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Running Head: EMOTIONAL CLIMATE

We Teach as We are Taught: Exploring the Potential for Emotional Climate to Enhance Elementary Science Preservice Teacher Education

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Abstract

Bellocchi, Ritchie, Tobin, Sandhu and Sandhu's (2013) study highlights the crucial role that emotions play in learning at the university level in a preservice secondary science teacher education class. They examine the classroom structures that tended to lead to both a positive valence and a high level of intensity of the emotional climate (EC). This article explores the implications of their study for better understanding how to foster a positive classroom emotional climate for elementary level preservice teachers, given the specifics of elementary school environments. Drawing on theories of interactional solidarity. I explore the implications of EC for increasing pre-service teachers' capacity to avoid order-giving rituals and to create science-centered communities in their classrooms. I also suggest possible areas for future research, such as the role of expectations in EC, the different EC outcomes of lectures, EC and the development of confidence in science, and the ways in which teacher candidates are positioned within interaction rituals in elementary science methods classes.

Keywords: emotional climate, identity, emotion, elementary science teacher education, interaction ritual

We teach as we are taught: Exploring the potential for emotional climate to enhance elementary science preservice teacher education

Bellocchi, Ritchie, Tobin, Sandhu and Sandhu's (2013) research emerges from previous studies that have shown that classroom emotions have an impact on learning outcomes for children, since the emotional, social and cognitive aspects of learning are inextricably linked. They highlight the crucial role that emotions play in learning at the university level in a preservice secondary science teacher education class, examining the classroom structures that tended to lead to both a positive valence and a high level of intensity of the emotional climate (EC). They describe EC as joint emotional arousal, collective identity formation, and reduced sense of self. In their conclusions, they offer suggestions for possible activity structures that can improve the valence and intensity of EC, such as facilitating the emergence of non-formal rituals and promoting discussion rather than Initiation-Response-Evaluation (IRE) dialogue.

Bellocchi et al.'s (2013) focus on cultivating strong positive emotions within college classrooms is an essential yet often overlooked aspect of teacher preparation. While there have been efforts to enhance student engagement and content knowledge, EC has not been extensively addressed. Bellocchi et al. write, "Studies of the EC of preservice science teacher education classes are lacking. This leaves the landscape of EC in preservice classes relatively unexplored." Even if new teachers have been told by their instructors that emotions and cognition are connected, that knowledge will not necessarily help them establish classroom climates with high levels of emotional energy. Research has shown that teachers tend to teach the way they were taught (e.g. Battista 1994; Zeichner 1991). If teacher candidates spend most of their college years in science methods classrooms with low levels of emotional energy, then when they

become teachers, they may not attend to EC in their own classrooms or they may not have as many strategies for helping to create a positive emotional valence associated with science learning. If teachers are to be able to facilitate classroom environments in which students are engaged on the social, emotional and cognitive levels, they need to also experience this type of engagement within their teacher education programs.

Bellocchi et al.'s (2013) study offers an important contribution to understanding how preservice teacher education programs might be able to model strategies for eliciting emotional engagement among their students. While their study focused on secondary level preservice teachers, in this forum piece I explore the implications of Bellocchi et al.'s (2013) study for elementary level preservice teachers, given the specifics of elementary school environments. I draw on theories of interactional solidarity in order to discuss the relationship between EC, students' sense of membership in elementary science methods classes, and membership within the K-12 classrooms that will eventually be the workplaces of those teachers. In addition, I suggest possible areas for future research on EC and elementary science teacher preparation.

