practice are effective professional development tools but also go further to suggest that such video models should be incorporated within a case structure (Hewitt et al. 2002; Marx et al. 1998).

Although exposing teachers to video modelling of exemplary practice in astronomy education seems to be ideal, some have found that teachers bring their own perspectives (Chaney-Cullen & Duffy 1999) and belief sets (Tippins et al. 1999) when interpreting such videos. In recognition of these findings and those who wonder if teachers do in fact perceive and recognize exemplary practice when they are presented with it (Bereiter 2002), we have reservations about this approach. Carl Bereiter (2002) makes this point:

The most brilliant pedagogical idea of all time could arise in one classroom and remain unknown to the teacher next door. If it did become known, however, its brilliance would likely go unrecognized --even by the teacher who hit on it. (Chapter 11)

Bereiter's observation suggests a number of research questions concerning the use of videos that demonstrate exemplary practice. Namely, what do teachers attend to when they are told that they are watching video vignettes of exemplary practice in astronomy education? Or, what factors affect the type of lenses through which teachers view video vignettes of exemplary practice? And finally, are teachers more likely to achieve a deeper reading of the actions and events portrayed in video vignettes of exemplary practice when they are instructed to seek out exemplary practice prior to viewing them?

The pilot study led us to postulate that teachers draw on their existing repertoire of exemplars to interpret video vignettes of exemplary astronomy teaching, which leads them to observe the vignettes through a combination of lenses; we have termed them content, form, and pedagogy lenses (Fong 2002b). cursory examination of data from this follow-up study suggests the presence of a fourth lens, surface-level media. Interrater reliability--that is, the frequency of common lens categorizations made by independent raters of statements made by this study's participants--was established using these data to determine if these lenses are a viable and assessable construct for analyses.

Content lens. When teachers use a content lens to view exemplary practice, they essentially watch the vignette as a student of the subject matter being taught in the vignette, not as a teacher. Their purpose is to learn about the *content* that is being presented, not to learn how to *teach* the content. Thus, the participant views the video vignettes of exemplary practice for his or her own learning of astronomy, rather than as a teaching tool.

Form lens. A teacher viewing exemplary practice through the form lens watches the vignettes as a "teacher-technician." He or she attends to literal events, and his or her "think aloud" protocol statements--that is, comments that he or she makes aloud while viewing the video vignettes--reflect a surface reading of the structure and form of the demonstrations presented. These teachers seem to be more concerned with the effective management of the learning activity than with the underlying purposes and functions of the exercise. They are preoccupied with issues of classroom management and logistics. Considerations of the foundations of student learning and deeper analysis of the underlying purpose or function of the astronomy presentations are not apparent.

Pedagogy lens. When video vignettes of exemplary practice are viewed through a pedagogy lens, the teacher is viewing the vignettes as a "master teacher." The teacher is processing what he or she sees at a deep level, focusing on the underlying purposes and functions of the demonstrations. It is apparent that the teacher is drawing on his or her knowledge of learning theory and subject matter knowledge as he or she processes the vignettes. Furthermore, it is clear that the teacher is thinking beyond the execution of the activity presented, and makes suggestions for lesson extensions.

Surface-level media lens. A teacher who views the video vignettes through a surface-level media lens watches them as a "video producer." His or her comments and queries relate strictly to the presentation modality itself, the set, and the demonstrator's appearance.

It was hypothesized that three factors impact the depth to which a teacher views and processes video vignettes of exemplary practice: teaching experience, prior subject matter knowledge, and directed viewing.

A qualitative/quantitative hybrid design was used to collect data on the video elements that 11 preservice and 11 experienced teachers attended to as they observed exemplary astronomy teaching vignettes related to concepts such as day and night, seasons, and Moon phases. The preservice teachers were enrolled at OISE/UT in the one-year postbaccalaureate primary-junior (kindergarten through sixth grade) division of teacher education. The experienced teachers had taught anywhere from 6 to 33 years in elementary schools in Toronto, Canada. The mean number of years of teaching experience for this second group was 17 years. Data sources included pretest astronomy scores and think-aloud protocols. The astronomy pretest is an online self-assessment based in part on the work of P. M. Sadler (accessible at <http://www.oise.utoronto.ca/~ewoodruff/schedule/schedule.html>). All think-aloud protocols were audiotaped and transcribed. Each protocol statement within a teacher's protocol was subsequently categorized into one of our four lens categories.

