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Tobin, Kenneth, [Ritchie, Stephen](#), [Oakley, Jenny](#), [Mergard, Victoria](#), & [Hudson, Peter](#)

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EMOTIONAL CLIMATE AND FLUENCY OF INTERACTIONS

Relationship Between Emotional Climate and the Fluency of Classroom Interactions

Kenneth Tobin, Stephen M. Ritchie, Jennifer L. Oakley, Victoria Mergard, & Peter

Hudson

Abstract This study examined emotional climate in relation to the teaching and learning of grade 7 science. A multi-method and multi-theoretic approach used sociocultural frameworks as a foundation for interpretive research, conversation analysis, prosody analysis, and studies of nonverbal conduct. Emotional climate varied continuously throughout a lesson. Dialogues occurred and afforded learning when interactions between the teacher and students were fluent and included humour and collective effervescence. Emotional climate was negatively valenced when the teacher and/or students endeavoured to establish and maintain power by restricting others' participation to spectator roles. The teacher's endeavours to maintain and establish control over students were potentially detrimental to teaching and learning, teachers and learners. This type of teaching gradually evolved into a form we referred to as cranky teaching, whereby the teacher and her students showed signs of frustration and the enacted teaching and learning roles lacked fluency. The methods we pioneered in the present study might be helpful for other teachers who wish to participate in research on their classes to ascertain what works and should be strengthened, and identify practices and rituals that are deleterious and in need of change.

Keywords Emotional climate Identity Learning Science education Teaching

Introduction

Despite the centrality of emotions in education there has been a dearth of research connecting emotions to learning environments. One exception is a study published in *Learning Environments Research* in which Thomas (2003) created an instrument containing a scale that examined emotional support, as it relates to the incidence of metacognition. Thomas's learning environment instrument included items that addressed whether students were cared for emotionally and the extent to which their ideas were respected. Thomas considered emotions such as pride, sadness, and joy, noting that marked changes in social interactions during learning might be associated with situations

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students perceived as emotionally negative. Although the measures obtained using this instrument were associated with important aspects of learning environments, the scales and items did not measure enacted and perceived emotions, social constructs we consider central to learning environments. Thomas's work on metacognition is cited 14 times in the SCOPUS database (<http://info.scopus.com/about/>); however, we found no follow-up research on the relationship between emotional support and educational outcomes.

We regard it as a priority for learning environment research to focus on emotions as they are enacted in the moment-to-moment unfolding of classroom life. In addition, we consider it important to identify positive and negative emotions that occur in classrooms and how they mediate outcomes such as achievement and identity. Furthermore, we have an interest in ascertaining how social artifacts from a classroom, including the practices of teachers and students, are imbued with emotional energy (EE). According to Durkheim (1995/1912), social artifacts are inscribed with EE that reflects the emotional climate (EC) of particular events. Durkheim explained how representations of social artifacts are associated with emotions produced during particular events. Durkheim noted, "It is, in fact, a well-known law that the feelings a thing arouses in us are spontaneously transmitted to the symbol that represents it ... The symbol thus takes the place of the thing, and the emotions aroused are transferred to the symbol." (p. 221) Consistent with Durkheim's theory, we are interested in the extent to which events within enacted curricula are inscribed with EE. Also, we acknowledge the importance of doing research that relates learning environments with individual's emotions and the collective phenomena of EE and EC. In an example of the research we feel needs to be done, Olitsky (2007) reported that students collectively applauded peers who successfully

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solved oxidation-reduction equations on the chalkboard in front of the whole class. Enjoyment was reproduced even when students talked about solving chemical equations, leading them to request the teacher to schedule more activities of this sort.

Emotion occupies a central position in understanding society and smaller collectives or groups; it is the “glue” that binds members of society together (Collins 2004). Turner (2002) theorized four primary emotions, three of which are negatively valenced (i.e., sadness, anger and fear) and one that is positively valenced (i.e., happiness). Emotions are necessarily viewed in relation to interactions and associated transactions. The sets of emotions expressed among individuals within a collective, such as a school or class, contribute to a climate that inscribes the feelings, actions and social identities of its members, distinct from the collective action of non-members (Berman Brown, and Brooks 2002). Emotional climate then is a collective state of emotional communion between members of a group or organization in which members’ salience of self decreases as their collective identity is enhanced (Kanyangara, Rime, Philippot, and Yzerbyt 2007). In his analyses of the corroborees of indigenous Australians Durkheim emphasized two important aspects of communion: taking on new practices of a collective and extinguishing practices no longer considered appropriate (Durkheim 1995/1912). Emotions, EE, and EC are considered to be valenced. Positive EC would be related to expressions of happiness and joy, and a sense of group belonging and social integration. Similarly, negative EC would be associated with excesses of sadness, fear, and/or anger within a group. Notably, solidarity can emerge in association with either negative or positive EC (Collins 2004).

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Research interest in EC has intensified within the last few decades. Studies of the EC of nurses (Berman Brown and Brooks 2002) and teachers (Grinning, Raver, Champion, Sardin, Metzger, and Jones 2010) illustrate research activity relevant to the current study. While the reliance on administration of coarse-grained perceptual instruments appears to be a legacy of its roots in organizational psychology, ethnographic methods, such as those used in interpretive research, are increasingly included in research designs (Tobin 2006). For example, Berman Brown and Brooks (2002) analyzed on-the-job conversations of night nurses and interviews to provide rich insights into EC and dynamics among hospital workers. They concluded that EC was still an underdeveloped area that would benefit from further investigation with new methods that redress the limitations of available instruments, which lack the capacity to provide important contextual information such as employee participation and job satisfaction (Berman Brown, and Brooks 2002).

Design

Fraser (2009) noted that, "...there is considerable scope for the development of new methods and the wider use of established methods for qualitative studies" (p. 130). We accept Fraser's stance as a necessary consequence of undertaking a new line of research on learning environments. The research is multi-method and multi-theoretic, involving macro, meso, and micro level analyses of science classrooms in which we regard interactions as the fundamental unit of analysis (Goffman 1983). Theoretical frames include cultural sociology (Sewell 2005) and the sociology of emotions (Collins 2004).

Event oriented social analysis uses multiple methods and theories in intensive analyses that are synthesized to provide increasingly deeper understandings about the

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relationships between theory and practice as they relate to teaching, learning, and learning environments. The multilevel methods we adopt are interpretive, theoretically grounded in post-structural hermeneutic phenomenology (Madison, 1988), and are consistent with Erickson's (1986) presentation of interpretive research as a participatory activity in which participants' subjectivities interact during research. We endeavor to find out what's happening through a careful analysis of participants' voices, including our own. As we ascertain what is happening we seek to understand why it is happening, making sure that diverse perspectives are retained in analyses. We regard difference and sameness as resources for the research and interpret each in relation to the other. This perspective is consistent with Sewell's theoretical framework in which culture is considered to be experienced as patterns having thin coherence along with ever-present contradictions (Sewell, 2005).

