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# Reproducing Successful Rituals in Bad Times: Exploring Emotional Interactions of a New Science Teacher.

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Abstract

Teaching is emotional work. This is especially the case in the first years of teaching when new teachers are particularly vulnerable. By understanding changes in teacher emotions in the early years of teaching we hope to identify strategies that might ultimately reduce teacher attrition. As part of a larger study of the transition of new teachers to the profession, this ethnographic case study explores how a new science teacher produced and reproduced positive emotional interaction rituals with her students in her first year of teaching. We show how dialogical interactions were positive and satisfying experiences for the teacher, and how they were reproduced successfully in different contexts. We also illustrate how both teacher and students used humor to create a structure for dialogical interactions. During these successful interactions the students used shared resources to satisfy their teacher that they were engaging in the relevant science content. The implications of what we have learned for the professional development of new teachers are discussed in relation to an expanded understanding of teacher emotions.

**Key Words**: Teacher Emotions, Beginning Teachers, Emotional Classroom Events, Interaction Rituals

**Emotional Teaching for New Teachers**

Teaching is emotional work (Chang, 2009; Oplatka, 2007; Schutz & Zembylas, 2009).

This is especially evident for new teachers who commonly experience a "reality shock"

in their transition to full-time teaching where their vulnerabilities and insecurities

manifest in expressions of such negative emotions as anxiety, irritation, and

disappointment (e.g., Moore & Kuol, 2007). For example, the new teacher (Vicky) at the

center of this study became upset when one of her seventh-grade students laughed

disrespectfully at another student's beliefs about an evolutionary link between dinosaurs

and chickens. This behavior irritated Vicky because she felt "that negative experiences

can damage that person's perceived worth when expressing opinions," and can affect

adversely that person's willingness to contribute to subsequent discussions. Fortunately,

in this case, Vicky created a positive outcome from this potentially bad event by

identifying the disrespectful student's remarks as inappropriate, establishing criteria for

appropriate classroom interactions, sharing a laugh with the aggrieved student, and then

following up these actions by mediating a more respectful discussion or interaction ritual

in a subsequent lesson. *Interaction rituals* "are stereotyped sequences of talk and body

language" (Turner, 2007, p. 168). Vicky repeated this sequence of talk in other instances

to establish classroom norms of behavior that she considered appropriate for her class.

From this experience early in her first year of teaching, Vicky promised herself "to

continue creating a positive and supportive classroom." As we have shown elsewhere

(i.e., Roth, Ritchie, Hudson, & Mergard, in press), Vicky used laughter and humor to

achieve intimacy and solidarity (or feelings of membership and belonging) with her

students in recurring IRE interactions (i.e., Initiation-Response-Evaluation, Lemke,

1989). Another type of interaction ritual identified by Vicky as a satisfying experience for her was that which has been referred to in the literature as *dialogical interaction*. A dialogical interaction is one where utterances invoke the text of another speaker who in turn grounds the argument in other speakers' utterances—using it as a step to new knowledge (cf. Wertsch & Toma, 1995). For example, in the utterance: "I said marshmallows and she (referring to Edith) said peanuts" (Ritchie & Tobin, 2001, p. 293), one eighth-grade student builds on the utterance of another (i.e., "she said" with reference to Edith) to make an argument about a predicted experimental result.

The literature consistently reports that bad events or experiences have a greater impact on people than positive events across a range of psychological phenomena (Baumeister, Bratslausky, Finkenauer, & Vohs, 2001). No wonder that the adage, "learn from your mistakes," has become such a popular cliché. Yet, just as Vicky turned a potentially bad experience into something good in the example above, the comprehensive review by Baumeister et al. (2001) concludes: "Even though a bad event may have a stronger impact than a comparable good event, many lives can be happy by virtue of having far more good than bad events" (p. 362). In this study of a new teacher's classroom practices, which employs the ethnographic case method (Walters, 2007), we document how interaction rituals that result in observable positive outcomes and emotional arousal for both the students and teacher are reproduced, thus avoiding overexposure to negative emotions. This focus is supported by recommendations that ongoing research ought to explore cases of positive emotional experiences prevailing in bad times (Baumeister et al., 2001). Furthermore, some researchers assert that research exploring emotions of new teachers is paramount to addressing the issue of teacher attrition and improving

preservice teacher education programs (Schutz, Aultman, & Williams-Johnson, 2009;

Schutz, Cross, Hong, & Osbon, 2007).

**Emotions and Teaching: A Theoretical Orientation**

Before research can address satisfactorily the role of emotions in teacher attrition and

teacher education at the macro or inter-societal systems' levels, more detailed work on

the expression of new teachers' emotions is needed at both the meso- and micro-levels.

Micro-level encounters occur as episodes of face-to-face interaction; and division of

labor and the treatment of individuals in the social organization of communities and

groups are meso-level concerns (Turner, 2007). We included such foci on a new teacher's

reproduction of successful interaction rituals in an earlier study of curriculum leadership

practices in a U.S. school (Ritchie, Tobin, Roth, & Carambo, 2007). In that study we

drew on Interactive Ritual (IR) Theory (Collins, 2004), to find that solidarity and positive

emotional energy were achieved through successful interaction chains reproduced in the

teacher's classroom. These recognizable patterns of speech between teacher and students

and between a department coordinator and a new teacher were reproduced across the

department (i.e., were generalized) for the benefit of other colleagues and their students

under the leadership of the department coordinator.

IR Theory is one of seven theoretical orientations to the sociology of emotions

(Turner, 2009). Collins (2004, 2008) reconceptualized the works of Durkheim (1912) and

Goffman (1967) to advance sociological understanding of emotional arousal through

social interactions that could be identified in societally relevant places including school

classrooms. IR Theory suggests that,

occasions that combine a high degree of mutual focus of attention, that is, a high

degree of intersubjectivity, together with a high degree of emotional entrainment—

through bodily synchronization, mutual stimulation / arousal of participants' nervous

systems—result in feelings of membership that are attached to cognitive symbols [i.e.,

solidarity]; and result in the emotional energy of individual participants, giving them

feelings of confidence, enthusiasm, and a desire for action in what they consider *a*

*morally proper path*. (Collins, 2004, p. 42, emphasis added)

In the example we have referred to in Vicky's classroom, the outcome of the successful

interaction ritual convinced her that she had taken "a morally proper path" that gave her

confidence and enthusiasm to reproduce the ritual in subsequent lessons. According to

Collins (2004), emotional energy is a strong steady emotion that affords participants the

capacity to act with initiative in the micro-details of interaction that manifest in confident

and rhythmically synchronized body movements, eye contact, facial expressions, and

vocalizations. A science class that responds to a group role-play by laughter followed by

spontaneous applause, for example, demonstrates positive emotional energy.

    In their daily classroom encounters teachers experience an up-and-down flow of

emotional energy, valenced positively and negatively respectively (cf. Turner, 2009). On

the positive side, teachers can experience the emotions of elation, excitement and

happiness. In contrast, on the negative side, teachers can experience sadness and even

depression. Typically, the diverse emotional labels available have been categorized into

four primary emotions (Turner, 2002), and combinations of these to form more complex

emotions such as guilt and shame. The primary emotions are: satisfaction-happiness,

aversion-fear, assertion-anger, and disappointment-sadness. Happiness can be classified

as a positive emotion with the other three categories negative (Baumeister et al., 2001). Yet, this oversimplification masks the importance of the relationship between emotions and expectation states. For a new teacher, the reason why satisfaction in teaching is a positive emotional experience is because this would align with the teacher's expectations associated with successful teaching. In contrast, the negative primary emotions of anger, fear and sadness are unlikely to align with the teacher's expectations for successful teaching. More generally,

> When individuals' expectations for self, other, and situation are realized, they will experience mild positive emotions […], and if they had experienced some fear about whether or not expectations would be realized, they will experience more intense variants of positive emotions when expectations are met…. The converse of this generalization is that when the actions of self and others, or situation in general, do not measure up to expectations, individuals will experience negative emotional arousal. (Turner, 2007, pp. 83-84)

The current study of Vicky's emotional expressions in classroom interaction rituals extends our previous work in several ways, as elaborated later. First, we track Vicky's classroom transactions throughout her first year of teaching (as part of a larger study of new science teachers' transitions to full-time teaching). Second, we identify the primary emotions experienced by Vicky during salient interaction rituals that are interpreted principally from the theoretical perspective of IR Theory. Third, we use innovative micro-analytic techniques to strengthen our findings.

