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A Study of Laughter in Science Lessons

Wolff-Michael Roth¹, Stephen M. Ritchie², Peter Hudson², Victoria Mergard²

¹University of Victoria, ²Queensland University of Technology,

Address:

Wolff-Michael Roth, Lansdowne Professor of Applied Cognitive Science, University of Victoria, Victoria, BC, V8W 3N4, Canada. Tel: #1-250-721-7885; FAX: #1-250-721-7598;

Email: mroth@uvic.ca

Running Head: LAUGHTER IN SCIENCE CLASSROOMS

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Abstract

Laughter is a fundamental human phenomenon. Yet there is little educational research on the potential functions of laughter on the enacted (lived) curriculum. In this study, we identify the functions of laughter in a beginning science teacher's classroom throughout her first year of teaching. Our study shows that laughter is more than a gratuitous phenomenon. It is the result of a collective interactive achievement of the classroom participants that offsets the seriousness of science as a discipline. Laughter, whereas it challenges the seriousness of science, also includes the dialectical inversion of the challenge: it simultaneously reinforces the idea of science as serious business. Furthermore, levels of intimacy, complicity, and solidarity between the teacher and her students were reproduced and transformed through their laughter in class.

Keywords Laughter • Social Interaction • IRE • Reproduction • Ethnomethodology • Conversation Analysis

The website of Youth Science Canada (2010) begins its page on youth science month with the words: "Serious! Fun! While science is serious stuff, doing science can be great fun." This opening quote explicitly expresses the dialectical tension that lies at the heart of this paper: science as serious business and science as fun. Are both dimensions possible at the same time? The headline, using the conditional in the second part, at least evokes the possibility. In the general population, there is indeed a perception that real science is serious business and conversation (dialogue) is not (Klamer, 2007). In school, science is often perceived as hard and discouraging (Aschbacher, Li, & Roth, 2010) and emphasizing "cold" and emotionless forms of cognition (Duit & Treagust, 2008). There is evidence that the purely cognitive learning outcomes in science are supported by triadic forms of interaction – teacher-*initiation*, student-*response*, teacher-*evaluation* – whereas affective learning outcomes are facilitated by forms of teacher-student interactions that do not follow the triadic forms (DeWitt & Hohenstein, 2010). The triadic form of interaction leads to authoritative discourse, which focuses on but one (correct) view on the scientific issues/concepts at hand (Aguilar, Mortimer, & Scott, 2010). In contrast, in a dialogic view – such as the one Bakhtin (e.g., 1984a) developed – the emphasis is on more than one perspective. In dialogue, the question concerning who is the authority on the issue at hand is interactively achieved and is not tied to the institutional position of the interaction participants (Roth & Middleton, 2006). Laughter, because it draws on ambivalence, has been recognized as "the second life of the people" (Bakhtine, 1970, p. 16), which, opposing and questioning the serious side of life, relativizes authority and one-truth perspectives (Bakhtin, 1984b).

Laughter – which may be for reasons other than and thereby transcending humor, comedy, and wit (Norrick & Spitz, 2008; Pietzcker, 2006) such as in tickle, funeral, anxious, or nervous laughter – is a fundamental human phenomenon. During the Middle Age and the Renaissance, "the infinite world of forms and manifestations of laughter was opposed to the official culture, to the serious, religious, and feudal manners" (Bakhtine, 1970, p. 12, our translation). That is, as a principle, laughter transcends specific sociocultural events (e.g., carnival, comedy) and becomes a principle of dialogically natured life generally (Gogan, 2009). One might therefore expect laughter to play some role in the teaching and learning of science. Yet we are aware of only one extended study investigating the role of laughter in science lessons and the understanding of science concepts (Roth, 2009). In that study laughter was exhibited not as a gratuitous phenomenon important to the enacted science curriculum – "when students have fun" yet are off task – but as an aspect associated with students' conceptual understanding.

In this study we investigate the interactional function of laughter. Therefore, we are not investigating, for example, what an individual might have felt in private, unnoticeable by other participants; rather, we study how laughter is both a resource and a product in the sequential order of turn taking of social interactions in science classrooms. Accordingly, we understand interactions as irreducibly social events that are reproduced and transformed by social actors, who, to bring about conversations in and through their actions, draw on resources that they make publicly available to and for each other.

Social-Interactional Functions of Laughter

The salutary and curative properties of laughter concerning both body and mind have been known since ancient Greece. It is therefore not surprising that it has become the

subject of research in the natural and social sciences and in the humanities. As of 2010, the ISI Web of Science lists over 2600 studies under the keyword “laughter.” Astonishingly, in the subject area of education and educational psychology, there are only 22 publications. In science education, the ISI lists only two studies: one is concerned with children’s reactions to a comic strip (Weltkamp & Burnet, 2007), the other focuses on topics and manner of talk in an undergraduate practical science laboratory (Tapper, 1999). Should we take this situation as an indication that laughter plays no role in the teaching and learning of science generally and for elementary and high school students specifically? Is science such a serious business that there is no place for laughter, especially in those places where people are inducted to its discursive and thinking practices?