The research is part of a larger study of beginning teachers' initial years of teaching science in middle and high school in Queensland, Australia. The study involves Victoria (hereafter Vicky), a teacher from an independent, suburban school and her grade 7 science class from 2009. The class met for 50 minutes twice a week, creating a double period as necessary for lab work. Vicky, who is a researcher and co-author of this paper, has a degree in health sciences and work experience as a nutritionist, recently graduated from a science teacher education program. The research group observed 11 lessons and analyzed video recordings of 7 of them.

The processes of understanding what is happening and figuring out why it is happening are ongoing. We do not sample randomly and do not differentiate between data resources on the basis of whether they are qualitative or quantitative. Instead we

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access many data resources continuously, qualitative and quantitative, in a hermeneutic project that focuses on making sense of social change through the analysis of events. Accordingly, we analyze all available videotapes, identifying salient events within them for multilevel analysis. The research reported in this paper emerged from intensive analyses of one science lesson, a double period in which students learned about density and flotation through participation in a lab involving sink and float activities. Member checking with Vicky and some of her students suggests that what we learned applies more generally to learning environments associated with Vicky's teaching.

An initial level of sense making involves collection of stories about what is happening. Entry into a hermeneutic cycle and increasing understandings of what is happening are afforded by aggregation of different participants' stories and a plethora of microanalyses of video files. We endeavor to learn from both coherences and contradictions and routinely share what we are learning with research participants so that their perspectives can enrich our unfolding understandings.

We transcribed salient parts from the video soundtrack, cogen, and interviews with Vicky. In all transcripts we have adopted conventions used commonly in video analysis (e.g., Olitsky, 2007) including: (.4) timed pause in seconds, (.) untimed brief pause of one tenth of a second or less, = no gap between speakers, [] bounds overlapping talk, (h) audible in breath, : stretched-out sound, ((comments or observations)).

Teacher and students' perspectives are incorporated in the research through cogenerative dialogue (i.e., cogen). Cogen, which is a reflective dialogue about what happened in class and how to improve the quality of teaching and learning, has been used as a methodology in classroom research (Tobin and Roth 2006). Several stakeholders are

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selected to discuss what happened in the class, what improvements could be made, and what worked well. The discussion among participants is dialogic, meaning that all participants listen attentively to one another, and when anyone speaks he/she builds on what has been said previously. Over time, all participants should have approximately equal turns to talk, equal time of talk, and the types of talk should be equally distributed—e.g., initiating, responding, reacting, etc. When cogen is used as methodology, members from a research team join the teacher and several persons she selects from her class. Students are usually selected to be different from one another, and they provide dialogue around events that are salient to the research. In this study Vicky, three students, and three researchers from the university participated in cogen that lasted for approximately 40 minutes. In this case Vicky chose three student participants. Marcus, who Vicky regarded as the top science student in the class was from a group that did the best boat design. Two selected girls were from a group that felt their design was superior to the “best design;” Alicia was the leader during a presentation the group made in class and Amy was the student held responsible for sinking their boat. The verbal and associated nonverbal interactions from cogen were transcribed and used as data resources for the study.

The teacher and students were shown offprint photographs depicting the teacher nagging. Without having to listen to the audio file the teacher and students associated being “crabby” with characteristics from the offprint such as facial expression, relative orientation of the head to the rest of the body, and upper body posture. The students indicated that they did not work as well when the teacher was crabby because they were afraid to get involved, especially if they had incorrect answers. The teacher concurred

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and added that nagging was prevalent in her approach to teaching, especially as the lesson progressed and students became inattentive. The cogen supported a claim that what we learned from the research was salient to participants and seemed to apply to other lessons and classes. Also, since the research is multiyear, it is apparent that what we learned in the first year applies also in the third year of the study.

Emotions

Dewey emphasized that emotions are produced continuously and simultaneously with other actions (Dewey 1895). Consistent with this view, we study emotions in classrooms as teaching and learning unfold, using methods appropriate for meso- and microanalysis. Teaching and learning are experienced at multiple social levels and are accessible to us in this research through interpretive research, narrative, and cogen. These windows into emotions are supplemented by micro level methods that include prosody analysis (Szczepk Reed 2006) and analyses of nonverbal behavior (Harrigan, Rosenthal, and Scherer 2005). The methods we use are consistent with Sewell's (2005) event-oriented sociology, which uses narrative and empirical methods in complementary ways. We use narrative to describe selected events and show their salience and tools such as StudioCode, PRAAT, and QuickTime to obtain complementary perspectives through microanalyses.

In our micro study of emotions we found it useful to combine frame-by-frame analysis of the video files with computer aided analyses of the acoustic waves that comprise the soundtrack from the video file (aif file). We used PRAAT to measure time intervals between utterances in seconds (s), the fundamental frequencies of the acoustic waves in Hertz (Hz) and the acoustic intensity (i.e., the amount of energy of a sound

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wave in the air standardized for time and area) of utterances in micro Watts per square meter (μWm^{-2}). These measures, together with subjective assessments using ethnographic methods are a basis for comparison of utterances for a given speaker and for utterances of different speakers.

Emotional climate

We measured EC in three-minute intervals or Segments throughout a class period. Adopting this procedure allows us to rate EC for the Segments that comprise a lesson. The assumption is that ratings meaningfully represent EC during a given segment. That is, we disregard variations of EC within segments. Five researchers reviewed a videotape of a double period class on the topic of *sink or float*. In this case Vicky used part of a mathematics class to provide sufficient time for completion of the practical activities planned for the lesson. Each researcher independently rated EC for 26 three-minute segments, using a five-point scale of 5, highly positive; 4, positive; 3, neutral; 2, negative; and 1, highly negative. Each researcher provided a rating to reflect his/her subjective assessment of the EC for each three-minute segment. A generalizability coefficient of 0.9 reflected relatively high internal consistency for differentiating time and generalizing across raters.

Overview

The remainder of the paper addresses: Variations in EC; teaching and learning roles enacted as theater; the teacher's use of repair rituals; uses of satire and orchestration of events; frustration, cranky teaching and negative emotions; and the authenticity of the research and implications for teacher education, school leadership, and teaching and learning.