Our study is significant because most research on teacher emotion has relied on interviews with teachers (Scott & Sutton, 2009), influenced by psychological rather than

sociological frameworks. For example, Williams-Johnson, Cross, Hong, Aultman, Osbon and Schutz (2008) conducted two semi-structured interviews, separated by four weeks (i.e., pre-teaching and post the first two weeks of school), with each of their purposively selected sample of eight experienced teachers about their emotional transactions with students in the first few weeks of school. Analysis of these interviews provided insights into how these teachers spoke about their teacher selves, building relationships, negotiating the classroom environment, and dealing with emotional events. In relation to emotional classroom events, the teachers' approaches were grounded in their beliefs and how they saw themselves as teachers. Several teachers found it difficult to identify specific emotional events suggesting that either interview was not a fruitful procedure by itself to elicit details about teachers' experienced classroom emotions or the teachers purposively "pushed back" their emotions. Of particular relevance for the current study, Williams-Johnson et al. (2008) argued that many teachers "used tactics to change negative talk in the classroom to reflect a more positive situation" (p. 1598), including shifting directions and emotional regulation. More specifically, they found that "the teachers' awareness of a particular student or types of student emotions served as a cue to monitor and, in these examples, change what they were doing in an effort to reclaim what they perceived to be a classroom more conducive to student learning" (p. 1598). These teachers engaged in emotional work when they deliberately managed their own feelings, adopted different roles in the classroom, and created and maintained a positive emotional climate within the classroom.

Demetriou and Wilson (2009) interviewed a sample of 11 Newly Qualified Teachers and Recently Qualified Teachers from London and nearby counties who specialized in

secondary science teaching. The teachers experienced a range of emotions including joy, despair, delight, frustration and hope. Positive emotional experiences were derived from communicating a vibrant, energetic lesson where a sense of humor was maintained. Successful lessons often were those creative and spontaneous lessons that were enjoyable for the teachers and yielded identifiable learning outcomes for the students which collectively strengthened teacher-student rapport. These teachers reported success from taking time to reflect on their teaching and their interactions with students (see also Baird, 1999), as well as engaging previously disinterested students through alternative teaching strategies.

In contrast to interview studies, Winograd (2003) conducted a self-study of his emotional return to classroom teaching as an elementary teacher for one year while on sabbatical leave from his teacher education faculty position. He identified with new teachers who also experience a wide range of emotions in their early years of teaching. For example, he concluded: "My feelings of inadequacy were normal and akin to those of all beginning teachers (Nias, 1989). However, I tended to keep these feelings to myself and engaged in what Lortie (1975) called self-accusatory and self-blaming behavior" (pp. 1668-1669).

Just as Winograd (2003) became despondent as he focused on the negative emotions associated with his lack of success in realizing his expectation states for his teaching, Cross and Hong (2009) reported on the negative emotions of an experienced teacher when confronted by curriculum reform that did not align with his own beliefs and practices. Whereas an overemphasis on negative emotions can lead to stress and self-doubt, Demetriou and Wilson (2009) argued that,

[e]ncouraging newly qualified teachers to acknowledge that it is healthy and necessary to experience such emotions, and to continue to be reflective about their experiences and emotions requires time, support and a focus and can be enhanced through learning conversations; peer observations and classroom focused development work. (p. 226)

**Method**

Our study of Vicky's emotional interactions during her first year of teaching can best be described as an ethnographic case study (Walters, 2007). The research strategy was a *case study* because Vicky's classroom emotional transactions were the phenomena under investigation rather than the school or her classroom more generally, and as *ethnographic* because the students with whom Vicky interacted and the school form essential components of the culture and context in which the transactions occurred. Merging ethnography and case study in this way signals that the social system and culture in which Vicky experienced teaching was an important constituent of who and what she was and could be as a science teacher (cf. Walters, 2007). The strength of ethnography "is its emphasis on understanding the perceptions and cultures of the people and organizations studied…. [T]he ethnographic researcher is able gradually to enter their world and gain an understanding of their lives" (Walford, 2007, p. vii).

 In relation to studying teacher emotions, specifically, Zembylas (2005) argued that an ethnographic approach was necessary to understand teaching and the political basis for emotional changes of teachers. In his ethnographic study of an experienced elementary teacher's emotional shifts during science lessons, Zembylas drew on analyses of his observations, interviews with the teacher, and artifacts that included classroom materials, field notes and the teacher's diary. Apart from a declared interest in science teaching,

Zembylas chose science lessons to observe because "there was a lack of any research on teacher emotion in this area" (p. 472) at that time. Even though Zembylas video-recorded science lessons taught by the teacher, analyses of interactions between students and teacher were not reported.

As described below, we accessed multiple data sources in our ethnographic case study. Other ethnographic features of the study included: relatively prolonged immersion in the field (i.e., one year); suspending premature judgments about what constitutes data, and allowing for the emergence of new questions from the fieldwork and preliminary analyses; accessing multiple data sources from multiple perspectives (e.g., insider and outsider); and attending to subtlety and complexity of the context (Walters, 2007). Before detailing the data sources and analyses, we contextualize the study by providing a brief background to the teacher and research site.

*Background*

Vicky was appointed to teach seventh-grade science, mathematics and Christian studies at a well-resourced independent school in South East Queensland, Australia, after graduating with a graduate diploma of education. Ritchie was her science education teacher during the graduate diploma. Prior to entering this program, Vicky completed her first degree in Health Science with a major in nutrition, which led to a brief career as a nutritionist within a pharmacy. Unlike the teacher in Zembylas's (2005) study, who experienced *emotional suffering* due to misalignment between her beliefs about testing and those of her colleagues and school, Vicky's Christian beliefs aligned well with those expressed in the school's prospectus and its practices.

The science class we studied was scheduled for two or three (occasionally Vicky

borrowed an additional lesson for lab work from her mathematics schedule with the same

class) 50-minute lessons per week in a well-appointed laboratory/classroom where desks

and chairs were arranged in rows with ample bench space forming the perimeter of the

room. Whereas Vicky used the whiteboard at the front of the classroom for annotations

and notes, she also used a data projector to illuminate images of artifacts relevant to the

topics. Although almost all lessons observed involved student activities at the lab

benches, each lesson typically began with formal announcements and teacher-student

interactive segments about the topic with students seated at their desks and Vicky

positioned at the front of the class. When students participated in group activities at the

benches, Vicky visited each group to monitor progress, issue equipment and engage in

conversations. Occasionally a laboratory technician or teaching assistant was present

during class time to assist students with equipment and help distribute materials.

*Data Sources*

The multiple data sources accessed were lesson observations and video recordings of

those lessons, Vicky's post-lesson coding of video-recorded lessons, stimulated recall and

end-of-semester interviews with Vicky, personal narratives of Vicky's experiences, and

one cogenerative dialogue (Tobin & Roth, 2005) involving three selected students,

Vicky—who is also a co-author of this article—and two of the other three members of

the research team (i.e., Ritchie & Tobin).