Interaction ritual and the elementary science classroom

Science is considered to be a high status subject, which can be alienating for many students. Researchers such as Barton and Yang (2000) and Lemke (1990) have argued that science is often portrayed as "too hard" or only for some people. Often it is students from non-dominant groups that are excluded and have to find ways of "crossing the borders" (Aikenhead 1996) into school science. There have been various calls by educators and researchers to move towards "science for all" or a universal "science literacy". While these terms can have many meanings depending on who is using them, exploring these concepts is not the focus of this

forum article. It is sufficient to say that any interpretation of an accessible science will require attention to students' experiences in elementary school since it is here that the foundation is set for students' identities and engagement in science. By the time students arrive at middle school, their relationship with science is becoming more solidified (e.g. Barton, Tan and Rivet 2008), as they are evaluating whether science is a membership group that includes or excludes them.

Taking a socially situated view of learning (e.g. Lave and Wenger 1991), a sense of membership in a community centered on science is vital for elementary school students. In such a view, learning entails acquiring the skills, knowledge and language use for participation within "communities of practice" engaged in collective activity in pursuit of common goals. It also entails identity formation, in that people need to develop a sense of group membership and identification with the group in order to desire the acquisition of the relevant knowledge for participation. Therefore it is crucial that elementary science classrooms are places where students experience a sense of belonging, identity and membership.

In exploring the potential for fostering group membership in elementary school classrooms and science methods classes, I draw on the work of the sociologist Randall Collins, who describes how participants in social settings, are drawn to situations in which they can engage in successful interaction rituals that generate emotional energy. These interaction rituals (IRs) are characterized by mutual focus, physical copresence, entrainment (or coordination) of body language and noisemaking, boundaries to outsiders, and a common mood. Outcomes of these successful IRs include high levels of emotional energy (EE) for the participants, EE invested in the symbols associated with the interaction, confidence in one's own ability to take part in these rituals, a sense of solidarity with the other participants. A related outcome is the positively valenced, high intensity EC that Bellocchi et al. (2013) describe.

Of course, as Bellocchi et al. (2013) observe, not all IRs are successful and sometimes groups experience a neutral or negatively valenced EC as a result of particular interactions. An unsuccessful IR in which there is failure to achieve entrainment could occur for a variety of reasons, such as lack of match-up of common symbols, or aspects of the physical setting that make it harder for people to become entrained, such as seats that do not face each other. Such experiences are unlikely to result in solidarity, investment of relevant symbols with EE, and group membership. In Bellocchi et al.'s (2013) study, the lectures were associated with a lack of entrainment.

Elementary school is a time when the emotional connection with teachers may be the strongest. Yet a strong connection with a teacher is not necessarily going to lead to successful IRs and a positive EC in the elementary science classroom. Teachers who avoid science, who convey a distaste or discomfort, or who portray status as a high status and exclusive group are unlikely to produce positive EC in their science classroom even if they can do so for different subject areas.

Even a successful IR can result in the loss of EE for someone who is present yet not sufficiently engaged. Participants that share a mutual focus and are caught up in rhythmic conversation recognize that they are inside the group. However, any individuals present who are not entrained in the collective emotional experience may lose EE and not develop a sense of identity associated with the group, even if the interaction is perceived as successful for everyone else. Witnessing such a ritual yet not being entrained is more alienating than not being present at all. For the purposes of this paper, I will refer to this as "IR-outsider" state, as opposed to "IR-insider" state. A strength of Bellocchi's et al.'s (2013) study is that they triangulated individuals' ratings with observations, therefore providing data not only on whether the

interactions as successful based on synchrony and mutual focus, but also on whether each of the participants also recognizes it as such. However, their approach prioritized the group emotion, since participants rated the EC of the classroom as a whole. It might have been hard to detect if a participant felt that the overall EC was positively valenced and/or high intensity, but his/her individual state was negative or low intensity.

More generally, participants' levels of EE will vary depending on how the person is positioned within an IR. The IRs discussed above can be thought of as "solidarity-producing" rituals, since anyone entrained in the ritual will experience a sense of membership and EE associated with the circulating symbols. However, some IRs are "order-giving" rituals, leading to a gain in EE for the order giver and a loss for the order taker, without actually increasing feelings of group membership (Collins 2004). The portraying of science as accessible to only a few can be thought of as an order giving ritual, since the teacher is positioned as a high status member whereas the students need to be deferent to his/her expertise. Bellocchi et al.'s (2013) findings suggest that focusing on dialogic interactions as opposed to lecture or IRE dialogue can prevent science from being experienced as order giving.