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Variations in EC

The average EC for the lesson was 3.4 (slightly positive) with a standard deviation of 0.6. The range extended from a minimum of 2.6 (just below neutral) to a maximum of 4.8 (highly positive). A graph in Figure 1 shows considerable variation in mean EC as a function of time throughout the lesson. Fluctuations from high to medium to relatively low raise questions about the salience of EC as it is imbued in events as compared to EC as it is represented in a macro sense (i.e., for the whole lesson or a series of lessons. Despite fluctuations such as those seen in Figure 1 the lesson as a whole might be imbued with highly positive EC because of the surplus positive emotions associated with segments 1 and 2).

The EC curve from Figure 1 was used to select as foci for microanalysis the segments associated with the change points in the curve (1, 6, 9, 13, 17, 19, 21, and 22). The EC plot also served as a heuristic for writing a narrative for the entire lesson and for each of the identified events. We then extracted each of the eight three-minute segments, carefully editing each to ensure that the events contained within them were complete. Selecting events necessitated extending some segments, shortening others, and deleting non-salient events within segments. Microanalysis then focused on the events, affording conversation, prosody and other non-verbal analyses. We analyzed each of the events and endeavored to learn from patterns and contradictions within and across events, aware that the selected events incorporated differences in EC and were associated with changes in the slope of the EC versus time plot.

<<insert figure 1 about here>>

Theater in science

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The first part of the flotation lesson included a review of a practical activity in which students designed boats in what Vicky described as, “the grade 7 boat building challenge.” The winning team consisted of three boys, Antonio, Marcus and Trent. Vicky described the challenge in the following way: “We put the boats in a tub of water and whoever had the most weight in it before it sunk. Some of them just went straight to the bottom and others not so much. Theirs had the most weight in it.” Acting as a television compère, Vicky invited Trent to explain the science of the award-winning design. Vicky noted, “With Marcus, even though he’s very technical, he would have been like, ‘yeah, we put a hole, we made a boat and we put it in the water and it was great.’ ... So out of his team, Trent is probably the most engaging and the most like, knowledgeable of the situation.”

Vicky began the role-play with a flourish as she introduced Trent, “This evening, with me, I have the famous Professor Wiley.” In her role as compère, Vicky used a whiteboard marker as a microphone and extended one arm sideways pointing to Trent as she introduced him to the class. Vicky froze for just under two seconds with her mouth wide open in feigned excitement, holding the “microphone” with one hand and looking directly at the audience. Trent adopted a goofy facial expression, initially gazing at the class and then turning his head slightly to direct his gaze to Vicky, who laughed with the students and clapped her hands together.

Episode 01

Turn	Speaker	Utterance
01	Vicky:	Professor Wiley has had a long and (1.7) interesting career in science. Haven't you

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- Professor? (0.3)
- 02 Professor Oh really it was only just 40 minutes (0.4)
Wiley: ((Short collective laugh of 0.8 s from the audience and a wide smile from Vicky)) (0.2)
- 03 Vicky: Forty minutes is a long time
- 04 Professor =Yes it is. (0.2)
Wiley:
- 05 Vicky: Yes. So, Professor, explain your boat building experience to us. (1.5)

((Vicky hands Professor Wiley a whiteboard marker to use as a microphone)).
- 06 Professor Um well, the first thing ladies and gentlemen is
Wiley: very much a miracle.

In Episode 01 Vicky and Trent participated in dialogue since each speaker built on what the other had said previously. Although each speaker had three turns, Vicky averaged 4.8 s and Trent averaged 2.9 s. In terms of power in the air, Vicky averaged $67 \mu\text{Wm}^{-2}$ whereas Trent had an average power in the air of $13 \mu\text{Wm}^{-2}$. The speech rate of both speakers reflected the EE of the particular turn. Vicky averaged 2.8 syllables per second and Trent averaged 3.8 syllables per second, due mainly to his excitement in Turn 02 (5.5 syllables per second). The pauses between speakers were very short, indicative of cultural fluency. That is, Vicky and Trent anticipated what the other did and acted in a timely and appropriate way. The main exception to this pattern occurred when Vicky asked Trent to explain his boat building experience to the class. Appropriately, Trent

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paused for 1.5 s before commencing his utterance. Although this utterance was humorous (within the theatrical genre), Trent became more serious in subsequent turns at talk.

Within the theatrical genre, Professor Wiley used nasally accented speech and expressive hand gestures. Usually he laughed at the end of his turn. After Turn 06, Vicky clapped her hands and took a few steps backwards as she laughed loudly. She covered her mouth and bent forward, giggling into her hand. Vicky then straightened her body and clasped her lips together in an attempt to contain her laughter. As her laughter erupted, Vicky again covered her mouth. The teacher's laughter appeared contagious and collective joviality built as Vicky sought to control her amusement. Students, including Professor Wiley, laughed in synchrony with Vicky, who, throughout this theatrical event, frequently catalyzed collective effervescence through her own laughter, facial expressions, and body actions.

In an endeavor to afford Trent sharing his team's winning boat design with the class, Vicky waved her hand in front of her face, to seemingly wipe away her smile and laughter as she remarked, "Sorry, sh sh serious face." It was significant that Vicky's conduct was a self-control endeavor rather than an attempt to control students. As might occur in any staged farce, Professor Wiley immediately mimicked Vicky's action to the delight of the class, which responded with an outburst of collective laughter. Vicky put her finger to her lips and repeated, "sh, sh," extending her arm to point to Wiley. On this occasion the "sh sh" appeared to serve the purpose of directing attention to Wiley rather than endeavoring to control students' conduct. The approach was successful in that the transition from collective joviality into a discussion of canonical science was seamless and fluent. Trent explained the flotation of his team's boat in terms of air pockets in the

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straws that had been placed at the bottom of the boat. When he focused on the science Trent did not act as Professor Wiley, but spoke in a voice characteristic of his own person.

Trent: Well, when our group first designed our boat we kinda didn't... When we first put it in the water we were kinda just like oh it's never gonna float and then yeah as I said a miracle. Then me and Marcus, with us standing on the side and we thought that with the air pockets that were in the straws that were on the bottom, they would help it stay afloat and well then they only got put on at like the last minute so yes, the third time a miracle.

Trent's explanation was 31.4 s in duration and was delivered at a rate of 3.2 syllables per second. The power in the air was $21 \mu\text{Wm}^{-2}$, reflecting his rather neutral EE during the delivery. Unlike the first time he used the term miracle, there was no laughter when Trent mentioned the word for the second and third times. As Trent spoke Vicky fixed her gaze on him, and her face radiated with a Duchenne smile (i.e., one in which it is difficult to control the facial muscles voluntarily). Vicky supported Trent's subsequent contributions with a diagram she sketched on the whiteboard and when he began to correct her, Vicky erased her diagram and handed the marker to Trent. Vicky's tone was lilting and pleasant as she and Trent continued a constructive dialogue with a mutual focus on each other and the diagram. Sitting at their desks, the majority of students also focused on the diagram and the dialogue.