*Video-recorded lessons*. Hudson and/or Ritchie observed 11 lessons throughout the

year. Seven of these were video-recorded and coded by Vicky (post-lesson) using

Studiocode™, a software package that captures and enables manipulation of identified

instances. Vicky coded instances, typically during post-lesson stimulated recall interviews, which corresponded to her recall of experienced primary (and related) emotions, by pressing computer hotkeys pre-programmed in Studiocode™. To afford more detailed microanalysis and transcription, other researchers expanded the 10-second instances Vicky identified. Selected group activities also were recorded using a mobile Flipcam during another three lessons. The observer typically followed Vicky from group to group to record noteworthy interactions that initially appeared to be characterized by either positively or negatively valenced emotional energy.

*Interviews.* Even though we relied most heavily on video recordings for analysis, post-lesson interviews were conducted because, as Olitsky (2007) argued, participants should have a conscious awareness of whether their interactions were successful because they would feel energized and positive about the activity of the group. Five stimulated recall interviews were conducted immediately following the related lessons. In these interviews, Vicky was asked to pause the video replay when she could recall her emotions. She then volunteered how she felt at the time and the circumstances that aroused those emotions. The interviewer sometimes sought further clarification and occasionally asked whether these were typical or atypical experiences, eliciting descriptions of examples (or non-examples) from lessons not observed by the research team. Each stimulated recall interview took 60 minutes to 90 minutes. Over time, these became uneconomical because they intruded too heavily into Vicky's busy schedule. Seven other interviews of varying durations (i.e., between 30 and 90 minutes each) were conducted with Vicky throughout the year. These interviews focused on specific issues observed during the lessons and Vicky's perceptions of her transition to full-time teaching. Vicky also reviewed segments

of video for descriptive background and to check on the accuracy of transcriptions. Ritchie and/or Hudson conducted most interviews, but both Tobin and Roth conducted separate end-of-semester interviews for the purposes of checking the accuracy of the data, clarifying issues, and checking the viability of tentative assertions.

 *Other data sources*. Vicky wrote personal narratives of her experiences throughout her first year. These helped recall her experiences during end-of-semester interviews, but they were not accessed directly for data analysis in this study. Similarly, one end-of-semester cogenerative dialogue (i.e., "cogen") was conducted with Vicky, three students (Bree, Tabatha and Martin), and two researchers (Tobin & Ritchie) during the lunch break. Cogen is a reflective conversation about what happened in class and how to improve the quality of teaching and learning. When cogen is used as method, members from the research team join the teacher and several selected students to discuss what happened in the class, what improvements could be made, and what worked well (Tobin & Roth, 2005). The data from the cogen session supported our assertions in that the students were able to confirm their feelings during video recorded events and identify patterns in speech and body language that signalled how Vicky was feeling at key moments during lessons.

*Video Analysis of Events*

The interviews helped us to appreciate Vicky's experience as a new teacher and to refine our coding procedures (e.g., we identified different sorts of laughter that were coded after the initial coding of the primary emotions—see Roth et al., in press). Nevertheless, in this study, we draw heavily on the teacher-student interactions that were observable to both the students and the teacher. In particular, we have selected events from two lessons from

different units separated by some five months. The first lesson on water featured students' group work positioned at benches around the perimeter of the room. The first event reported here was selected because it featured a conversation that illustrated how Vicky celebrated different cultural stances that she expected in her science classes. As well, it was an event that linked to our opening example of a potentially negative emotional encounter for Vicky at the beginning of her career – one that was at odds with her expectations of appropriate classroom interactions. Subsequent videotapes for a similar event were searched without success until the topic shifted to mountain building. In one of these lessons, one event (Event 3) was characterized by positive emotional energy, but most others were unusually flat where the interactions did not produce positive emotional energy. For comparison purposes, one of these events (Event 2) was contrasted with the successful event (cf. Collins, 2004).

We use "event" to refer to a happening, like Vicky's experience with one student ridiculing another's beliefs, "that significantly transform structures" (Sewell, 2005, p. 100) that can "begin with a rupture of some kind" (p. 227) and then touch off "a cascading series of further ruptures that will result in structural transformations—that is, changes in cultural schemas, shifts of resources, and the emergence of new modes of power" (p. 228). Whereas Sewell (2005) described the "powerful emotional releases" (p. 249) associated with major historical events, classroom events that transform subsequent structures also are likely to involve unpredictable shifts in emotions.

After identifying the salient events, each video clip was played and replayed at both natural speed and then frame-by-frame. Transcripts were made of the interactions, and where relevant, overlapping speech and pauses were measured and noted. Observations

of the participants' facial expressions, gestures, and other body movements were noted alongside the associated speech.

In the first instance, utterances were scrutinized in terms of the semiotic resources each speaker made available to other participants, whether these were non-verbal (e.g., gestures) or verbal (e.g., laughs and utterances). We assumed, as in conversation analysis (CA) (e.g., Selting, Auer, Barden, Bergmann, Couper-Kuhlen, & Günthner, et al., 1998), that these are the resources made available to each speaker with which to make sense of the utterance in the moment. Each turn, then, was related to preceding and following turns in such a way that turn pairs became the fundamental unit of analysis. Not all CA conventions were used in the analysis of these records, however. For this reason, and for ease of use by readers unfamiliar with CA, we have adopted conventions used commonly in video analysis of science classrooms (e.g., Olitsky, 2007). These conventions are represented in Table 1.

Insert Table 1 here

A recent innovative ethnographic study of (science) intern teachers in the U.S. (Roth & Tobin, 2010) focused on the prosodic analysis of teacher-student transactions. Prosodic characteristics (i.e., pitch, intensity, rhythm) were used to attribute social alignment between teachers and students. Those interactions that were judged successful were associated with the convergence of prosodic parameters between teacher and students. On this basis, Roth and Tobin argued that the analysis of speech parameters is a powerful tool for ethnographers who study naturally occurring situations including the emotions and changes thereof that participants make available to one another.

Prosodic characteristics of utterances of interest in our study were measured for pitch or vocal frequency (fundamental frequency, $F_0$ [Hz]), vocal intensity (dB), and speech rate (syllables/s)—the main reliable variables used in studies of the vocal expression of emotion (Scherer, 1989). Yet, the predominant method used to develop evidence for discrete emotions and comparative benchmarking has been actor portrayal of emotions. As well as some unresolved inconsistencies across studies, Juslin and Scherer (2008) acknowledge, "the jury is still out" (p. 89) on the extent to which there is sufficient alignment between actor portrayal and natural talk. Another concern with the application of prosody in natural settings is that studies from different disciplines are not easily integrated. In relation to the differences between psychological and linguistic approaches, for example, Juslin and Scherer note that "[w]hile linguists may argue that psychologists do not take language and interaction into consideration, psychologists may retort that linguists stay psychologically uninformed and focus too much on ill-defined concepts" (p. 67). Nevertheless, in relation to speech rate, social linguists (e.g., Szczepek Reed, 2010) make the irrefutable point that English speech is rhythmic, "created by the distribution of its stressed syllables at roughly regular intervals" (p. 1038), where stress is defined as the "syllable prominence through loudness" (Szczepek Reed, 2006, p. 6). This means that despite Scherer's use of speech rates for the benchmarking of emotions, as calculated by syllables per unit of time (typically, per second), this could only be a crude indicator for identifying discrete emotions from speech, which suggests that prosody should be used alongside other approaches in studies of emotional arousal in naturalistic settings.

In relation to pitch, because the "fundamental frequency is directly proportional to the length of the vocal folds, males, females and children have rather different modal fundamental frequencies" (p. 173). Accordingly, Scherer (1989) recommends that great care should be taken in comparing the $F_0$ measurements of males and females. For this reason, only events from single sex (i.e., females) participants were compared in this study. That is, all events analyzed here involve interactions exclusively between females. Whereas there will always be exceptional cases, the general trend observed in actor-portrayed emotional utterances in laboratory contexts is that "Emotions with high arousal and activity are characterized by increased $F_0$, range, and variability, as well as intensity, whereas the opposite is true of more passive, withdrawn emotions" (p. 184). This means that it would be reasonable to predict higher measurements of $F_0$, for example, for joy/elation (e.g., Events 1 and 3) than boredom/indifference (e.g., Event 2).