Collins (2004) describes how over the course of time series of IRs accumulate into ''interaction ritual chains,'' forming the basis of people's feelings of membership in particular groups and interests in particular ideas. In an elementary science methods course, relevant membership groups could be fellow pre-service teachers, science educators, and/or the field of science as whole. One potential question for investigation is under what conditions teachers are able to draw on stored EE from their methods classes in order to promote a positive EC in their own science classrooms.

In order for successful IRs to take place, there needs to be sufficient match-up between

cultural capital (Bourdieu 1986) and the emotional energy of participants. In the context of a science classroom, cultural capital can be considered science knowledge, science language, and methods of argumentation. For teachers to create successful IRs in their classroom, they face a different situation from when adults are meeting each other and have a choice as to what symbols to invoke in their conversations, which usually center on common interests. In a classroom, the students may not yet have emotional energy invested into the symbols associated with science. They may not have sufficient cultural capital in the form of science knowledge to begin. An implicit understanding of the need for both students and teachers to bring cultural capital to the interaction may inform the common practice of having a "hook" into a science lesson, or eliciting students' home knowledge about particular topics. In this way, both students and teachers are contributors of cultural capital, and both are invoking symbols that have emotional energy associated with them. Conversely, a lack of relevance of material or depictions of science as too difficult for most students (e.g., Barton and Yang 2000), can lead to exclusion on an interactional level, as there is not a shared basis of symbols for the generation of successful IRs.

In addition to cultural capital in the form of science knowledge and other knowledge, teachers must be able to bring sufficient stores of EE to the classroom. EE is both an input and output of successful IRs, and can be thought of as "confidence" in the sense that a teacher considers him or herself being able to initiate and/or participate in a successful IR regarding that particular content (Collins 2004). Efforts to built the confidence or self-efficacy of elementary science teachers is an essential component of professional development, and therefore needs to be a part of science methods classes. In Bellocchi's et al.'s (2013) study, having the students act as presenters, with opportunities to initiate IRs with their classmates, could be an experience that

builds self-efficacy.

In other words, teachers and students must both have the knowledge of the relevant symbols to participate, and have emotional energy invested in those symbols. Yet most of the focus of professional development has been on teacher content knowledge, pedagogical content knowledge, and dispositions towards student-centered teaching, without a focus on emotions. While elementary school teachers need to have such knowledge, the ability to promote membership also requires positive emotions becoming associated with the language, concepts, and methods of argumentation of science. Teachers who convey distaste or discomfort with science or who portray status as an exclusive group are unlikely to produce positive EC in their science classroom even if they can do so for different subject areas.

In terms of methods classes, it is especially important for elementary school teachers to not experience science as order-giving, as this would inhibit their developing positive attitudes towards the subject. Just as some students do not feel a sense of membership in science, some elementary school teachers hold anti-science attitudes (e.g. Eshach 2003). These attitudes need to be addressed by insuring new teachers begin to identify themselves as members in a science-centered community. Overall, in applying the concept of EC discussed in Bellocchi et al.'s study to thinking about improving elementary science methods classes, it is important to consider how new teachers need to enter into their own classes with sufficient stores of EE and cultural capital in order to initiate rituals.

Of course, EC is not as easily taught as content knowledge. Being able to establish a positively valenced, high intensity EC in a classroom might not even be a generalizable disposition that can develop, as some people can initiate successful IRs in some domains yet not in others. The emergence of IRs is highly contingent upon setting and the other participants.