Contradictions to the generally positive EC occurred when Trent twice showed negative emotions, switching seamlessly to Professor Wiley to enact his anger. On the first occasion Antonio and Marcus endeavored to provide suggestions on the design of

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their award winning boat in relation to the physics of flotation. Trent commented, “In case you don’t mind gentlemen, I’m speaking.” The duration of the utterance was 2.7 s, delivered at a rate of 4.4 syllables per second, 37% higher than his speech rate in his more emotionally neutral utterance a few moments earlier. The power of the wave in the air was approximately $50 \mu\text{Wm}^{-2}$, well above the intensity of his earlier emotionally neutral delivery. The most intense words were, “don’t mind” which had a power in the air of $122 \mu\text{Wm}^{-2}$. These two words were uttered in 0.4 s, equivalent to a rate of 5.5 syllables per second. On the second occasion Trent was drawing a diagram of the boat design and became frustrated with Antonio’s suggestions. He remonstrated with Antonio uttering, “No. No. Dang. Dosh.” The duration of the utterance was 1.4 s, equivalent to 2.9 syllables per second. The power in the air of the utterance was $31 \mu\text{Wm}^{-2}$ with the most intense syllable being “dosh,” having power in the air of $50 \mu\text{Wm}^{-2}$. The two patterns depicted frustration/anger and, when compared to the prosody of Trent’s emotionally neutral speech, had a higher rate of production and higher intensity.

When we discussed these contradictions with Vicky she felt that Trent’s actions were appropriate. She noted:

Like with Antonio, like he can interrupt like inappropriately and say kind of random things that will sort of move the tangent away from where I wanted it to go. So you know, he was saying stuff to Marcus about, “oh, and Trent did this wrong.” And it really annoyed me and we had a big fight. Like, even though he was preventing him from participating like it was kind of a participation that probably wouldn’t have been appreciated by me ... I think he was doing it because he wouldn’t have appreciated

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what Antonio was going to say. 'Cause they had a big blow up on the day we made the boat. I'm pretty sure that's what was going on there.

These instances of resistance/aggression from Trent (as Professor Wiley) effectively restricted the roles of his peers to members of the audience during the first two segments of the lesson. That is, the theatrical performance afforded high levels of positive EE while restricting audience participation to forms that were collective, choral, and humorous (often satirical). This genre, which is similar in form to Bakhtin's carnival, afforded students mocking Vicky and Professor Wiley, and vice versa (Bakhtin 1988). When the laughter and clapping subsided, Trent spoke eloquently and fluently and the verbal interaction between he and Vicky was symmetrical and dialogic. Although Trent appeared unreceptive to include others in the dialogue, the verbal interaction afforded connections between what happened in the practical activity and the science of flotation. At the same time the EE was high throughout the event, possibly inscribing a positive valence on the learning environment for the entire lesson.

During this theatrical activity the most successful and emotionally positive interactions occurred when Vicky and the students were in synchrony, that is, when the teacher and students collaborated to produce dialogue and cultural fluency, rather than interaction rituals built around teacher questions and student answers. For example, collective effervescence occurred regularly, mainly taking the form of laughing, clapping, and choral responding. When Vicky and students joined in collective effervescence culture flowed smoothly and dialogues usually occurred, affording Vicky and students doing/learning science.

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Five interactions involving collective effervescence occurred in the first event (i.e., spread over two segments), which was the most highly rated in terms of EC. Examples included clapping, exaggerated role-play, playful mimicking, making fun of others, laughter, and choral responses. The teacher laughed loudly at the front of the class, illustrating that she was willing to laugh frequently; setting the stage for collective laughter, hand clapping, and choral utterances. Students and the teacher mimicked one another on several occasions, contributing to a shared impression that the purpose of this activity was to have a lighthearted review that was enjoyable to all participants. Collective effervescence also was a sign that traditional power structures pertaining to teachers and students were suspended, at least for this activity.

As Trent began to exit the stage two important events occurred. Anne raised her hand in an endeavor to get Vicky's attention and another girl indicated she had a question for Professor Wiley. In her role as compère Vicky invited Professor Wiley back on to the stage to answer what turned out to be a satirical question, playfully announcing that Trent cheated and was aided by Vicky, who provided the winning group with materials others in the class did not have. Once again students enacted forms of culture like the peasants did during carnival, mocking authority figures such as royalty, judges, police, and clergy (Bakhtin 1988). Here, students engaged in humorous, good-natured banter directed at Trent and Vicky, including choral responses of "you cheated" and exaggerated collective laughter from Vicky and the class. In response to admonishments about allowing cheating to occur, Vicky (as compère) stated that, "we will deal with controversies in our section labeled that later." Significantly, Vicky joined the carnival and did not try to

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control either satire or associated rowdy conduct. Accordingly, interactions flowed smoothly and noise levels subsided as Trent left the stage.

Anne raised her hand three times toward the end of Trent's role-play. On the third occasion she persisted, holding her hand aloft for approximately 40 seconds before Vicky called on her. Anne stated, "We were going to win, except Amy poked a hole in it." As Amy protested about Anne's allegation, Vicky agreed that the girls could explain the features of their design to the class.

Repair rituals

As the three girls made their way to the front of the class and Trent returned to his seat, Vicky enacted a repair ritual (Turner 2007) with Marcus and Antonio, who Trent had admonished during the theatrical activity. From the front of the room Vicky lent forward using both of her hands to give a high 5 to each of the boys, in recognition of their accomplishments. The youths showed their delight, Antonio raising his arms in victorious triumph, pointing both index fingers toward the ceiling to signify number one and Marcus giving a fist pump as Vicky commented, "so, you can be the construction engineer." Vicky explained, "it's their team but they didn't get asked to explain what was going on so the high 5 thing was a whole acknowledgement of their participation and their involvement in it and that they're still a team even though I didn't ask them to get up and talk."

We refer to this as a repair ritual because a feature of Vicky's teaching throughout this and the other lessons we experienced was the way in which she interacted with students, one-on-one, to produce positive emotions after those students had negative experiences. This repair ritual was just one of many that were crucial in maintaining

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positive EC throughout the lesson. Repair rituals were an important part of this and other transitions in the lesson, and in all lessons Vicky taught in the study. Also, when students were assigned individualized or small group activities Vicky interacted with individuals to produce positive emotions. These interactions were not necessarily oriented toward science, but toward producing and maintaining positive EC—by strengthening social bonds and networks through the production of success. In this way Vicky constantly tuned EC toward the positive spectrum.