PRAAT software (http://www.praat.org) was used to work with the soundtrack (aif File) of selected events to measure the pauses using the waveform display of the sound, and to establish measurements of the relevant speech parameters. The use of PRAAT software for prosodic analyses of selected emotional events from the video-recordings, some of which Vicky had coded using Studiocode™ software, provided innovative procedures for the study of her in-the-moment emotional experiences. Chang (2009) recommended that such technological procedures were necessary to understand teachers' in-the-moment emotional classroom transactions. Researchers (e.g., Scott & Sutton, 2009) who argue that interview studies are limited because they fail to recognize "teachers' emotions change day by day, class by class, sometimes even moment by

moment" (Chang, 2009, p. 203), reinforce the methodological position we have taken in this study to complement interview data with less inferential microanalysis of video clips.

**Reproducing Positive Emotional Rituals**

In this section we present evidence from three different events to build an argument to support an assertion that *dialogical interactions afforded students opportunities to contribute to the production of positive emotional energy*. We begin by illustrating how one group of students generated positive emotional energy through its dialogical interactions with Vicky (i.e., Event 1). We follow this with our analysis of contrasting events from a lesson five months later. In one event (i.e., Event 2), we show how the interaction was flat in that it did not produce positive emotional energy. In the final event (i.e., Event 3), we show how this emotionally positive interaction was reproduced in multiple (cascading) episodes, and was defined by humorous exchanges that led seamlessly to the expression of relevant science content, as accepted by Vicky, through dialogical conversation.

*Dialogical Versus Univocal Interactions in the Production of Positive Emotional Energy*

In this part of our analysis we contrast dialogical interactions (Events 1 and 3) with a related univocal interaction (i.e., Event 2, in which the speakers did not build on the utterances of others) to show that dialogical interactions were perceived and experienced as positive emotional encounters by Vicky.

Where does water come from?

The first (65 s) event (i.e., Event 1) analyzed here relates to a small group discussion between Vicky and the students in Group 4 (Trish, Narelle, Sam). This was Workstation 4, situated at the back of the classroom. The lesson was planned around workstations

positioned to the side and back of the classroom. The workstations related to the topic of

the unit on water, and Workstation 4 focused on the water cycle which included a

question: "Where does water come from?"

Vicky takes a seated position next to Trish just prior to Turn 01. Vicky leans into the

group with her elbows on the bench. She initially engages eye contact with Trish in Turn

01 before responding to Trish in Turn 02. This event represents a dialogical interaction

because Vicky builds on the utterances of her students (Turn pair: 15 & 16, followed by

Turns 18 & 20), and Trish comments (Turn 13) on Narelle's explanation (Turn 12).

<u>Event 1: A Positive Dialogical Interaction Emanating From Fearful Expectations</u>

| 01 | Trish | () |
|---|---|---|
| 02 | Vicky | A weird documentary thing |
| 03 | Trish | Yeah (.) in year 5 and 4 and there was this cartoon (.) and the water goes up into the sky and in the clouds and turns to ice (.) then it started falling |
| 04 | Vicky | Was it <u>ice</u> when it fell? |
| 05 | Trish | Yup and it started falling and then because it got hotter and hotter (.) hh and the water (.) the hail turned to water and rained. Big chunks turned to rain |
| 06 | Vicky | ((Distracted by two passing female students carrying small tree branches)) ((To the passing students)) #In the box thanks ladies and then find your group# ((Vicky's gaze follows girls, screws her face and comments to Group 4)) The poor wildlife ((Vicky laughs without an audible sound as she re-engages eye contact with Trish)) |
| 07 | Trish | haha\|ha\| |
| 08 | Narelle | \|And\| in year 1 we had this teacher and she told us how to make clouds |
| 09 | Vicky | Okay |

| 10 | Narelle | It was like hot water in the bottle and like then you had i:ce |
|----|---------|---------------------------------------------------------------|
| 11 | Vicky | O:h okay |
| 12 | Narelle | So then you had ice on top so the clouds |()| |
| 13 | Trish | |That| was so co:ol |
| 14 | Vicky | ((With raised eyebrows)) Did you know that some Indigenous people say that the rain spirits are crying sa:d when it is raining |
| 15 | Trish | Or it could be God is just watering his garden or |something| |
| 16 | Vicky | |God| is watering his garden |
| 17 | Trish | hahaha |
| 18 | Vicky | ((smiling)) another one |haha| |
| 19 | Trish | |haha| |
| 20 | Vicky | So you can grow big and stro:ng |
| 21 | Trish | haha |
| 22 | Vicky | Okay so we kno:w about that what happens to rain when it falls to the ground |

Whereas Trish's opening comment is inaudible (however, at interview, Vicky remembers hearing something about ice in the clouds), Vicky paraphrases her comment in Turn 02. As she recalled at interview: "I was really happy that she'd talked about this documentary that she saw and that I had picked up, that was the whole purpose of that activity, pick up whether there was any misconception." Interestingly, Vicky had prepared for this activity by Googling student misconceptions on the water cycle, only to be disappointed that there were so few hits identified in her search. Despite Vicky returning to the group because she thought she had heard Trish express a misconception, Trish does describe a reasonably accurate explanation for rain melting from hail stones in large cloud formations in Turn 05.

During the post-lesson stimulated recall (SR) interview, Vicky expressed excitement about this activity initially. As she declared during this interview,

> I was really excited about… that activity went well, and I think that is also a really good one for about identifying misconceptions…. Now this: one, this one, I was really happy, oh no, oh yeah, here we go, this one is 'H', because Trish said something and I was going to walk away and then I came back because she said something really *weird*.

There are two related points of importance here. First, the pace of Vicky's speech picks up (i.e., the first sentence has a speech rate of 2.6 syllables/s and 0.5 stressed syllables/s, whereas the second sentence increases to 4.3 syllables/s and 0.9 stressed syllables/s, with "this" stretched to 0.5 s) reflecting her excitement during the interview as she recalls her excited state at that moment in the lesson. She stumbles to find the right hotkey on the computer keyboard before finding "H" that indicates her primary emotion of happiness. Second, the fidelity of Vicky's recall is enhanced further by her use of *weird* in the paraphrased Turn 02 from the transcript of the event, which has a rising and falling contour. The video source that was used to stimulate Vicky's recall in this interview had failed to record sound of the lesson (yet the sound for this interaction was recorded on the Flipcam, which was used later for transcription purposes), so Vicky's response at this stage was stimulated by video images alone. This means that Vicky accurately recalled the student's use of the word without a sound prompt.

Vicky added the mythical story to the conversation in Turn 14, "just as a side note," to add "interesting facts…just to get them talking and get them thinking." Here, Vicky presses the "F" hotkey (for Fear) to indicate a level of concern she felt about the possible

response of her students to her account of mythical beliefs by some Indigenous peoples to explain rainfall. Vicky explains her reason for worrying as,

Well I just think sometimes children don't think about what they're going to say before they say it and we've had inappropriate, not particularly about any people group or anything like that, but you know, inappropriate comments before. I guess I was a bit worried about inappropriate comments like, oh that's dumb or something like that, but they didn't.

This comment also links back to Vicky's first encounter with inappropriate comments expressed in the introduction. No wonder her emotions shift suddenly from happiness to fear as soon as she utters the words in Turn 14. As Vicky elaborated,

I just worry about the attitude, you know, like, that kind of attitude and paying out other people's beliefs and that kind of thing…. So I am concerned, like, I guess what goes through my head is, oh they just said something inappropriate. What am I going to do about it? How am I going to approach it? How am I going to tell them it's inappropriate without sounding angry and blaa, blaa, you know, like those sorts of things go through my head…. I don't want to appear angry but I do want them to know it's inappropriate.