Laughter is a social phenomenon through and through: “when a person laughing suddenly realizes that he is laughing alone – his laughter either ceases or degenerates, becomes forced, loses its assurance and clarity and its ability to generate joking and amusing talk” (Vološinov, 1976, p. 103). Whereas laughter is a pervasive feature of human life, in certain domains and at certain times, it is associated with taboos. The function of laughter is to triumph over situations, to elevate oneself over them. Only dogmatic cultures – including scholarly science that lays exclusionary claims to truth (Bakhtin, 1984b) – are unilaterally serious. From interactional sociolinguistics’ perspectives, laughter, wit, humor, and ridicule are phenomena that cannot be analyzed independent of their occurrence in social interaction. Rather, they are performances and achievements that interaction participants concretely produce in and as part of speech activity (Kotthoff, 2003). As performances and achievements, these phenomena require work, which is accomplished interactively. It is precisely the function of laughter in this interactional work that is of interest in this study. In this approach, hidden intentions are irrelevant (Wittgenstein, 1953/1958/1997). Thus, if we observe someone laughing, we do not know whether the laughter hides something, such as pain; and it does not matter if the observer imagines the laughing person to be in pain or some other experience or intention that the laughter is to cover up. There is no point “in asking someone, ‘What actually went on in you as you imagined this?’ – And what sorts of answers would we expect” (p. 120d). A smile or laughter has interactive function in a human context (“a smiling mouth only *smiles* in a human face” [p. 153d]), and this function is inherently understood: Competent social actors can “read” it from the situation as a whole. Research therefore needs to investigate the community within which laughter has certain functions.

Jokes (and laughter associated therewith) are an integral feature of laboratory talk (Lynch, 1985). A separation of normal everyday talk and “scientific talk” turns out to be difficult if impossible, as scientific talk may be received in non-serious ways. Certain remarks can be heard both as playful inserts in the ongoing work at hand and as serious ways of opening up avenues for new topics in a discussion. In scientific laboratories, the conversations often oscillate between different forms of talk and topics, sometimes both forms of talk are integrated into a unified whole. To understand the unfolding of laboratory work and shoptalk, therefore, we must not eliminate non-serious talk, jokes, and other aspects of talk often considered to be “off-topic” and therefore irrelevant to science learning. In the analysis of science lessons, we need to include them in the analysis to show how they mediate the classroom process and, thereby, the learning that may emerge from it (Roth, 2009). Whereas laughter is an expression of the fullness of life, it might actually be suppressed in schools. For example, the teacher-researcher at the center of this study (i.e.,

Victoria) acknowledged she suppressed her preference for fun and animated conversations with her students because she worried that the noise it created would disturb the class of her more experienced colleague next door. Yet, as a bodily expression of affect, laughter is an integral part of learning and understanding (cf. Vygotsky, 1986). Laughter may even be a sign that a person understands science such as when it is produced following an exchange such as “A proton says, ‘I lost an electron’; its interlocutor asks, ‘are you positive?’” The laughter then would constitute a resource in constituting the contents of the verbal exchange as a joke.

Laughter is not randomly produced as an interactional resource. It is a point that marks recognition and is both a legitimate and expectable instant for the audience to act in the course of an unfolding utterance (Jefferson, 1979). When the current speaker laughs within the utterance, it also constitutes an invitation to the audience to laugh. It is suggested that an audience may be awaiting an invitation because the presentation itself is equivocal with respect to its articulation of an invitation. The recipients’ warrant for laughing then becomes the laughter, smile, or other presentational feature that more clearly marks the invitation as such. But these points are always only possibilities, not determinant features of interaction. In this way, what the precise role is depends on the next turn or turns, which reify the turn pair as an invitation–acceptance or invitation–declination pair. The question of when laughter occurs is not a simple one. Interaction participants do not just laugh because they feel like it. A participant may produce some sounds by audibly inhaling or exhaling, clearing the throat, coughing, and so on and thereby provide an initiation that subsequently, post completion, may be taken as the invitation to laughter. These sounds, which themselves do not constitute laughter, “can be followed by sounds which retroactively formulate the initial sounds as having indeed been the start of a laugh” (p. 89). The advantage of the ambiguous sound is that it can remain what it is, especially when followed by a sign that clearly articulates the preceding as a non-instance of laughter.

The invitations to understand a particular utterance as humorous or joking may fail to be confirmed, for example, by laughter or by contributing to the further elaboration (Bell, 2009). Disapproval may be shown by means of silence or by acknowledging the production of humor/joke without actually showing approval. Groans and fake laughter are other interactional forms that may be used to disaffiliate with an offer of a humorous tale or joke. Whether something is to be understood as a joke or humorous tale, when it has not been accepted as such, may nevertheless be marked, such as when the speaker suggests, “You are supposed to laugh, for this was a joke” (e.g., Jefferson, Sacks, & Schegloff, 1986). A repeat offering of a particular contribution to the interaction may constitute a marker, as it does not have to be repeated once acknowledged in the intended manner.

Method

As part of this ethnomethodologically and conversation-analytically (Garfinkel & Sacks, 1986) oriented study of beginning teachers’ transitions to the profession, we observed and videotaped teachers repeatedly throughout their first year of teaching. All instances of laughter in the recorded lessons were marked using a hot key in the Studicode™ software, which allowed us to establish a library of all relevant episodes in our database. An episode is defined as a significant event that interaction participants using initiation and ending markers (e.g., asking a question [beginning], providing evaluation [ending], and moving to a new question [new beginning]). Episodes were exported to *mov* and *aif* formats for

subsequent analyses. The sound was imported to and analyzed with the cross-platform PRAAT software for linguists (www.praat.org), a package that allows the analysis of speech parameters such as speech intensity, pitch, formants, speech rates, and pause lengths. Episodes were subsequently transcribed using a conversation-analytic system modified for including prosody (Selting et al., 1998). (For the conventions used, see the Appendix.)