Although Vicky was unaware of it at the time, a repair ritual was probably highly desirable since Marcus reported to us that Trent did not like him. Accordingly, it is likely that Marcus's attempts to provide what he considered to be accurate and helpful suggestions were rebuked by Trent because of his negative emotional response when Marcus attempted to get involved. Trent appeared to regard Marcus's efforts to assist as disruptive and disrespectful, and he enacted power rituals that effectively mocked the authority Marcus held by virtue of the symbolic capital associated with being regarded as the best science student in the class. Accordingly, Marcus, and most likely Antonio, experienced social violence. In those circumstances a repair ritual was appropriate and anticipatory, affording high quality participation from both boys in the remainder of the lesson.

Satire and orchestration

The boat designing and building competition provided a context for sprinkling good-natured humor throughout the lesson. The girls in the “hole poker group” were friends, enjoyed working together in class, and were pleased to have this chance—Alicia pumped her fists in triumph as she stood with the others and, with verve, began to move to the

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front of the class. Alicia skipped past other students in her row as she moved toward the front of the room. As Vicky and the rest of the class talked about which groups were still eligible to win the competition, Alicia facetiously remarked that their group was not eligible because, "one of them stuck a hole in the boat."

Episode 02

Turn Speaker Utterance

- 01 Vicky: Okay ladies so please explain your design, [why you did
- 02 Anne: [We had
- 03 Vicky: =that (0.5)
- 04 Anne: =um, well, we had
- 05 Vicky: =and what the bribe you're gonna pay me is (0.4)
- 06 Anne: We were gonna cut like the lunch bag thing that we got a hole to blow in to with air, [coz
- 07 Alicia: [coz that way it floats
- 08 Anne: =Yeah and crunched all the bottom of it
- 09 Alicia: =keep it up
- 10 Anne: =Yeah and like give that more balanced. And then we have plasticine on the top um to well now how we put plasticine on to the side to the weight before
- ...

The conversation in Episode 02 has two parts, Turns 01-05 and Turns 06-10. The first part involves Vicky and Anne in a ritual that essentially transfers the floor from Vicky to the girls. The use of humor was highly visible throughout the entire event. As the girls made their way to the front of the class Vicky commented that they would need to mention a bribe during their presentation. Vicky smiled as she joked and walked away from the whiteboard, but Anne did not appear to hear the joke because she was involved

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in overlapping speech with Vicky. Initially Anne had difficulty getting started because Vicky was speaking with much more intensity ($80 \mu\text{Wm}^{-2}$ compared to $22 \mu\text{Wm}^{-2}$) and was resolved to make a joke before relinquishing the floor. The speech rate in the first part varied from about 4 syllables per second, increasing to 6 as Vicky made her joke about a bribe. The second part of Episode 02 featured Anne's explanation about the design, supported by Alicia, who inserted utterances and gestures. The second part is dialogic with virtually no time separating speakers, who used similar cadence and rate of speech. For the most part the intensity of the utterances was a little over $20 \mu\text{Wm}^{-2}$, except for Turn 07 when Alicia increased the intensity to $34 \mu\text{Wm}^{-2}$ so as to insert a turn of talk. Interestingly, Anne did not compete with her, but immediately continued when Alicia had finished her turn.

As Anne commenced Turn 06, Alicia assumed a role of orchestra conductor and with considerable flourish she gestured to Amy to begin sketching the design on the whiteboard. Alicia used large gestures as she coordinated the presentation and interactions between the three girls. Each of the girls contributed in a dialogic manner, speaking and interacting synchronously and fluently in ways that complemented others' actions. When Alicia moved her body she used graceful dance-like moves (i.e., twirls and moves of body, arms and head) that complemented the theatrical performance the class had just finished.

When Alicia reached an impasse she signaled Amy with an extended "end:" (Turn 01; Episode 03) accompanied by a double gesture, also moving her head and body to look toward Amy. Seeming to disagree with Alicia's comments about a barrier at each end, Amy presented her perspective on the design and what they did (Turn 02). As Amy

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explained the design from the diagram, Alicia took a marker pen and drew where the hole was located on the boat. As she drew the hole, Alicia coordinated her speech, saying, “then there’s the hole” (Turn 03)—an example of ongoing satire being enacted in this event.

Episode 03

Turn Speaker Utterance

- 01 Alicia: Kinda like a barrier at each end: (0.5)
- 02 Amy: ((turns from drawing the diagram on the board)) Nah ah: and ah it’s kinda ours. And so this is the glad wrap bag we were blowing up to the air is that and tied our straws at the bottom. (0.2)
- 03 Alicia: ((takes the marker pen from Amy)) then there’s the hole (0.1) (she draws a hole).
- 04 Amy: yeah
- 05 Alicia: =that hole there
- 06 Anne: =which Amy cut in it (0.3)
- 07 Vicky: Why did you cut a hole in it?
- 08 Alicia: =Because. We didn’t cut a hole ‘coz we inflated it with everything going (0.3) ((Amy speaks at the same time as Alicia, both of them uttering “we didn’t cut a hole.”))
- 09 Anne: We just cut it down because we were just about finished putting everything on and then we thought it ((oh, yeah)) would float better
- 10 Amy: =We put everything um the glad wrap bag and then someone poked a hole in it ((this is humorous because Amy poked the hole))
- 11 Alicia: =Ha ha someone h h
- 12 Amy: =Someone. And um we put plasticine at the sides and a bit cardboard over the top of the

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- ((indecipherable)) (0.7) ((points to the diagram throughout turn))
- 13 Alicia: When, as of (0.5) ((gestures a pressing down motion with her right hand slapping down on her left hand))
- 14 Anne: coz if he had if someone hadn't poked a hole in it then it would have won because the plastic bag kept it floating
- 15 Alicia =yeah (0.6)
- 16 Vicky: Oka[y:] ((Okay extends for 2 s))
- 17 Amy: [This is what it looked like] (1.5) ((Utterance take 1 s as she adds to the diagram))
- 18 Anne: It kinda went completely flat because someone poked a hole in it (0.8)
- 19 Amy: someone? (0.5)
- 20 Male: who was it?
- 21 Alicia: ((laughing)) =Someone called Amy.
- 22 Vicky: =OK. Does anyone have any questions for the group called hole pokers?

The 22 turns represented in Episode 03 are fluent and dialogic. There is considerable synchrony evident in the interactions within the “hole poker” group, between Vicky and the group, and between all participants at the front of the room and the students as a collective. Just as Vicky was jocular and subtle, the girls constantly made mention of the hole punched into their boat, causing it to sink. Anne and Alicia ragged Amy in ways that led to good-natured bantering about the boat and why “one of them” poked a hole in it. Satire was woven throughout the presentation as repeated references were made to someone poking a hole in the boat, without revealing that the person concerned was

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Amy. In Turn 10 Amy joins the humor in a way that is probably self-deprecating when she notes, “and then someone poked a hole in it.” The humor was lighthearted since Vicky and the rest of the class knew that Amy had made the hole, even though they asked playfully, “who poked a hole in the boat”? As Alicia stated “Someone called Amy,” the two girls mocked one another nonverbally, with exaggerated body stances, facial expressions, smiles and head movements as they faced one another and enacted a fun routine in which one friend teased the other. Vicky concluded this activity with the humorous query, “Does anyone have any questions for the group called hole pokers?”