Instead of considering a direct link from EC in a methods class to EC in a classroom, indirect linkages may need to be considered. Certainly as Bellocchi et al. (2013) suggest, teachers do need to be able to "read" the EC of a classroom and respond accordingly. One way to approach such "reading" is for teachers to be able to recognize the types of IRs that might occur in the classroom. Science teacher educators would benefit from being aware of these types as they occur within their own methods classes. They could also help teacher candidates to develop this type of awareness.

Whole-group solidarity

Whole-group solidarity, described in the section above, emerges from successful interaction rituals leading to EE invested in the circulating symbols and a sense of membership. One of Bellocchi et al.'s (2013) contribution is the importance of intensity of EC. It is possible that high-intensity EC could lead to a stronger sense of membership than low intensity EC.

Order-giving rituals

When we say emotions are mutually constitutive, it is important to remember that depending on the type of IR, there may be a collective effervescence, or there may be a situation in which one participant's high emotions can come at the expense of another. Order-giving rituals can occur if the teacher experiences a sense of emotional energy and confidence, yet it occurs with the cost of a loss of EE for the students. For example, if a teacher portrays science as "too hard" for most people, this is a gain of EE for the teacher for having earned a place in this special group, and a consequent loss of EE and confidence for students.

Partial-group solidarity rituals

This type of interaction produces solidarity, yet the boundaries do not include all of the

students in the classroom. For example, if a teacher and several of the students are having an animated conversation using science discourse, yet other students are not entrained in the interaction, this would be an example of partial-group solidarity.

Lemke (1990) writes that the strategies of argumentation that are privileged in classrooms tend to be those that are cultivated among white-middle class families. It is possible that only those students would have opportunities to develop EE in classrooms if partial group solidarity rituals were prevalent. Students from non-dominant groups would be excluded if they were positioned as IR-outsiders, and they would therefore not develop a sense of membership. Series (interaction ritual chains) of partial-group solidary IRs would lead to a lack of identity formation associated with science over time. This makes it imperative that elementary school teachers attend to the interaction rituals of the classroom to ensure that all students are IR-insiders.

Yet partial group solidarity is not always undesirable. Promoting partial group solidarity is an important approach for teachers when they are working with small groups in a lab, for example. In addition, positive cognitive, emotional and social outcomes would ensue from group work if students could experience partial-group solidarity within their small groups. It is only problematic if students are frequently observing successful IRs in which the boundaries do not include them.

Unsuccessful ritual

Unsuccessful rituals can occur under several conditions. If the teacher does not feel a sense of membership in school science, and lacks confidence, it will be difficult for him/her to initiate successful IRs, since IRs require both EE and cultural capital as inputs (Collins 2004). However, even if a teacher does feel a sense of membership in science, s/he may still fail to initiate successful IRs because the activity structures do not facilitate entrainment among the

students. Examples of activity structures that prevent successful IRs include the shutting down of all side talk or seating students in ways that they cannot see each other, since under those conditions they will therefore be unable to become entrained in noisemaking and motion (Olitsky 2007c). In addition, if students are unable to bring their own ideas and experiences to the interactions, IRs may fail since the students are prevented from using their cultural capital as inputs.

Other ways to prevent successful IRs in science class could be to have only textbook-based instruction, without physical artifacts such as lab or demonstration materials. Without physical materials in science, students are unlikely to develop a mutual focus that would allow for entrainment. Even though watching a demonstration is not hands-on, it can still lead to successful IRs because it establishes a mutual focus with opportunities for students to synchronize their movements and sounds (Olitsky 2007b).

Bellocchi et al. (2013) discuss the importance of being able to read the EC in a classroom. In addition to reading participants' emotions, it is important for science teacher educators to be able recognize any barriers to the development of IRs in their own classrooms. By attending to such barriers within the methods classes, and discussing their approaches with their students, they could also help teacher candidates learn how to recognize barriers to successful IRs within elementary school classrooms.