Ethnographic Context

For reasons of economy of description, we draw our exemplary materials from one seventh-grade classroom and its teacher, Victoria, who is also a co-author of this study. Our results, however, are not limited to her and her class, because all interactional resources that interaction participants produce are inherently cultural-historical and ideological, thereby transcending the individual (Bakhtine [Volochinov], 1977; Rawls, 2002). Victoria taught seventh-grade science and Christian Studies at a well-resourced independent school in South East Queensland, Australia. Victoria was appointed to the school upon graduating from a graduate diploma in education (taught by Ritchie). Prior to entering this program, Victoria had completed her first degree in Health Science with a major in nutrition, which led to a brief career as a nutritionist within a pharmacy.

Each science class was scheduled for two to three, 50-minute lessons per week in a well-appointed laboratory/classroom where desks and chairs were arranged in rows with ample bench space forming the perimeter of the room. While Victoria used the whiteboard at the front of the classroom for annotations and notes, she also used the data projector to illuminate images of artifacts relevant to the topics. Although almost all lessons observed involved student activities at the lab benches, each lesson typically began with formal announcements and teacher-student interactive segments about the topic with students seated at their desks and Victoria positioned at the front of the class. When students participated in small-group activities at the benches, Victoria visited each group to monitor progress, issue equipment and engage in conversations – some serious while others were punctuated by laughter. Occasionally a laboratory technician or teaching assistant was present to assist students with equipment and help distribute materials. Eleven lessons were observed throughout the year; seven of these were video-recorded. Selected group activities were recorded during another three lessons.

In this manuscript, we exemplify teacher-student interactions from the lessons of a unit on bridge design to exemplify the functions of laughter that were identified in and through our analyses. Because the functions of laughter and laughter as a resource are interactional phenomena, they constitute cultural possibilities rather than phenomena specific to individual students or the teacher. They are in fact observed across the lessons, in lecture-type and laboratory classes. The lessons began by situating engineering activity such as bridge design with a discussion of the work of engineers and the education required to qualify. This moved on to the range of bridge structures that traversed the Brisbane River in the capital city of Brisbane, landmarks with which all students had some familiarity. Later lessons in the unit required students to manipulate materials to experience first hand how to balance tension and compression within particular bridge structures.

Analyses

In our analyses we attempt to produce *ethnographically adequate accounts of the actions* that we observe. This means that, as researchers we “must articulate the same hesitant and momentary contexts that the natives are displaying to each other and using to

organize their concerted behavior” (McDermott, Gospodinoff, & Aron, 1978, p. 246). That is, an ethnographically adequate account aims at providing descriptions of events at the level of the participants rather than, for example, at the “meso-level” accessible only to temporally and spatially removed observers. Such ethnography draws on “the programmatic work of ethnomethodologists and the empirical work of conversational and context analysts” as well as on “supposedly diverse schools of anthropology as the interactionist, the cognitive, the ethological, and the linguistic” (p. 267–268) and is very similar to the approach that others also advocate (e.g., Erickson, 1982; Mehan, 1979). Because social structure is both resource in/for and product of social interactions, therefore visible in the give and take of each situation, no further additional meso- and macro-analyses are required to access structure in institutional talk generally (Boden, 1994; Rawls, 2002) and STEM classroom talk particularly (Roth, 2010). Moreover, because we investigate laughter as a resource in the interactions observed, a posteriori accounts for example by the classroom teacher are of little interest. In fact, because a participant’s understanding of an event changes with hindsight and with distance to the event (Husserl, 1991), such a posteriori accounts may actually be detrimental to an ethnographically adequate account of interaction as process.

This approach has immediate consequences for professional analysts, including the authors of this paper: to be able to make sense in the way of the actors, the professional analysts have to have the equivalent social competencies. No *special* (meso-, macro-) methods are required to do this research other than the methods that the interaction participants – i.e., people, ethno – themselves use (Garfinkel, 2002). In talking, social actors produce both the context and content of their talk. In trying to understand social action, we take the turn pair as the smallest unit. That is, we are not concerned with individual utterances (turns at talk), which cannot be understood in and of themselves. The value of an utterance in and to a conversation is tied to its social evaluation, which the listeners make available in their own immediately following turn or turns (Bakhtine [Volochinov], 1977). Thus, what the function of an utterance is from the perspective of the collective activity can be established only on how a second social actor “interprets” and acts upon the actions of the previous social actor – a position consistent with the conversation analytic method employed in the transcriptions and analyses of this paper.

Conversation Analysis

To concretize our analytic approach, consider the example of “This is a test tube.” Without further clues, we cannot say what is “meant” by this locution. Although locution has the grammatical structure of a statement, it could be heard as a question or as an insult. Consider the following three situations with the same words in the first turn but with different intonations and different subsequent turns.

- A 01 V: THIS is a test tube?
02 S: no its a beaker.
- B 01 V: THIS is a test tube?
02 S: what else could it be.
- C 01 V: this is a TEST tube.
02 S: so do you think i am dumb?

In situation A, the second speaker treats turn 01 as a question about the nature of an object (perhaps also pointed to by the first speaker). In situation B, the second speaker treats turn 01 as something like a rhetorical question, asserting in fact that the object at hand is a test tube. In situation C, the second speaker treats turn 01 as a statement about his/her mental capacities. That is, the content (“meaning”) of turn 01 cannot be established on its own but only through the effect it has on others, which, in turn, is indicated by the subsequent locution or action. We, the authors and analysts, therefore do not impute what the speakers intend to say, because in most instances, we do not have access to it.