Widespread synchrony, or entrainment, afforded the development of shared positive mood, collective effervescence (e.g., laughter, hand clapping, and chorus cajoling), and high EC. It is important to emphasize that the actions that contributed to the learning environment that supported positive EC were verbal and nonverbal. As well as what was said and when and how it was said, features such as eye gaze, facial expression, gesture, body orientation, and body movement also were salient. Furthermore, the humor, laughter and spirit of camaraderie that was evident in most cases was situated in a larger matrix that allowed all participants to accept what happened as normal and expected—affording their anticipating actions and acting in ways that were timely and appropriate. Without having to announce consciously to the class that, “for the next 15 minutes we will participate in carnival” the participants seemed to be receptive to participating in carnival and their practices suggest they had a history of enacting carnival—knowing what to do in contexts of satire, farce, exaggeration, mockery of authority and sacred symbols, and at times boisterous and bawdy humor. It is likely that Vicky and the students

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experienced carnival in fields outside of the school, in the home and during leisure activities.

In Vicky's science class satire, sarcasm that makes fun of somebody was commonplace, characterized by wisecracks, banter, and mimicry. Vicky used the transition as the girls moved back to their seats to infuse satirical humor into the lesson. She noted that there was one more thing to add to the girls' design. She then smiled as she strode to the whiteboard and used a marker to add to the design a container and water surface that clearly showed the boat had sunk. She completed the drawing with a flourish using facial expression, head orientation, and body posture to mock an "award winning" boat that sunk. Several students playfully admonished Vicky with exclamations of "oh miss"! Vicky erased the diagram with a smile on her face before commencing a review of what had been accomplished in the lesson so far. Notably, nobody resisted the carnival atmosphere and the ebbs and flows in EE supported an accumulation of positive EE that possibly imbued the entire lesson with positive EE. It is likely that learning environments like this are commonplace in Australia. In a discussion of Australian humor, Davis (2007) focused on a genre she called "taking the mickey (baiting others, particularly the obviously 'other', with joking, teasing and insult)." (p. 22) Davis noted that:

... this Aussie custom ... now enjoys such broad social permission that objecting in any particular instance is ineffective, even when the experience (as not infrequently happens) is offensive. Hidden cultural rules decree that when its victim either rejects the baiting or 'doesn't get it', by definition the mickey has been taken. Thus the only truly effective response is to accept that the mickey has indeed been taken, to

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appreciate its skill and to reply in kind. Most Australians believe that taking the mickey in this way is effectively their own national civil liberty. (p. 22)

Cranky teaching

Following the emotionally positive events featuring Trent and the hole pokers, Vicky led a whole class discussion on what aspects of design worked and what did not work. Vicky's goal was to relate successful and unsuccessful designs to density, Archimedes principle, and buoyancy. During this time EC was relatively low and the verbal interaction was not as dialogic as it had been in the earlier parts of the lesson. The pattern of verbal interaction that occurred increasingly consisted of Vicky asking a question, a student providing an answer, and Vicky evaluating the adequacy of the response. As Lemke noted, this initiate-respond-evaluate pattern is familiar in science education (Lemke 1990), a pattern that others have noted does not foster inquiry. Kaberman and Dori (2009) examined metacognition in relation to students posing questions in science classes. They noted, "By asking questions, students frequently reveal what they want to learn, what they know, and what they do not know. Questions are also part of social functioning when students seek their classmates' views and communicate and negotiate during group activities." (p. 406) Kaberman and Dori regarded students' failure to ask questions as a potential problem, citing Becker's (2000) concern that cognitive, social, and emotional growth are decreased when students do not ask questions.

There were three spikes in the EC curve in which the average EC for the interval was negatively valenced. These occurred at segments 13, 19 and 22 respectively during which there was a higher abundance of teacher conduct we described as cranky. During the cogen the students noted that they could tell when Vicky was becoming cranky.

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Vicky: So when I get cranky does it affect you that's the question.

Marcus: Yeah

Amy: Yeah

Alicia: A little

Amy: I feel too scared to ask questions

Vicky: Hmmm

Alicia: Yeah

Amy: She might go, what you listening?

Alicia: Yeah

Marcus: I think a lot of people are too scared to talk. Like we all just sitting there and then she told us write this. Just sit there in dead silence.

Tobin: What's the sign that she's going cranky? When do you first know?

Marcus: That she starts raising her voice

Amy: She stops leaning on stuff

Alicia: Yeah and hands on your hips.

Amy: Coz you'll be like leaning on stuff and like in this photo here you'll be like leaning and once you get cranky you're up straight.

We used StudioCode to identify events in which Vicky was cranky. Ethnography and microanalysis support an assertion that the teacher's nagging moves were associated with negative emotions (i.e., frustration), negative EE, and negative EC. There were 12 events in which Vicky appeared exasperated, 10 of them in Segments 13, 19 and 22, the ones associated with negative EC. Each utterance identified for analysis was relatively short and characterized by increased loudness, body orientation, gestures, and orientation of the

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head. Within each nagging utterance a small number of words/syllables had much higher intensity than the other words/syllables in the utterance. In comparison with other types of talk, nagging utterances had a much higher intensity. During whole class activities when the teacher addressed the class from the front of the room the power of the sound in the air was of the order of $20 \mu\text{Wm}^{-2}$ compared to an average of $77 \mu\text{Wm}^{-2}$ when Vicky endeavored to control students using her voice. Some examples of the nagging utterances are included in Table 1.

Table 1. Examples of nagging utterances and their power in the air.

No. Guys thank you. One at a time ($54 \mu\text{Wm}^{-2}$)
Scuze me. I said one at a time. Thank you. ($57 \mu\text{Wm}^{-2}$)
Thank you grade seven. I asked you a question. ($84 \mu\text{Wm}^{-2}$)
OK. Everybody has some oil. ($105 \mu\text{Wm}^{-2}$)

Signs of crankiness increased as the lesson progressed, reflecting students getting restless, getting involved in such conduct as messing about with materials when they should have been participating in verbal interaction. As negative EE increased Vicky's actions oriented toward obtaining focus and synchrony using gestures, body orientation and stance, short, loud utterances (e.g., No!), facial expressions and eye gaze. Nagging utterances also were associated with the orientation of the head and body (e.g., the teacher cocked her head to one side, pushed her chin forward, and held her shoulders back at the moment she uttered the highest intensity sounds). It is possible that the orientation of head and body were resonant structures for creating negative emotions such as frustration. That is, as we attributed to Durkheim (1995/1912) earlier, when Vicky adopts a particular posture others who had experienced her before might produce similar emotions to those that were associated historically with Vicky's body orientation.