Areas for further research

In this section, I describe the potential for future research based on Bellocchi's et al.'s (2013) work, with a particular focus on the recognition of different types of rituals and the implications for elementary science teacher preparation.

Outcomes of intensity

Bellocchi et al.'s (2013) discussion of intensity adds an important element to our understanding of EC. While whole-group solidarity IRs can contribute to group membership and learning regardless of the intensity of EC, it is still important to acknowledge that these different levels of intensity may have different effects. In Bellocchi et al.'s study, the researchers were able to determine some activity structures that led to greater intensity of EC. However questions still remain about the implications of this intensity. What role does intensity of the EC have on identity-related outcomes? Does a greater intensity lead to stronger sense of identity and membership? What are the implications for high-intensity EC emerging from partial-group interaction rituals? Do those have a stronger negative outcome for IR-outsiders than if they were of low intensity?

Another issue is whether there can be too much intensity. Is there an ideal level? Would too high of an intensity lead to unrealistic expectations of classroom climate on the part of students? Bellocchi et al. (2013) suggest that unmet expectations could lead to negative outcomes, so perhaps the goal of high intensity EC in a science classroom is not necessarily sustainable. Given that intensity is relevant to students' experience and emerging sense of membership, teacher educators could benefit from more insight into how to address this factor. Perhaps the goal is not high intensity all the time, but sufficient intensity to solidify the community in ways that provide a buffer against potential negative EC at a later time. Bellocchi et al. (2013) suggest that: "If positive emotions dominate students' perceptions of EC and have lasting effects on their impressions of science classes, then there may not be any need for teachers to be concerned if they observe short-term displays of negative emotions."

Expectations, positioning, and variability between activity structures

Elementary science methods classrooms can run the risk of being perceived as order-giving rituals, since many elementary teacher candidates do not have extensive knowledge of science content and may feel ill equipped to teach science. Even before entering the classroom, some teacher candidates might expect science methods classes to be places where they are to be "filled up" with the science content that they lack. One potential area for research would be to investigate the expectations of elementary science teachers. Do some enter with perceptions that could contribute to low EC, in that they see themselves in need of something rather than as a contributor? What are potential approaches for addressing these perceptions?

After elementary teacher candidates enter the classroom, the actions of the teacher educator could further reinforce the view of science classes as consisting of order-giving rituals. A focus on "lack of knowledge" or a transmission model is likely to be perceived as order giving, which could interfere with positive EC in the methods classroom, and therefore with these teachers' capacities to establish positive EC in their own elementary school classrooms. In addition, elementary school science teachers who experience too many order giving rituals might end up reinforcing the inequitable view of science within their future classrooms. An important area of research would be investigating possible approaches in elementary school classrooms and methods classes that reduce the perception of science instruction as "order-giving".

However, there may be some erroneous assumptions about the types of activity structures that promote order-giving rituals. For example, it seems as if inquiry-based instruction would be more solidarity producing and contribute to positive EC just because it is participatory. However, inquiry-based instruction could be experienced as order giving if teacher candidates are not properly scaffolded or if they feel they do not have sufficient knowledge and confidence to participate. Further, it is possible that some forms of lecture may also be solidarity-building

if, for example, the speaker is dynamic and provides an effective mutual focus allowing for entrainment, and/or if participants are able to contribute cultural capital to the discussion. One area of investigation could be the circumstances under which lectures, inquiry-based instruction, and other formats are experienced as order giving, and the circumstances under which they are experienced as solidarity producing.

A related area of exploration is the ways in which participants' levels of EE vary depending on how the teacher candidate is positioned within a particular lecture, activity or discussion within a methods class. Bellocchi et al.'s (2013) findings suggest that expectations matter in terms of whether a formal ritual will be experienced as negative. They write, "One possible explanation for the differences in EC ratings during univocal debate presentations and univocal discussions about educational implications could be that the students had expectations of being positioned as recipients of information rather than being positioned as vocally active participants." Using Bellocchi et al.'s approach of triangulating ratings of EC at intervals with video data and interviews, researchers could analyze how positioning impacts EC within various activity structures.