Prosody is an important resource for interaction participants. That is, if the intonation (pitch) moves upward in turn 01, then the utterance tends to be treated as a question. If the prosodic cues emphasize “this,” then the question tends to be whether the indicated or another object is named “test tube.” To indicate more precisely what speakers make available to each other as resources for hearing, we also provide prosodic information, that is, information about pitch, speech intensity, and speech rate.

What ultimately matters in the analysis is the trajectory of the analyzed episode. This trajectory depends on how participants themselves hear one another. Therefore, conversation analysts do not use the individual locution as the unit of analysis but the turn pair, which is referred to as a speech act. The first turn encompasses the locution (the act of speaking) and the illocution (intend of speaking), whereas the second part constitutes the perlocution (effect of speaking). Therefore, it is the second turn that reveals whether the participants heard a question, statement, admonishment, and so on. To understand what is happening in an episode, therefore, analysts have to be able to follow the conversation that they overhear in the recorded episodes. Rather than a special method, analysts need to bring the same cultural competence that the interaction participants display to each other. (Interested readers find more on this form of analysis and how to teach it in Roth and Hsu, 2010, especially chapter 10.)

Laughter as Interactive Achievement

This study was designed to investigate the function of laughter and the situations out of which it arises in the enactment of science lessons. Our analyses show that sometimes the situations emerge from student comments, in other instances a situation is initiated by the teacher, such as when producing resources designed for laughter. Our analyses also show that whether or not a situation will be associated with laughter cannot be predicted, as laughter is a collective. As we show in the following presentation of our research findings, there are series of events that generally precede laughter that can be understood (a) in terms of invitations and acceptations to understand the situation as a whole or the topic articulated in talk in a humorous, jocular, witty, funny or ironic manner and therefore (b) in terms of invitations and acceptations to laugh. Through our analyses, we learned that laughter is an interactive achievement in which the laughter sound plays an integral and constitutive part. It is not that some situation is inherently laughable or humorous. Rather, all parties work together, offering invitations that are accepted or declined. For example, in Episode 1, the teacher Victoria asks a question that appears to have an obvious answer. Many students laugh. Now we should not think that a situation of this kind is *inherently* funny. If humor is singular – it cannot be predicted or anticipated – and shared, then it is an interactive *achievement*.

Episode 1

01 V: ben and jane *(1.33) you dont know who ben and jane are but listen and you will find OUT

02 S: <<f>h:>

> 03 V: ben and jane have recently grADuated from qu u t as CIVil engineEers (0.61) they have secured jObS with quEEEnsland depARTment of mAIn roads what do THEY build *

04 (0.41)

> 05 S: <<f, several Ss in unison >[rOAds]>

> 06 V: [roads] yea

<<smiling>[good (0.44) [a:nd]

[*]

> 07 Ss:<laughing>[hehaha]



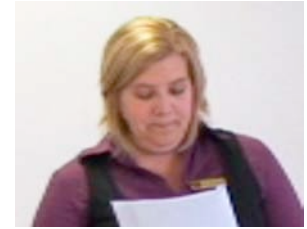
The question of what is a joke cannot be decided on the basis of the intellectual content of an utterance. There are instances – even coded as funny (“laughter”) by Victoria – that are not associated with laughter as a visible or audible phenomenon, on the part of the speaker or the audience. In the present instance, the teacher asks the obvious: “What does the Queensland Department of Main Roads build?” Up to this point, she has been reading from the teacher’s manual with a serious facial expression. Then, right at the end of what will turn out to have been a question, her head jerks a little forward and her face changes to produce an expression that one might gloss as exhibiting surprise and laughter simultaneously (image turn 03). There is a little pause before about 6 to 8 students, together with Victoria, articulate in a loud voice, “roads” (turn 05). Victoria acknowledges and evaluates the response, “Yea,” and several students laugh. Victoria, too, has a broad smile on her face (image turn 06) as she moves to continue reading from the teacher booklet. In this instance, the laughter does not just come because something is inherently funny. It arises from the situation following specific resources that after the fact can be seen as *accepted* invitations. It begins with Victoria reading while featuring a serious expression on her face. Then, immediately after asking the obvious, her body moves in a jerk, constituting a marker, followed by a significant change in the facial expression. These changes may be seen as invitations to laughter; they may be seen as marking the preceding text as something that does not need to be asked because it is the obvious. Several students respond in unison, thereby marking complicity of the kind that allows jazz musicians to play in unison during their improvisations and jam session. This is followed by student laughter and by a big smile on the teacher’s face. In this case, Victoria invites students not only to respond but also to evaluate the question as the obvious, perhaps even as ridiculous because it is the obvious, and sufficiently ridiculous to warrant laughter and smiles.

Invitations are invitations only, and, though the preferred next turn is acceptance, do not have to be accepted but may be declined. Whether an utterance constitutes an invitation is an empirical matter for participants and professional analysts. How an invitation is declined is a situated achievement that emerges from the instant in unanticipated ways. In the following episode, Victoria is in the process of reading from the instruction booklet. At one point, she reads: “at the South Bank, the new bus bridge will

reduce delays along Victoria Bridge.”

Episode 2

01 V: ((reads from instruction booklet)) a::t south
bank the new bUS bridge will redUCe delay:s
alO:NG victoria bridge. (0.27) <<p, all>ve a
bridge named after me*,> (0.84) <<f>`so (0.44)
ben> . . .