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When Vicky resisted collective effervescence and endeavored to control students by the use of body and voice, the students displayed negative emotions and the enacted culture lacked fluency (i.e., it was not anticipatory, timely, and appropriate). The incidence of nagging actions increased as the lesson advanced and was related to troughs in the EC curve. For example, in Segment 19, which was negatively valenced, six events involved nagging in which negative emotions were evident in the teacher's body posturing, facial expressions, gestures, and prosody. Vicky used her voice, with a nagging tone, to emphasize what she wanted students to do and as she did so an increasing number of student actions breached fluency. Vicky appeared frustrated and increasingly her mood was cranky. Whereas students had been cooperative in the early segments of the lesson, with time there were signs of fatigue and an increasing incidence of negative emotions.

Authenticity criteria

Vicky participated in cogen with a number of university-based researchers to discuss and come to a shared understanding of what had been learned from the microanalysis of several science lessons, including the lesson at the focus of this study. Dialogue regarding positive emotional climate, collective effervescence and carnival seemed to assure Vicky that her in-class tendency to laugh, and smile and joke with her students appeared to benefit their learning and understanding of canonical science. Vicky was also quick to recognize that becoming angry; using loud authoritative voice, stern facial expressions, and aggressive body postures when remonstrating with students were deleterious to the production and maintenance of optimal learning environments.

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Participating in this research was educative for Vicky who was determined to instigate changes immediately to her teaching pedagogy and her interactions with students to improve the emotional climate of the classroom. Vicky felt empowered by the research process and the shared understandings that supported her own goals of teaching, and was able to enact changes to develop and maintain a positive learning environment almost immediately. Thus, the research process was tactically authentic in that it afforded Vicky sufficient agency to implement changes within her classroom—which she is now doing on a regular basis as a teacher researcher. Thus, the research process, involving interviews and cogen, afforded transformations in Vicky’s teaching, indicating catalytic authenticity of the research.

Teacher education programs and textbooks have emphasized the importance of teachers establishing and maintaining control over students. The emphasis on good control/discipline also has been included in accountability models and assessment systems. Vicky has felt the pressure to be more of a disciplinarian too, noting that: “I love teaching, I really love it. The thing I don’t like is, you know, feeling obliged to be this sort of authoritarian, you know and I have felt that that’s what’s expected of me. I really love doing the interactive stuff and being noisy and just into it ... this year, I haven’t been doing it as much, and I’ve been trying to figure out why but I think that’s why, to the parents.” In contrast to this conventional wisdom, in this study high EC was associated with activities in which the teacher and students collaborated, demonstrating emotional attunement and mutual focus. Consistent with Bakhtin's caution that it is not possible to defeat carnival, the only recourse being to join it, Vicky showed her connection to the collective by participating in acts of collective effervescence (Bakhtin 1988). When she

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did so the lesson was fluent and the transitions from laughter and clapping, for example, to discussions about science were seamless. In stark contrast, when Vicky enacted disciplinary moves students either stopped what they were doing or continued doing what they were doing. Notwithstanding advice from school administrators and teacher educators that the teacher needed to minimize collective effervescence (e.g., laughing, clapping, chorus responding), this study suggests that collective effervescence affords cultural fluency, high quality canonical science, and the entire lesson being imbued with positive EE.

What next?

Teaching and learning are complex cultural enactments and are not subject to improvement through the use of oversimplified formulaic approaches. Accordingly, we caution about the ways in which what we have learned from this research might be enacted. To be clear we are not advocating that all classes should begin with theater and interlace humor and associated collective effervescent rituals throughout. Instead, we suggest that teachers and others with a stake in education participate in research on what is happening in classes, ascertain what works and should be strengthened, and identify practices and rituals that are deleterious and in need of changing. One feature of Vicky's teaching that warrants further thought and research is the role of humor and uses of carnival-oriented activities. There seems to be merit in using activities such as these to produce and sustain high positive EC and to obtain interaction patterns that are dialogic. However, just as there are many types of humor that might be applicable to school teaching and learning, so too are there many ways of laughing and expressing collective effervescence. We regard it as a priority to gain a deeper understanding of ways in which

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positive emotions can be produced in excess to initiate and sustain high quality learning environments.

This study broke ground in school-based research by creating a method to measure EC from digital video of teaching and learning. The method we adopted was used subsequently by teachers, students, and university-based researchers using digital video and coding actual classes. In this ongoing research we now use electronic clickers (i.e., audience response devices) to measure EC “in the moment” as teachers and students record their experienced EC as the lesson unfolds. Hence, numerous methods have emerged already from this initial attempt to study EC in classrooms.

Emotions were studied in this research using a variety of nonverbal methods that centered on the use of microanalysis of videotape. We have examined face, body, movement, and gestures in relation to the emotions produced and created in classroom interactions. In addition, conversation and prosody analysis have shown remarkable convergence with what we have learned from the other forms of analysis. The information available to us as researchers and from digital video files is also available to students in real time as curricula are enacted. Not surprisingly, students interpret and can accurately assess changes in EC using these data resources and accurately anticipate their teacher's emotions in the micro contexts of classroom interaction and in the meso contexts of activities within lessons. As well as the need for further research on the ways in which experienced EC is related to social categories such as gender, aptitude, ethnicity, and native language proficiency, there is also a clear need for teaching and learning to be responsive to changes in EC. Since all participants in a classroom have access to pervasive signs concerning emotions and EC, it makes sense to enact cogen to review

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systematically what is happening in the class and how to improve learning environments. This study reinforces the importance of including students in an ongoing way in research and evaluation of the quality of learning environments—with the goal of improving the quality of education.

Many of the tools we have used in this research are included with the operating systems of desktop and laptop computers (e.g., digital video editors such as QuickTime) or can be downloaded at no cost (e.g., PRAAT; <http://www.fon.hum.uva.nl/praat/>). Our experience has been that even children in the first grade are able to use these tools to analyze video and audio files recorded in their class. The advantages of having students involved in using technologies such as these is that their valued insights are available for potential educational improvement and the technological skills they develop are broadly applicable and may even have implications for future careers. There is much to be said for using activities such as cogen to include students more actively in the process of education by conducting regular dialogues involving teachers, students and other stakeholders in establishing and maintaining high quality learning environments.