However, in order to better understand positioning, it would be useful for participants to rate both the EC of the classroom and their own individual emotional state. In this way, the ratings would account for the fact that emotional contagion is not always straightforward. While sometimes people can become infected with others' high levels of EE, leading to high intensity and positive EC, if an individual is positioned as an IR-outsider, positive EC could have the opposite effect. One approach would be for participants to rate the EC of the class and rate their own emotional state at that same point in time. Researchers would then be able to investigate times of synchronicity between the individual and the collective, and times of mismatches.

These mismatches could suggest that particular individuals are positioned in ways that place them outside the boundaries of the interaction ritual, or as "order takers".

The role of lecture and formal rituals

Bellocchi et al. (2013) write, "Formal rituals are an inevitable part of classrooms life; at some point direct explanations or lectures are likely to surface. Our findings that EC was neutral, and sometimes positive during formal rituals, suggests that these kinds of teaching approaches are not entirely deleterious to class EC." Future research could be directed at understanding why lectures and univocal students presentations at times lead to a reduction in EC, whereas at other times they do not.

In Bellocchi et al.'s (2013) study, many of the univocal presentations were able to elicit entrainment and solidarity. They write, "All four cases of negative EC coincided with flat debate presentations; that is, presentations where speakers spoke in very soft voices, when they read notes to the class, stumbled in their speech, or did not appear to master the concepts of their argument." Their results suggest that univocal presentations can have different impacts depending on the way in which they are implemented; there is nothing inherently problematic in univocal presentations for EC.

While the skill of the speaker seems relevant, there may be other issues that also come into play and could be investigated in future studies. For example, one issue could be how the professor conveys his/her connection to the subject matter. Previous classroom research has shown that whether or not a teacher makes visible the backstage processes of acquiring information can affect the success of classroom interaction rituals. In one study, while front stage teacher performances reduced student participation, allowing students to see the

"backstage" and discover that the teacher does not know everything increased student comfort with the subject matter and participation (Olitsky 2007a). A similar process may take place in college classrooms. A front stage performance (Goffman 1959) could indicate an order-giving ritual that leads to high EE for the professor but a drop for the students. It is possible that the issue is not lecture vs. non-lecture, but instead whether the professor allows students to see the learning processes by which s/he came to learn the subject matter. This "backstage" visibility might be particularly important for elementary teacher candidates who come to the profession without the stores of cultural capital or confidence as science teachers.

Transferability of EE into different membership groups

While Bellocchi et al.'s (2013) study investigates the development of collective identity within the science methods classroom, it is still unclear as to whether the collective identities that are fostered in the methods classroom are transferable to the teacher candidates' future classrooms. Further research could address how EC in one group becomes relevant within another. Does EC in the science methods classroom contribute to EC in groups involving other teachers, thereby assisting in collegiality with peers? Is it transferable to other groups involving science?

Conclusions

An implication of Bellocchi et al.'s (2013) study is that not only do teacher educators need to support teacher candidates in learning about science pedagogy and content, but they also need to support them in establishing their own science classrooms as places with positive EC. Since teachers tend to teach how they are taught, it is likely that teachers who are taught in methods classrooms with negative or neutral EC might perpetuate this in their science

classrooms; conversely, in methods courses with positive EC, teachers might develop the awareness and expectations to support positive EC. However, there are many issues that still need to be investigated, such as the role of expectations in EC, the different EC outcomes within the same activity structures, the role of intensity, EC and the development of confidence in science teaching, and the ways in which teacher candidates are positioned within interaction rituals in elementary science methods classes. Overall, Bellocchi et al.'s (2013) work has implications for research into the ways in which an understanding of EC can inform efforts to improve teacher educators' and teachers' capacity for creating science-centered communities in their classrooms.

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