Set apart by pauses, with considerably lower speech intensity than the preceding comment ($\underline{I} = 68.1$ vs. 73.7 dB, which corresponds to nearly a factor 4 in volume), she utters, “I’ve a bridge named after me.” She then continues with a much louder than previous volume ($\underline{I} = 80.9$ dB) – thereby marking off the end of the “side comment” – “So, Ben and Jane . . .” In this instance where Victoria makes a self-reference, none of the students laugh, as they have done in the episodes concerning the looks of engineers or the mention of Victoria’s husband (see below). Victoria has a serious expression on her face, during part of the gazing at the booklet (image turn 01). There is very little variation in the pitch ($F_0 = 179.8$ Hz, $SD = 12.6$ Hz, $min = 156$ Hz, $max = 203$ Hz; preceding: $F_0 = 258.3$ Hz, $SD = 41.6$ Hz, $min = 194$ Hz, $max = 401$ Hz). The comment is uttered much faster than the normal rate. Victoria then continues to read from the manual with a louder than normal voice. A similar situation occurs when Victoria utters “that makes me sound smart” (Episode 4 below, turn 01) right after having said, “trusses have a high strength to weight ratio.” She looks up from the sheet that she has been reading from and into the class, then returns her gaze to the teacher’s manual and makes the comment about sounding smart. There is no audible reaction from the class, and without taking the gaze from the sheet, Victoria continues. Again, there is no laughter in a situation that might have been an occasion to give rise to it based on its self-deprecating nature.

In this episode, although the utterance could be a part of a situation with laughter, other aspects are missing that might invite laughter in a stronger manner, which could then be accepted or declined. Here, as the transcript shows, there is a longer pause of 0.84 seconds, when students could have taken a turn in responding, for example, by laughing, but there is no audible response. Thus, the face remains serious, the gaze directed toward the teacher manual from which Victoria continues to read. In the end, although the utterance itself may have more laughable matter than the preceding episode, it is *not* associated with and does not bring about laughter. The situation is also similar and different from another one in which she does what we may hear as “mocking” the students’ production of “rockets,” where she also has a flat delivery – resembling the present one – but where there is laughter (see below, Episode 4). In that situation, there is a contradiction between the content of the first part of the utterance (“you sound so excited”) and the monotonic delivery of the repeated word “rockets.” In sum, it is neither obvious nor self-evident that a particular utterance *ought to* bring about laughter. Whether it does or does not arise indeterminately from the situation is the result of interactive work – offers, invitations, acceptances, and declinations to laugh. Laughter or its absence, therefore, is a collective achievement that requires a certain level of complicity, perhaps solidarity, to bring it about. It is unpredictable, and something like an incorrect response may end with laughter in one instance but remain associated with the absence of laughter in another instance.

Laughter and the Serious Nature of Science

The headline “Millikin team peels back seriousness of science” (Wells, 2007) – announcing in humorous form an article on bananas in science classrooms to turn kids on to science – re-articulates the common perception of science as a serious matter. Here, too, there is a dialectical inversion whereby the seriousness of science is both questioned and reinstated by means of humor. Humor, though not admitted into scientific journals, is an aspect that both questions and reinforces the seriousness. Laughter, too, because it is an essential aspect of everyday culture, tends to be excluded from the formal endeavors concerned with truth, such as scientific knowledge (Bakhtin, 1984b). In this section, we identify functions of laughter in both undermining and reaffirming science as serious business.

IRE and the Reproduction of Knowledge

An important interactional form that teachers use to reproduce schooling generally and the differential institutional power/knowledge relations specifically follows a particular turn-taking routine: the teacher initiates the turn with a question, a student responds, and the teacher evaluates the response (e.g., Lemke, 1989). This sequence, the interactional function of which is control and the reification of a “positivistic” conception of knowledge (Poole, 1994), is generally referred to by the acronym *IRE* (i.e., Initiation, Response, Evaluation). Control is no laughing matter: “The tenants of the old truth and power tend to be gloomily serious . . . they do not know how nor do they want to laugh” (Bakhtine, 1970, p. 213). The *IRE* sequence tends to be serious business because it asserts that the teacher already has the answer, which students often do not know; and the sequence asserts not only who is in the know but also who is in the position to provide the evaluation of knowledge. Not yet investigated has been the question whether laughter, which is a way of undermining and inverting existing structures of knowledge and power, has a function in the reproduction and transformation of the *IRE* structure. In the following, we produce an extended analysis of one *IRE* episode, identified as an episode by the teacher who initiates a review for all those students who had been absent during the previous introductory lesson to the unit. The episode is completed with the review and when the teacher begins to introduce students into the present lesson.

The *IRE* exchange denoted here as Episode 3 begins in turn 06, when Victoria formulates what is to come as “to refresh the memory of those people who were away” followed by the question to be answered “What is engineering, who are engineers?” The episode ends when Victoria evaluates what turns out to be the final answer as “beautiful,” then flags a summary to come by saying “okay, so,” which is followed by the summary proper, “engineers are very cool people.” In turn 41, she gives an example of the “more efficient” that she has earlier articulated. In this episode, there are several answers. Victoria deals with them in different ways, provides different kinds of evaluations. In turn 12, she repeats Corey’s answer with falling intonation like a statement, followed by the evaluative term “beautiful,” so that the answer thereby is evaluated positively. She then solicits another response from Terra. Victoria repeats his answer, “they are incredibly good looking,” grins, and laughs, referring to an instant where this has been stated before.