Even though Vicky's pre-lesson preparation of reading about related Indigenous legends might have been activated in this instant, Vicky admits her utterance was unintended for that moment, "It just popped into my brain."

Vicky's comment in Turn 14 opened up the possibility for responses of derision. Group 4's acceptance or at least non-rejection of the Turn is possibly due to it being the teacher's comment rather than another student's. Aligned with Vicky's introduction of a

mythical and non-scientific explanation, Trish spontaneously follows up with another

mythical/non-scientific explanation that features a religious rather than Indigenous belief

in Turn 15 that is paraphrased by Vicky in Turn 16. Upon hearing Vicky's

acknowledgement of her contribution a brief laugh by Trish in Turn 17 is set off

immediately. In synchrony with Trish's laugh in Turn 17, Vicky laughs into her further

acknowledgment of Trish's recognition of alternative explanations for the water cycle in

Turn 18, which sets off another laugh by both Vicky in Turn 18 and Trish in Turns 19

and 21.

　　Vicky's concerns are unfounded in this event. The students do not make any

inappropriate comments and Vicky does not have to intervene to bring to their attention

what constituted inappropriate comments. Unsurprisingly, Vicky's positive emotional

arousal from this event (e.g., "I was really excited…") is intense, possibly because, as

theorists point out (cf. Turner, 2007), her fearful expectations are not realized. Vicky

again employs laughter, which she had used previously to diminish the likelihood of

disrespectful challenges to personal beliefs. That is, laughter accompanies trailing (and

leading) comments during small group conversations. In this event, Vicky first initiates

laughter (silently) in this way in Turn 06 that Trish reciprocates immediately in Turn 07

with an audible laugh of similar duration and intensity as the repeated structures in Turns

17 ($t = 0.5$ s; $F_0 = 426$ Hz; Intensity $= 70$ dB), 19 ($t = 0.5$ s; $F_0 = 342$ Hz; Intensity $= 72$

dB), and 21 ($t = 0.5$ s; $F_0 = 347$ Hz; Intensity $= 74$ dB), demonstrating synchrony of

actions and emotions between Vicky and Trish.

　　Importantly, whereas Vicky offered an Indigenous alternative explanation, Trish

responded with a Christian alternative explanation, suggesting that Trish felt comfortable

that her comment would not be dismissed or derided by her teacher and group members, especially when laughter was associated with the utterances. It seems that use of laughter associated with expressions of alternative explanations is a structure that might encourage students to express themselves openly. In this case, Vicky led the unfolding sequence of positive emotionally charged exchanges with reference to an Indigenous alternative explanation, a structure repeated in the next event in a different group on the topic of mountain building.

How are Mountains formed?

Five months later, the topic was mountain building. In the planned lesson sequences observed during the week, the main task for students was to build a three-dimensional model of a mountain from a photocopy of a contour map. Each group was allocated one of the Glasshouse Mountains—a cluster of volcanic plugs not too far away from the school. In the second lesson observed from this unit, as groups continued to cut out and paste various layers of cardboard together, Vicky moved between each group to ask questions about their understanding of mountain building and how the Glasshouse Mountains, in particular, formed. Like the water cycle topic in Event 1, this was a topic that afforded an opportunity to explore Aboriginal legends and possibly share students' personal and alternative beliefs. Unlike her experience in Event 1, Vicky's questioning routine fell flat. In other words, there was a lack of positive emotional energy, and the interactions were univocal rather than dialogical—the conversation faded out quickly. In Group 2, for example (three girls), Vicky asked, "What about the Indigenous legend that we talked about?" The conversation continued between Bree and Vicky in Event 2, with both of the other girls looking on.

Event 2: A Flat Univocal Interaction

| 01 | Bree | #We did it, we did it#, yeah we did |
|----|------|-------------------------------------|
| 02 | Vicky | Yeah |
| 03 | Bree | <u>How</u> they had a <u>ba:by</u> and one of them they threw it down from the mountain or something ((twirling hair throughout)) That was ages ago ((Tabatha turns head away from Vicky, demonstrating non-alignment of bodies and eye-gaze)) |
| 04 | Vicky | That was ages ago wasn't it? <u>Cool</u> (.) <u>So</u>: (1.0) Alright |
| 05 | Tabatha | ((with reference to their drying model)) Can we put it outside? |

Prior to the interaction episode, Bree had yawned for four seconds while maintaining eye contact with Vicky, which Vicky read as "disinterest" (SR Interview) as evident by Vicky's question at that moment, "Am I boring you?" This signal marked Vicky's move to question the group about the Aboriginal legend of how the Glasshouse Mountains were formed prior to Turn 01, that Bree completed in Turn 03. Prosodically, in Turn 04, the question: "That was ages ago wasn't it?" had a speech rate of 6.3 syllables/s (without stressed syllables); $F_0 = 240$ Hz; and Intensity = 69 dB. In the same turn, "so" had somewhat of a flat contour where $F_0 = 311$ Hz. Following a different contour, "alright" began at 330 Hz dropping off to 247 Hz (mean=281 Hz). Both words maintained about the same intensity of mean = 71 dB and 72 dB, respectively. The 1.0-second gap between "so" and "alright," Vicky recalled, was spent considering whether to ask another question as the following SR interview transcript shows,

> Vicky    I was thinking should I bother keeping on questioning them or should I just move on.  And then I looked up and saw the clock, and Okay moving on.

Researcher The only way that you determined to move on was because of the time on

the clock?

Vicky        Well the time and also you know, their disinterest.

At no stage in this event was the conversation characterized by laughter or jokes.

Furthermore, the other two group members remained silent until Tabatha changed the

topic in Turn 05 by asking an unrelated question, perhaps another sign of disinterest.

This group was typically one of the most energetic or "bubbly" (Tabatha, cogen)

groups in the class, so again, the failure for Vicky's expectation (of a successful

interaction) to be realized accounted for her emotional arousal, this time a rather flat or

despondent feeling. Interestingly, during the cogen session, Bree and Tabatha were

surprised and apologetic when they inspected still shots of this interaction. Red faced,

Bree remarked, "We really love you Miss," which evoked laughter from Vicky that

spread to include all cogen participants, including Bree and Tabatha.

Even though Vicky's subsequent interactions were monitored continuously with

different groups, Vicky did not ask other groups the question about the Aboriginal

legend, suggesting a lack of success in reproducing the structure of a dynamic and

emotionally charged conversation she experienced in Event 1. Vicky confirmed this

interpretation during an interview, "I kind of gave up on it because they weren't really

interested about it. They just seemed really, 'whatever,' you know." This also

demonstrates that conversation starters that do not evoke anticipated responses, and

reproduce previously successful interaction chains (cf. Collins, 2004), are abandoned in

the moment until an alternative starter is found to reproduce the structure.

As the lesson closed, we asked Vicky on the fly what was the highlight of the lesson for her. Without hesitating, she quickly replied, "the last group." The video recordings from this group show that, in contrast to Event 2, within a span of just 6 minutes, there were four dynamic episodes that each followed the same pattern of Event 1—a structure valued by Vicky (as evident in her post-lesson comment).

For greater clarity and to sustain focus, only Episodes 3 and 4 are detailed here. The first episode however, related to Vicky's questioning about the formation of the Himalayas (i.e., folding mountains resulting from the collision of two tectonic plates). Vicky then asked: "Did you know that Miss Nolan (another teacher who is familiar to the students) is going to climb Mt. Everest in the holidays?" Once the students appeared to be attentive, and after a brief pause, Vicky announced (smiling): "To the base camp (biting lip, pausing)," before laughter erupted from the students and Vicky in unison once the joke had been realized. The joke, rather than the planned Aboriginal legend, evoked a high-energy and generalized response from the students. Vicky's initiation of humor in this small-group setting opened up the possibility for the students to reciprocate in subsequent interaction chains to lead off with humor, just as Trish had done in Event 1.