A think-aloud report is one of two types of concurrent verbal reports. In a concurrent verbal report, the cognitive processes, described as successive states of heeded information, are verbalized directly. Thus, every thought that occurs to the subject is spoken aloud immediately and without reservation or conscious inhibition from the subject. Ericsson & Simon (1984) claim that cognitive processes are not modified by these reports. Heeded and verbalized information is determined by task-directed cognitive processes. Thus, it would seem that concurrent verbal reports are the closest reflection of the cognitive processes when verbal data are called for.

Quantitative results derived from statistical analyses of the qualitative data suggest that teaching experience significantly influences the type of lens through which a teacher will observe vignettes of exemplary practice. There is also some evidence to suggest that, prior to viewing a vignette, instructing a teacher to actively seek out characteristics of exemplary practice aids them in attending to the underlying

functions and purposes of the methodology presented.

Specifically, using formal statistical tests--analysis of variance (ANOVA), analysis of covariance (ANCOVA), and/or Mann-Whitney nonparametric tests--to determine the probability of the data if we had assumed absolutely no group differences, we found that: (a) preservice teachers made significantly more content lens statements than experienced teachers did (this was not due to the difference in their prior subject matter knowledge); (b) preservice teachers made more form lens statements, but not significantly so; (c) experienced teachers made significantly more pedagogy lens statements than preservice teachers did; (d) the effect of teaching experience on the proportion of surface-level media lens statements was negligible; (e) preservice teachers and experienced teachers performed about the same on the subject matter assessment; (f) there was no correlation between performance on the subject matter assessment and the proportion of statements of any lens type, with one exception: a significant relationship between performance and raw frequency of pedagogy statements; and (g) preservice and experienced teachers who are given direct instructions to look for pedagogically sound teaching principles made significantly more pedagogy lens statements.

The research findings confirm the original two postulates. Just prior to being presented with the video vignettes, all teachers in this study were told that they were about to observe video vignettes of exemplary astronomy teaching. Despite this, the teachers drew on their existing repertoire of exemplars to interpret the video vignettes as they viewed them, which led them to observe the vignettes through multiple lenses. We found that when teachers are presented with notions or situations that fall outside their existing repertoire of exemplars, they fail to understand models of exemplary practice in astronomy education as they are intended to be--that is, the teachers rarely recognize the exemplary practice presented to them as being "exemplary."

Our study provides one more example of a general problem in science education and communication: What learners absorb may not be what the educators think they absorb. In recognition of this study's marginally significant finding ($p = 0.056$) that directing a teacher to look for aspects of exemplary practice prior to presenting him or her with the videos results in a higher proportion of pedagogy lens statements in his or her think-aloud protocol, we suggest that teachers must be made explicitly aware of their tacit professional lenses through which they view video modelling of exemplary astronomy teaching. Only then can there be conceptual change in teachers' understanding of astronomy education methodologies, and an increased likelihood that they will view video vignettes of exemplary practice through the pedagogy lens and indeed recognize the exemplary practice as such. One way to make teachers aware of their professional frames prior to watching video vignettes of exemplary astronomy teaching is to show them Fong's (2002a, Appendix D) manual of lens categorizations, emphasizing that they are to view the vignettes through the pedagogy lens. This would not only foster awareness of the possible frames but also provide a clear description and exemplar statements of the pedagogy lens. Unlike an exemplary astronomy teacher, the knowledge base of the other teachers seeking support in astronomy education will not likely include knowledge of student misconceptions in astronomy. To confront the deeply rooted misconceptions that we know students and teachers have, we must endeavor to develop exemplary demonstrations. Because an exemplary lesson must necessarily address student misconceptions, we further suggest that video vignettes modelling exemplary astronomy teaching be prefaced with a discussion on how that particular demonstration addresses specific student misconceptions in astronomy.

Note

Portions of this article were presented at the annual meeting of the Canadian Society for the Study of Education, Toronto, May 2002, and at a Special Session of the General Assembly of the International Astronomical Union, Sydney, Australia, July 2003.

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