The Dialectics of Laughter in an Extended IRE Sequence

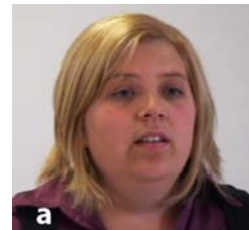
The following account breaks the *IRE* sequence into four fragments, identified by the markers that the participants themselves use: The teacher names or points to a student,

which marks the beginning of a fragment, and, by naming or pointing to another student, transitions to another lesson fragment.

Reviewing and the Setting up of the IRE The total episode (i.e., Episode 3) has the IRE structure, with a few additional turns until the anticipated/expected response has been provided. During the episode, there are instances of student contributions that give rise to laughter on the student and on the teacher part, that is, some of these instances are student initiated, others are teacher initiated. However, the teacher-initiated instance comes after the IRE sequence, after the teacher has summarized the exchange in her words and gone on to lead to the next issue in the unfolding of the curriculum.

Episode 3, Fragment 1

- 01 V: ((questioning look)) okay (0.72) we talked about what is engineering
LAST week DIDnt we.
- 02 L: uh hm.
- 03 V: ye[ss;]
- 04 S: [yea];
- 05 (0.67)
- 06 V: to refrESH the memory of thOSE people who were away:. (1.22) 'whAT
is engineering; 'who are engineers.
- 07 (0.60)
- > 08 T: <<p>weis>
- 09 V: 'what type of <<flicker of a smile>pEOple>.
yes krissy.
- 10 K: people who build stuff and desIGN stuff.
- 11 (0.42)
- 12 V: people who bUIld stuff and desIGN stuff;
'bEAUtiful tAY[lor]? *



In the first fragment of this episode – itself defined by the teacher who announces a review of what the lesson has covered before, “to refresh the memory of those who were away” to the point of summarizing what the students have said here and in the preceding lesson. There is a first offer of an answer, “Wes” (turn 08), the name of Victoria’s husband, which is not taken up. Whereas Wes in fact is an engineer, so that his name is a correct answer to the question, “Who are engineers?” it may not be such here, not as a possible response to the other question offered twice, “What is engineering?” Rather, Victoria makes another offer, “What type of people?” (turn 9). Here, the request is made to name a *type* of people rather than a specific person. It can be heard as a rebuke of the previous utterance, an indication that it is inappropriate. The next student utterance, then, reifies a question–answer sequence, “People who build stuff and design stuff” (turn 10). Victoria repeats what the student has said and then utters an evaluative term, “beautiful” (turn 10). In this case, although it might appear that she produces a *mere* repetition, *pure* repetition does not exist in language and every repetition constitutes difference and has a function (Bakhtine [Volochinov], 1977). In the present instance, the student utterance is produced with descending pitch, which marks it as an offer for a declarative statement. Victoria’s utterance also is marked with a descending pitch – though it descends less strongly than that of the students. It therefore follows the pitch contour, affirming the declarative nature rather than having a questioning intonation. Up to this point, we observe a typical IRE sequence. The teacher initiates by offering a question, a student reifies the question with a response offer, and the teacher produces an evaluative term.

“Engineers are Incredibly Good Looking”: A Side Comment? Victoria then solicits another answer by calling on Terra. The student begins to offer a response even before Victoria has finished uttering his name, “yea, they are incredibly good looking” (turn 13). It is clearly an utterance that completes a question–response sequence, as it completes the logic of the query for a type of people. But it is a special type of response, as seen from the fact that it in turn is greeted by and therefore responded to with laughter, both on the part of fellow students (turn 15) as by Victoria herself. Up to this point, the teacher has had a serious facial expression (turn 12). Right toward the end of Terra’s utterance, her eyes move upward and she begins to grin with an expression that might be seen as saying, “Oh here he goes again” (turn 13). She then breaks out in full laughter at the end of uttering what can be heard as an acknowledgment that they “did mention that they [engineers] were incredibly good looking” and while soliciting the next student for making another offer to complete a question–response turn.

Episode 3, Fragment 2

12 V: people who build stuff and design stuff;
'beautiful
tER[ra]? *

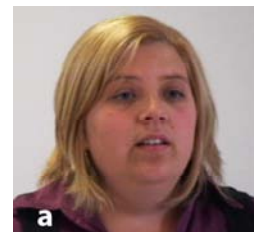
> 13 T: [yea] they=re incrEDibly good looking.
((* grin, then facial expression gloss: “oh, here he goes again”, gaze upward, slow lid closing))

14 (0.20)

> 15 S: .hh <<f>heh> ((others laugh, too))

> 16 V: <<p, grinning>we did mention they were incredibly good looking.> <<laughing * ↑>

pra(h)sa(.h)di(hh[h])> *



Here, Victoria begins to grin at what will be the very end of Terra’s response, itself joined by a student’s in-breath followed by an out-breath after the fact can be recognized as the beginning of laughter, when several other students join in. The teacher’s grin and the first student’s sounds can then be heard as an invitation to laugh, which, first, several students accept. This is an invitation to further laughter, which Victoria accepts in her turn (turn 16). In this situation, Terra has made an offer of a question–answer completion, but, whereas logically correct, it has not led to the evaluative comment that the teacher utters in other situations, here and in other lessons. Instead, the response has led to laughter, which

thereby has punctuated the otherwise serious nature of the lesson. In a way, the offer is a challenge to the seriousness of the IRE sequence that is in the process of unfolding. The structure is such that the challenge arises by being both correct and incorrect simultaneously. It is logically correct as an answer and yet clearly not anticipated as the answer, creating an effect that changes the very nature of the lesson at this instance, as indicated in the emotional response to which the utterance has given rise. One of the ways in which comedy, the joke, functions is that it rides on the undecidable nature between the correct and the incorrect nature of the answer to the response.