In the third episode, one of the students (i.e., Lizzy) related the conversation to a MacDonald's television commercial that played on the old myth of digging a hole in the ground deep enough that it would reach China, where, of course, you could then purchase a hamburger, to which Vicky jokingly asked, "Do you mean to say that Mackas is responsible for the misinformation of today's youth?" Vicky's response here recognizes the student's humorous contribution at the same time as noting that it is not consistent with scientific explanations. As Vicky accepts the student's contribution, she uses it

dialogically to relate back to the conceptual issue of a hotspot, which, in turn, is taken up

by the other students in their subsequent responses—elevating energy levels through their

laughter.

As detailed below in the (20 s) excerpt for Episode 3, the topic then shifted from

mountain building through the collision of plates as in the case of the Himalayas, to the

formation of the Glasshouse Mountains.

<u>Event 3 Episode 3: The Production of Positive Emotional Energy</u>

| 01 | Vicky | Remember how we talked about a (…) a hotspot? |
|----|-------|-----------------------------------------------|
| 02 | Madison | ((Nodding)) \|Yeah\| |
| 03 | Lizzy | \|Yes\| |
| 04 | Vicky | Remember? |
| 05 | Maggie | Yes |
| 06 | Vicky | Okay |
| 07 | Lizzy | Was that about a farmer? |
| 08 | Vicky | ((Maintaining eye contact with Lizzy)) #Okay that was China that was different# ((smiling and laugh)) |
| 09 | Sally | ((Smiling)) That was \|China\| |
| 10 | Lizzy | ((Laughing)) \|That\| was China |
| 11 | Vicky | That's where \|mackas was\| ((laugh)) |
| 12 | Lizzy | \|That was China\| |
| 13 | Vicky | Yeah Yeah |
| 14 | Madison | <u>Mack</u>(h)as ((laughing)) |
| 15 | Vicky | So (..) explain (.) cause #I explained to you, you explain to me# how you think the Glasshouse Mountains were formed? |

Vicky declares her intentions in Turn 01 by asking students if they remember a previous discussion in class on hotspots, and how these relate to forming mountains like the Glasshouse Mountains (Turn 15). Whereas there appears to be general agreement within the group in Turns 02-06 that they remember hotspots, Lizzy transforms the structure of the conversation from information recall (i.e., IRE) to a joking interaction chain where participants display positive emotions that they shared moments earlier in relation to the McDonald's advertisement when a farmer digs a hole to China, by asking: "Was that about a farmer?" in Turn 07. As in Event 1, Vicky accepts the student's (in this case, Lizzy) contribution by recognizing her attempt to return to the previous conversation, but at the same time noting that it is unrelated to the current question (Turn 08). Importantly, Turn 08 trails with Vicky's laugh that sets off leading and trailing laughs in Turns 09, 10, 11, 14, and overlapping speech turns (e.g., Turns 09, 10, 11, 12) that show group effervescence and solidarity (cf. Collins, 2004). As in the previous events, Vicky's response in Turn 08 shifts the power back to the students momentarily before resuming her intended dialogical structure with another task-related question in Turn 15. This recurring structure acknowledges student contributions, no matter whether they are task-related or not, or whether they are mythical or scientific. In groups (i.e., Events 1 and 3 here, but more generally elsewhere—see Tobin, et al., submitted) where Vicky leads with alternative explanations associated with humor, students respond with positive emotional energy that can lead to subsequent and effective task-related discussions (see also, Episode 4 on mountain building, which follows).

Prior to Episode 4 Vicky had drawn a representation of a volcanic plug on a piece of cardboard. There was mutual focus on the drawing and students listened to Vicky's

explanation that refers to weathering of rock outside of the plug. Melissa then relates

what the class had seen about the volcanic eruption of Mt. St. Helens to Vicky's

explanation of the formation of the Glasshouse Mountains, before Lizzy continues in

Turn 01 below.

Event 3 Episode 4: Reproducing the Dialogical Interaction Ritual

01    Lizzy      If you see a meteorite so it was like that big (.) dish (.) thing (..) It looked like

              that

02    Vicky      Oh, yea (.) didn't the si:de of it blow out?

03    Melissa    Yeah

04    Vicky      Was it the si:de?

05    Melissa    Yeah well at the end as well it erupted like seven times

06    Vicky      Seven?

07    Melissa    |Yep|

08    Maggie     |I |thought it was ten

09    Vicky      |Wow|

10    Melissa    |Oh| no it was 10 actually

11    Vicky      Wow

12    Melissa    It was like seven more times because we have already spoken of three

13    Lizzy      Ye(h)ah ((laughing))

14    Melissa    It was smaller, it was and then it kept on erupting next week and then a

              couple of weeks after that

15    Vicky      So it kept on going like little minor ones?

16    Melissa    Yeah

17    Vicky      So okay it had a big one

| 18 | Lizzy | And then it had another one and it was bigger |
| 19 | Vicky | Really (.) far ou:t |
| 20 | Melissa | A couple of weeks later |
| 21 | Vicky | <u>So</u> (.) it blew the side of the mountain off and now the magma was #building up again causing the mountain to grow again# |
| 22 | Melissa | Yeah |
| 23 | Vicky | Oh right |
| 24 | Melissa | Yeah, so they said the mountain was going to explode again |
| 25 | Vicky | That's a worry |
| 26 | Melissa | Yeah |
| 27 | Lizzy | I like the look of cool lava into swirls like the patterns you know like its cool swirls |
| 28 | Vicky | O:h the patterns. #I thought you said lava is cool and I'm like no it's not# actually |
| 29 | Melissa | ha\|ha\| |
| 30 | Vicky | \|ha\| |
| 31 | Lizzy | No it co:ols |
| 32 | Vicky | Right |

   Prosodic analysis of Turns 21 and 23 of Vicky's vocal expression were conducted so
that comparisons between matched utterances with those from Event 2 could be made.
Without introducing unnecessary complexities into the analysis (e.g., comparing prosodic
features of polysyllabic and monosyllabic words, and of vowels and consonants), the
word "so" in Turn 21, Event 3 (Episode 4) was compared with "so" from Event 2, and
"oh right" in Turn 23, Event 3 (Episode 4) was compared with a similar pair of syllables

in "alright" from Event 2. The relevant prosodic measures for "so" in Event 3 were: $F_0 =$ 287 Hz, Intensity = 69 dB; and "oh right" were: $F_0 = 261$ Hz, and Intensity = 64 dB. The utterances of "so…oh right" in the highlight event (i.e., Event 3) were predicted to be generally higher than "so alright" in the flat clip (i.e., Event 2). Whereas there were differences between the prosodic measures for these utterances this analysis was inconclusive. Accordingly, the more inferential data from the observable acts of laughter and interview transcripts were needed to support an assertion that Event 3 was more positive emotionally than Event 2 for Vicky.

The prosodic differences between the two events were more noticeable, however, when two of Vicky's questions of identical number of syllables were compared. In Turn 02 in Episode 4 (Event 3) ("oh yeah didn't the side of it blow out"), $F_0 = 332$ Hz and Intensity = 70 dB, whereas these corresponding measurements for Turn 04 in Event 2 ("that was ages ago wasn't it") were all lower; namely, $F_0 = 241$ Hz and Intensity = 68 dB. Even though the comparison of the prosody of similar utterances was inconclusive, and required qualitative data to differentiate between them, the comparison of the prosodic parameters of like questions, convincingly demonstrated that Event 3 was emotionally more positive than Event 2.