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References

EMOTIONAL CLIMATE AND FLUENCY OF INTERACTIONS

- Bakhtin, M. (1988). *Rabelais and his world* (H. Iswolsky, Trans.). Massachusetts: MIT Press.
- Becker, R. R. (2000). The critical role of students' questions in literacy development. *The Educational Forum*, 64, 261-271.
- Berman Brown, R., & Brooks, I. (2002). Emotion at work. Identifying the emotional climate of night nursing. *Journal of Management in Medicine*, 16, 327-344.
- Collins, R. (2004). *Interaction ritual chains*. Princeton, NJ: Princeton University Press.
- de Rivera, J. (1992). Emotional climate: Social structure and emotional dynamics. *International Review of Studies on Emotion*, 2, 197-218.
- Davis, J. M. (2007). Taking the mickey. *The Fine Print*, 4, 20-27. Accessed on August 10, 2010 at <http://www.emendediting.com/html/ezine/issue4/PDFs/TFP4links.pdf>
- Dewey, J. (1895). The theory of emotion II: The significance of emotions. *Psychological Review*, 2, 13-32.
- Durkheim, E. (1995/1912). *The elementary forms of religious life*, trans. K.E. Fields. New York: Free Press.
- Eisenhart, M. (2001). Educational ethnography past, present, and future: Ideas to think with. *Educational Researcher*, 30(8), 16-27.
- Fraser, B. J. (2009). Science classroom learning environments. In S. M. Ritchie (Ed.). *The world of science education: Handbook of research in Australia* (Volume 2), (pp. 117-135).
- Goffman, E. (1983). The interaction order: American Sociological Association, 1982 Presidential Address. *American Sociological Review*, 48, 1-17.

EMOTIONAL CLIMATE AND FLUENCY OF INTERACTIONS

Grining, C., L., Raver, C. C., Champion, K., Sardin, L., Metzger, M., & Jones, S. M.

(2010). Understanding and improving classroom emotional climate and behavior management in the “real world”: The role of Head Start teachers’ psychosocial stressors. *Early Education & Development, 21*, 65-94.

Harrigan, J., Rosenthal, R., & Scherer, K. R. (Eds.). (2005). *The new handbook of methods in nonverbal behavior research*. Oxford: Oxford University Press.

Kaberman, Z., & Dori, Y. J. (2009). Metacognition in chemical education: question posing in the case-based computerized learning environment. *Instructional Science, 37*, 403-436.

Kanyangara, P., Rime, B., Philippot, P. & Yzerbyt, V. (2007). Collective rituals, emotional climate and intergroup perception: Participation in “Gacaca” tribunals and assimilation of the Rwandan genocide. *Journal of Social Issues, 63*, 387-403.

Lemke, J. L. (1990). *Talking science: Language, learning and values*. Norwood, NJ: Ablex.

Madison, G. (1988). *The hermeneutics of postmodernity: Figures and themes*. Bloomington: Indiana University Press.

Olitsky, S. (2007). Promoting student engagement in science: Interaction rituals and the pursuit of a community of practice. *Journal of Research in Science Teaching, 44*, 33-56.

Philippot, P., Chapelle, G., & Blairy, S. (2002). Respiratory feedback in the generation of emotion. *Cognition & Emotion, 16*, 605-627.

Sewell, W. H. Jr. (2005). *Logics of history: Social theory and social transformation*. Chicago: University of Chicago Press.

EMOTIONAL CLIMATE AND FLUENCY OF INTERACTIONS

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

Tagiuri, R. (1968). The concept of organizational climate. In R. Tagiuri & G. H. Litwin (Eds.), *Organizational climate: Explorations of a concept* (pp. 11-32). Boston: Harvard University Graduate School of Business Administration.

Thomas, G. P. (2003). Conceptualization, development and validation of an instrument for investigating the metacognitive orientation of science classroom learning environments: The metacognitive orientation learning environment scale–Science (MOLES-S). *Learning Environments Research*, 6, 175-197.

Tobin, K. (2006). Qualitative research in classrooms: Pushing the boundaries of theory and methodology. In K. Tobin, & J. L. Kincheloe, (Eds). *Doing educational research: A handbook*. (pp. 15-59). Rotterdam, NL: Sense Publishing.

Tobin, K., & Roth, W.-M. (2006). *Teaching to Learn: A view from the field*. Rotterdam: Sense Publication.

Turner, J. H. (2002). *Face to face: toward a sociological theory of interpersonal behavior*. Palo Alto: Stanford University Press.

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

EMOTIONAL CLIMATE AND FLUENCY OF INTERACTIONS

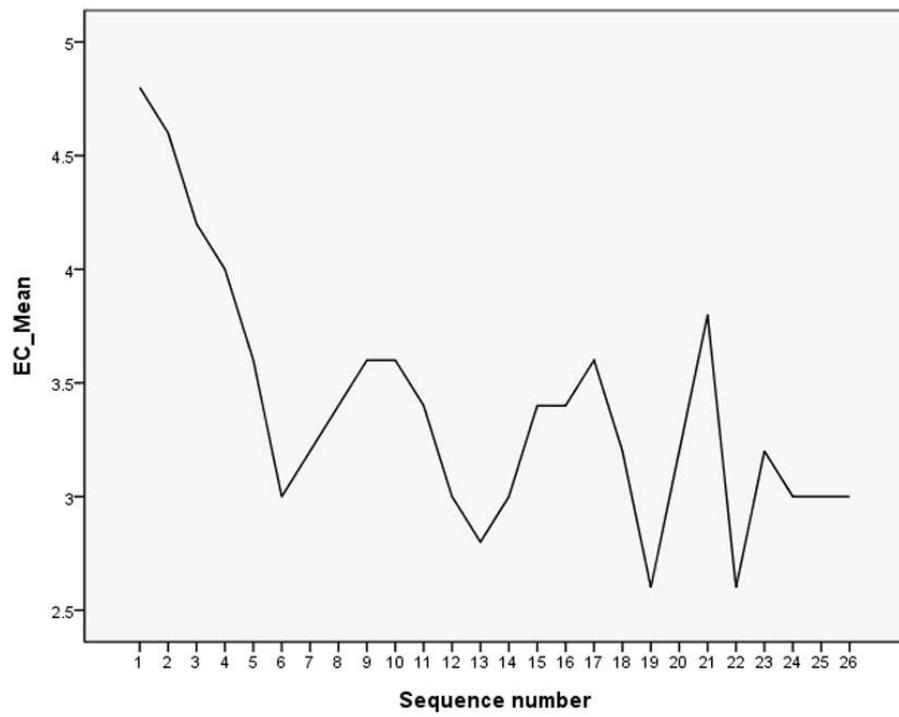


Figure 1. Mean EC as a function of time.