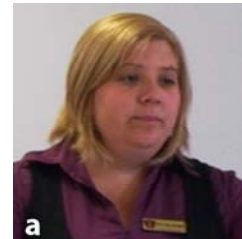
There is another indeterminable aspect here, the one between the conceptual and the bodily. On the one hand, we have discourse concerned with the conceptual issue. Victoria has offered a question to be completed by the naming of types of engineers. Such naming would normally be analyzed in terms of its cognitive aspects. Yet in the present situation, we hear and see responses on the part of fellow students and the teacher that are not cognitive at all, the facial expression changes and there is a bodily production of laughter (rapid movement of the diaphragm, cackle, punctuated taking in or releasing of breath [turn 15]). This question–response pair is both questioning (undermining) and reifying the IRE sequence. There is a teacher evaluation, which here comes in the form of laughter that follows, as previously, a repetition of what the student has said and a formulation that they have mentioned this fact before. The very structure of the IRE has been asserted all the while the inappropriate dimension of the response has questioned the seriousness of the lesson to that point, and, the seriousness with which science (engineering) tends to be presented generally. We have both reversal and reaffirmation, an opening for life as a whole to come through the crack momentarily provided, which immediately closes again as Victoria asks another student to contribute to the enactment of the IRE sequence.

In a way, there is a parallel to the analysis of Rabelais's work by Bakhtin (1984b), which shows how the official seriousness of life during the Middle Ages could be questioned and relativized. But this questioning and relativization had its place – during feasts and carnival, in carefully framed poetry and writing, in the specific roles of the buffoons and harlequins. In some countries, the practice of carnival continues; and in other countries, stand-up comedy and comedy shows have taken over the role previously relegated to carnival. Nearly anything can be said because critique and laughter are constituent parts of the frame. Certain truths can only be articulated as joke and other derivatives of humor (e.g., pun, satire, derision) because they are both correct and incorrect, truths and non-truths, seriousness and its inversion. The joke relativizes itself in asserting the truth of its own untruth, its undecidable nature, ambiguity, the double take. There is an additional aspect. The joke seeks an audience; it is produced at the cost of a second party, but has to be witnessed by a third party. Stand-up comedians and satirists deride, for example, politicians explicitly for the audience present. In the present instance, the joke is at the expense of Victoria, to whose husband the reference has been made, and we can hear that the audience has attended through the laughter and cackles. Victoria also gazes in the direction of the camera and the researcher recording the lesson, then to Prunella, again at someone else in the classroom, and then returns to Prunella. That is, not only does the author produce the joke with a sideward glance at and for an audience, but also the recipient of the joke, the “victim” is oriented to those third parties who not only overhear what is said but also for whom it is said.

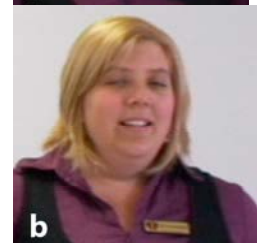
“Engineers are Rich”: A Stereotype? The next Fragment of Episode 3 has the same structure as the previous one. At first, Prunella produces an utterance as a candidate for completing a question–response pair to be evaluated in a third turn at talk. Prunella suggests that “they [engineers] . . . think of more efficient ways to do something” (turn 17). Victoria immediately responds with a positive evaluation, “Ooh, I like it” and then, as previously, repeats what Prunella has said, “the more efficient ways of doing something” (turn 18). A side sequence designed to ascertain that other students understand the term “efficient” occurs prior to the next solicitation of a response to the initial question. The next student called upon, Irisana, suggests that “they are rich” (turn 22). Victoria grimaces and grins, and then repeats the student’s utterance, “they are rich,” while emphasizing the adjective (turn 23). But even before she has completed her utterance, and in particular before having the time to provide an evaluative term, another student comments with low volume, “they are not that rich” (turn 24). In the next turn, Victoria utters what can be heard as taking on this student utterance and simultaneously evaluating two previous comments, “we did mention the topic of stereotyping engineers” followed by a negation of Irisana’s and Terra’s offers, “they are not all incredibly good looking and rich” (turn 25).

Episode 3, Fragment 3

- > 16 V: <<p, grinning>we did mention they were incredibly good looking.>
 <<laughing ↑> pru(h)ne(.h)lla(hh[hh])>
- 17 P: [uh] they got um think of more
 efficient ways; to do something,
- 18 V: OOh i LIKe it (0.22) pruNELla said that the more effICient ways of
 DOing something. (0.40) effICient mEANing?
 19 (1.16)
- 20 P: bETta.
- 21 V: EASia:: betta and? (0.43) quICka (0.20) yes: ↑irisANa
- > 22 I: * they are RICH:



- > 23 V: * they are RI[CH:
 24 T: [<<p>they are not that rich>]
 25 V: we did [mention]
 [((a student laughs))]
 the tOpic of stereotyping engineers they are not
 All incredibly good looking and rIch. ↑yes
 ((points))