As we have shown previously, Vicky and or her students made (humorous) comments to which others laugh. In Episode 3, for example, Lizzy's question in Turn 07 was taken as humorous by Vicky in Turn 08. Yet, humor also was used by students (e.g., Trish in Event 1) to demonstrate an appreciation of the difference between mythical and canonical explanations of phenomena. The teacher too used humor in relation to checking student understanding. In Episode 4, Vicky's comment in Turn 28 plays on the double meaning

of "cool" expressed by Lizzy in Turn 27 in regard to lava. This comment not only checks
that the students realize that molten lava solidifies when it cools (as verified by Lizzy in
Turn 31), but also is taken as a humorous utterance by Melissa who laughs spontaneously
in Turn 29 which is reciprocated by Vicky in Turn 30. This style of interaction was
highly valued by Vicky, who explained why this group was the highlight of the lesson, as
follows,

> The fact that they wanted to talk about it was the first thing. They wanted to discuss
> the actual topic instead of going off the topic. The other thing was that they were able
> to tell me information but in their own words. The fact that they had understood what I
> was saying. They had thought about it and then put it into a way that they understood
> it. That would be, you know, funny.

*Summary*

From our analyses thus far, we have shown that dialogical interactions were positive and
satisfying experiences for the teacher. Shared humor and group effervescence (laughter)
typically accompanied these successful interactions. As well, some evidence showed that
the teacher in these successful interactions expressed vocalized positive emotions.
Furthermore, the teacher reproduced these structures successfully in different contexts
when another interaction ritual fell flat (i.e., teacher initiation of an Indigenous
perspective in Event 2).

In these successful interactions both teacher and students used humor to create a
structure for dialogical interactions. The students injected humorous comments that
linked previous conversations and resources to the topic. Participants took up these
moves for short periods, contributing to the achievement of group effervescence.

**Discussion and Further Reflection for New Teachers**

The teacher in this study experienced positive emotional arousal when her positive

expectations for teaching were realized (Event 3) and when her fears for negative

outcomes were not realized (Event 1); and she experienced negative emotions when her

positive expectations were not realized (Event 2). More specifically, the teacher was

satisfied (even excited) when the students discussed the planned scientific content of the

lessons through dialogical conversations, but became somewhat despondent when her

interactions with students could achieve only univocal conversations, where the students

demonstrated disinterest in the topic of conversation. This finding coheres well with

several studies from a social-psychological perspective (see Sutton, 2007). From this

perspective, the intensity of aroused emotions is dependent on the relevance or

importance of events (Chang, 2009). More importantly, the study provides evidence from

a new teacher's classroom to reinforce the first principle of Turner's (2007) sociological

theory of emotions; namely,

> [w]hen expectations for self, other, and situation are met in an encounter, individuals
>
> will experience mild positive emotional arousal and will be more likely to give off
>
> positive sanctions to others…; and if they had some fear about expectations being met,
>
> they will experience more intense variants and elaborations of positive emotions. (p.
>
> 200).

In addition to providing concrete evidence from science classroom interactions for this

principle, our study successfully applied the sociological construct of interaction rituals

(Collins, 2004) to identify the moment-to-moment emotional arousals in the classroom

interactions of a new science teacher. Wider use of these sociological principles and

constructs in the analysis of interactions in science classrooms has potential of providing

teachers and researchers greater access to theoretical constructs that can help teachers to

change negatively valenced emotional events into positively valenced emotional events,

that will be mutually beneficial for teachers and their students.

To avoid negative emotional energy generalizing across the classroom, new teachers

could redirect their attention from flat events that are relatively unimportant in meeting

expectations for students to demonstrate science understanding, such as Event 2, to those

interactions more likely to realize such expectations; that is, those rituals that generate

dialogical conversations and positive emotional energy (e.g., Events 1 & 3). A unique

feature of this study has been that we have illustrated at the meso- and micro-levels the

differences between an interaction ritual that was valenced negatively (i.e., one that she

moved away from) and those that were imbued with positive emotional energy.

Student disinterest, as recognized by the teacher in the form of non-synchronized body

movements and bored facial expressions (Event 2), could cue the teacher to act

differently (e.g., move to another group or abandon thematic questions not perceived by

the students as highly relevant in the moment). Becoming aware of cues for negative

emotional energy and shifting directions were two strategies that experienced teachers

used to re-establish a classroom emotional climate more resonant with their expectations

in another study (Williams-Johnson et al., 2008). The immediate challenge for new

teachers is to develop skills to recognize such cues. Whereas the teacher in our study

eventually identified such cues, it took most of one lesson before she engaged one group

of students in a series of successful interactions. Doing so more quickly and more

consistently would seem to us to be desirable pursuits for the teacher's professional

development. Wider application of cogen in Vicky's classes is likely to help her develop greater awareness of these cues. Cogen can be likened to "learning conversations," recommended by Demetriou and Wilson (2009) for professional development, yet with an added emphasis on student input and action in the production of dialogue. Our ongoing research with Vicky over the next two years will help us to evaluate the efficacy of this approach in this context, as well as to determine whether the collaborative products of cogen improve the emotional climate of her classrooms. Our reflections on our work together (and with other new teachers) not only are likely to provide much needed insight into new teachers' emotions, but also to impact on Vicky's teaching development. After all, Demetriou and Wilson (2009) found that successful teachers took time to reflect on all aspects of their professional practice and learning.

Through our year of working together thus far, the teacher has become aware of the structures of various positive (or successful) and negative (or unsuccessful) interaction rituals. Typically, successful rituals are characterized by synchronized leading and trailing humor that leads seamlessly to dialogical conversations in which students are afforded opportunities to demonstrate their fluency with the science content. Studies (Demetriou & Wilson, 2009; Winograd, 2003) of other new and inexperienced teachers also have highlighted the importance of maintaining a sense of humor in interactions characterized by vibrant positive emotional energy to establish rapport with students. Regardless of content, interactions in the observed class were successful only when all contributors (i.e., teacher and students) collectively produced dialogical conversations that drew on shared resources rather than being controlled by any particular individual alone (e.g., teacher during IRE structures). These successful interactions also could be

recognized from beyond the group by the participants' mutual focus, synchrony of gestures and facial expressions, and laughter and positive emotional energy (cf. Collins, 2004). In contrast, the unsuccessful interactions could be identified by the absence of these features.

Whereas there is ample literature (e.g., Schutz & Pekrun, 2007) that demonstrates how desirable positive emotions are for learning generally, and science specifically, we did not attempt in this study to undertake robust inquiries of student learning outcomes that might have emerged from interactions characterized by negative emotional energy. Rather, our focus here was to identify how new teachers like Vicky can more readily produce/reproduce interaction rituals that can help to realize their expectations for teaching and learning science—structures that generate positive emotional energy and help to develop rapport between teacher and students. This approach is more likely to reinforce the core and professional identities of the teacher (Chang, 2009; Turner, 2002), enhancing the retention of new teachers in the profession (Schutz, et al., 2009). Whereas we did not present evidence in this study to show how the teacher's identities changed over her first year of teaching, subsequent research will focus on this important issue.

Given the relevance of Turner's (2007) first principle to the study of emotional arousal in one new teacher's science class, it is exciting to anticipate the degree of helpfulness of the other 16 principles for teachers and researchers. For example, Principle 2 asserts: "The likelihood that expectations will be met in an encounter is a positive function of the degree of clarity in expectations…" (p. 200). Emphasizing and illustrating this and other principles from classroom encounters in teacher education programs, for example, may prepare new teachers better for their transition from pre-service to in-service teaching.

A major limitation to their study of new teachers' emotions declared by Williams-Johnson et al. (2008) was they did not collect data during class time to support their claims. We attended to this limitation in our study by focusing on the identification of in-the-moment dialogical structures or rituals used by a teacher in establishing the emotional climate of her classes in her first year of teaching. Whereas prosodic analysis was used to provide in-the-moment low inference evidence for the vocal expression of emotions during classroom transactions, this evidence would not be useful without corresponding evidence from interviews and micro analysis of video clips due to difficulties in isolating sound tracks for the speakers in focus in this busy naturalistic setting. Notwithstanding this limitation, our study begins the much-needed research to help new teachers develop structures for their successful interactions with students that might improve their transition to full-time teaching.

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**References**

Baird, J. R. (1999). A phenomenological exploration of teachers' views of science teaching. *Teachers and Teaching: theory and practice, 5*, 75-94.

Baumeister, R. F., Bratslausky, E., Finkenauer, C., & Vohs, K. D. (2001). Bad is stronger than good. *Review of General Psychology, 5*, 323-370.

Chang, M-L. (2009). An appraisal perspective of teacher burnout: Examining the emotional work of teachers. *Educational Psychology Review, 21*, 193-218.

Collins, R. (2004). *Interaction ritual chains*. Princeton, NJ: Princeton University Press.

Collins, R. (2008). *Violence: A micro-sociological theory*. Princeton, NJ: Princeton University Press.

Cross, D., & Hong, J. Y. (2009). Beliefs and professional identity: Critical constructs in examining the impact of reform on the emotional experiences of teachers. In P. A. Schutz, & M. Zembylas, M. (Eds.), *Advances in teacher emotion research. The impact on teachers' lives* (pp. 273-296), Dordrecht, The Netherlands: Springer Press.

Demetriou, H., & Wilson, E. (2009). Synthesising affect and cognition in teaching and learning. *Social Psychology of Education, 12*, 213-232.

Durkheim, E. (1912/1995). *The elementary forms of religious life* (trans. Fields, K. F. 1995). New York: Free Press.

Goffman, E. (1967). *Interaction ritual: Essays on face-to-face behavior*. New York: Pantheon.

Juslin, P. N., & Scherer, K. R. (2008). Vocal expression of affect. In J. A. Harrigan, R. Rosenthal, & K. R. Scherer (Eds.), *The new handbook of methods in nonverbal behavior research* (pp. 65-135). Oxford, UK: Oxford University Press.

Lemke, J. L. (1989). *Using language in the classroom*. Oxford: Oxford University Press.

Lortie, D. C. (1975). *Schoolteacher: A sociological study*. Chicago: University of Chicago Press.

Moore, S., & Kuol, N. (2007). Matters of the heart: Exploring the emotional dimensions of educational experience in recollected accounts of excellent teaching. *International Journal for Academic Development, 12*, 87-98.

Nias, J. (1989). *Primary teachers talking: A study of teaching as work*. London: Routledge.

Olitsky, S. (2007). Facilitating identity formation, group membership, and learning in science classrooms: What can be learned from out-of-field teaching in an urban school? *Science Education, 91*, 201-221.

Oplatka, I. (2007). Managing emotions in teaching: Toward an understanding of emotion display and caring as nonprescribed role elements. *Teachers College Record, 109*, 1374-1400.

Ritchie, S., & Tobin, K. (2001). Actions and discourses for transformative understanding in a middle school science class. *International Journal of Science Education*, *23*, 283-299.

Ritchie, S. M., Tobin, K., Roth, W-M., & Carambo, C. (2007). Transforming an academy through the enactment of collective curriculum leadership. *Journal of Curriculum Studies, 39*, 151-175.

Roth, W-M., Ritchie, S. M., Hudson, P., & Mergard, V. (in press). A study of laughter in science classrooms. *Journal of Research in Science Teaching*.

Roth, W-M., & Tobin, K. (2010). Solidarity and conflict: aligned and misaligned prosody as a transactional resource in intra- and intercultural communication involving power differences. *Cultural Studies of Science Education*. *5*, 807-847.

Scherer, K. R. (1989). Vocal correlates of emotional arousal and affective disturbance. In

H. L. Wagner & A. S. R. Manstead (Eds.). *Handbook of psychophysiology: Emotion

and social behavior* (pp. 165-197). London: Wiley.

Schutz, P. A., Aultman, L. P., & Williams-Johnson, M. R. (2009). Educational

psychology perspectives on teachers' emotions. In P. A. Schutz & M. Zembylas

(Eds.), *Advances in teacher emotion research: The impact on teachers' lives* (pp. 195-

212). Dordrecht, The Netherlands: Springer.

Schutz, P. A., Cross, D. I., Hong, J. Y., & Osbon, J. N. (2007). Teacher identities, beliefs,

and goals related to emotions in the classroom. In P. A. Schutz & R. Pekrun (Eds.),

*Emotion in education* (pp. 223-241). Amsterdam: Academic Press.

Schutz, P. A., & Pekrun, R. (Eds.). (2007). *Emotion in education*. Amsterdam: Academic

Press.

Schutz, P. A., & Zembylas, M. (2009). *Advances in teacher emotion research: The

impact on teachers' lives*. Dordrecht, The Netherlands: Springer.

Scott, C., & Sutton, R. E. (2009). Emotions and change during professional development

for teachers. A mixed methods study. *Journal of Mixed Methods Research, 3*, 151-

171.

Selting, M., Auer, P., Barden, B., Bergmann, J., Couper-Kuhlen, E., Günthner, S., et al.

(1998). Gesprächsanalytisches Transkriptionssystem [Conversation analytic

transcription system]**.** *Linguistische Berichte*, *173*, 91-122.

Sewell, W. H. Jnr. (2005). *Logics of history. Social theory and social transformation*.

Chicago: The University of Chicago Press.

Sutton, R. E. (2007). Teachers' anger, frustration, and self-regulation. In P. A. Schutz & R. Pekrun (Eds.), *Emotion in education* (pp. 259-274). Amsterdam: Academic Press.

Szczepek Reed, B. (2006). *Prosodic orientation in English conversation*. Basingstoke, UK: Palgrave MacMillian.

Szczepek Reed, B. (2010). Prosody and alignment: a sequential perspective. *Cultural Studies of Science Education, 5*, 859-867.

Tobin, K. & Roth, W-M. (2005). Implementing coteaching and cogenerative dialoguing in urban science education. *School Science and Mathematics*, *105*, 313-322.

Turner, J. H. (2002). *Face to face. Toward a theory of interpersonal behavior*. Stanford, CA: Stanford University Press.

Turner, J. H. (2007). *Human emotions: A sociological theory*. London: Routledge.

Turner, J. H. (2009). The sociology of emotions: Basic theoretic arguments. *Emotion Review, 1*, 340-354.

Walford, G. (2007). Preface. In G. Walford (Ed.), *Methodological developments in ethnography* (p. vii). Oxford, UK: JAI Press.

Walters, S. (2007). 'Case study' or 'ethnography'? Defining terms, making choices and defending the worth of a case. In G. Walford (Ed.), *Methodological developments in ethnography* (pp. 89-108). Oxford, UK: JAI Press.

Wertsch, J. V., & Toma, C. (1995). Discourse and learning in the classroom: A sociocultural approach. In L. P. Steffe & J. Gale (Eds.), *Constructivism in education* (pp. 159-174). Hillsdale, NJ: Lawrence Erlbaum Associates.

Williams-Johnson, M., Cross, D., Hong, J., Aultman, L., Osbon, J., & Schutz, P. (2008).

"There are no emotions in math": How teachers approach emotions in the classroom.

*Teachers College Record, 110*, 1574-1612.

Winograd, K. (2003). The functions of teacher emotions: The good, the bad, and the ugly.

*Teachers College Record, 105*, 1641-1673.

Zembylas, M. (2005). Beyond teacher cognition and teacher beliefs: the value of the

ethnography of emotions in teaching. *International Journal of Qualitative Studies in

Education, 18*, 465-487.

Table 1. Conventions Used in Transcripts

| Symbol | Meaning | Example |
|---|---|---|
| # | Bounds utterance said quickly | #building up again causing the mountain to grow again# |
| _ | Underline for emphasis | <u>Sev</u>en |
| : | Stretched-out sound | si:de |
| \|\| | Bounds overlapping talk | V: \|Wow\|<br>M: \|Oh\| no it was 10 actually |
| () | Inaudible | |
| (.) | Untimed brief pause | |
| (.4) | Timed pause | |
| (()) | Comments or observations | Ye(h)ah ((laughing)) |