Prunella provides an answer that receives a clear positive evaluation, “ooh I like it” (turn 18), followed by a question concerning the sense of the term “efficient” (turn 18). One student responds, but Victoria then provides the synonyms for the term efficient, “easier, better and quicker” (turn 21). In the next response, Irisana provides an answer according to which engineers “are rich” (turn 22). Victoria repeats, a student utters in low voice, “they are not that rich” and then Victoria limits the generality of this and a preceding response, “they are not all incredibly good looking and rich” and classifies them as stereotypes. Here

she formulates the description as a stereotype, and that they have already mentioned it. As previously indicated, the response is both appropriate and inappropriate simultaneously. Victoria marks it as such when she says that it is a stereotype. A stereotype takes a characteristic and over-generalizes it to an entire population in a clearly inaccurate or inappropriate way. However, this response may be correct as it is likely to be representative of engineers in particular positions at certain points during their careers but, as a stereotype, it is also inappropriate. This particular response is realized in part as a humorous one, as indicated by the teacher's grin and students' laughter. It thereby both undermines and reaffirms the IRE structure. The teacher evaluates the comment as an expression of a stereotype. More so, she articulates the two statements as having been the subject of a previous discussion, and of the topic of these characteristics as stereotypes. She formulates the dual nature of the responses as appropriate and inappropriate, as stereotypes; and she formulates the repetition.

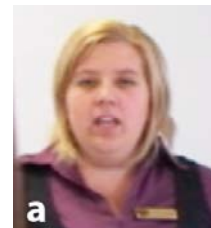
Engineers are Smart and Are Called Wes In Fragment 4, we again find a student utterance followed by the completion of the IRE sequence by the teacher. The student says, "They [engineers] are smart" (turn 27), followed by Victoria's repetition, "they're smart" and the evaluative affirmative, "Yea" (turn 29). The next student then offers, with a much louder speech volume, the name of Victoria's husband, "Wes" (turn 31). Victoria begins to repeat, "They're called Wes," when a boy in the front row claps his hand, Victoria, who preceding this point has displayed a very serious face, breaks out in laughter, and several students in class begin to laugh (turn 33).

Episode 3, Fragment 4

```

26      (0.40)
27 P: they are smart.
28      (0.32)
29 V: they=re sma:rt; ~yea:
30      (0.92) ((Fig. 3a))
31 B: <<f>'weis>
32      (0.95)
> 33 V: <<len>they=re called [weis (0.36)>
      <<smiling>[yea(hh)<<ff>(.heh)>
      >                                     [((boy claps))
      >                                     [* ((laughter, in class))
> 34      (0.68)]

```



Here, as before, Victoria both repeats the student statement – though in an expanded form “They’re called Wes” – and provides the evaluative affirmative, “Yea.” That is, she marks the response as one that turns the utterance sequence into a proper question–response pair; and, in and with her laughter, she simultaneously marks it as a joke, as something to be laughed about. It is both an appropriate and inappropriate response simultaneously and the difference is undecidable. Moreover, it is not just Victoria who laughs. There is a more general enjoyment. Here, then, as before, the understanding about the dual nature of the non/response is shared, at least we know it for those students who, as Victoria, laugh or provide other relevant signs. In this situation we see the function of laughter to reproduce and transform a close relationship with a topic that is improper to science content. However, by laughing with the students, Victoria actually marks a level of

intimacy, which “is enacted as an interactive matter in and through the production of impropriety and the uptake of it through the production of shared laughter in response to it” (Pomerantz & Mandelbaum, 2005, p. 166). In this instance of introducing the teacher’s spouse into the classroom discourse, there is laughter. But in a similar situation, the production of an answer making the same reference to the teacher’s private life is not associated with laughter. Then, there is a possible initiation (Episode 3, Fragment 1), when, following Terra’s uttering of Wes, the name of Victoria’s husband, there is a hint of a smile crossing her face. This smile comes while she rearticulates the question and calls on Krissy to respond. Here, then, what could have been a possible initiation of laughter is resituated by the continuation and by calling upon another student. An instantiation of intimacy is averted as one of the possible interaction trajectories in that this sense is not taken up and reasserted by other contributions.

Outrageousness: Explicit Challenges of the Serious Nature of Science

Laughter may arise from instances when a participant utters something that evidently, as marked by the responses to the turn, as (gross) exaggeration. Exaggeration generates grotesque realism, which is one of the forms in which the material and bodily principle presents itself in its festive and utopian way (Bakhtin, 1984b). Gross exaggeration in particular inverts the truth of realism, and, in so doing, reaffirms it. Grotesque realism constitutes a parody of the world experienced as humorous and associated with laughter. The popular laughter that organizes all forms of grotesque realism has been an integral part of human history. Grotesque realism reaffirms the real by presenting it in forms in ways so exaggerated in which they do not or could not exist. Grotesque realism is the impossible made possible, a form of the inner contradiction that not only makes possible but also constitutes the very principle of dialectical materialism. The main trait of grotesque realism is abasement; that is, the transfer of anything and everything that is elevated, spiritual, ideal, or abstract to the material and bodily level – to the level of the earth and the body and their indissociable unity. Exaggeration overturns the claims of science to truth, relativizes the truth by rendering aspects of reality that exceeds anything possible in reality. It is a form of inversion, bringing the noble to the ground by mixing truth and lie, the impossible as a form of the possible. We find examples of grotesque realism throughout the lessons and in various forms. Laughter, and the funny (humorous) nature of the instance, is produced and derived from the outrageous number (in turn 09) and the facial grimace (image b).

Episode 4

- 01 V: this is what is happening; the report says that by the time yo=re
thirty=seven; (0.37) in two thousand twenty six. (0.48) sou:th ea:st
quEE:nsland is expected to have more than threE point SEVEN MILLion
people.
- 02 (0.44)
- 03 T: whAT?
- 04 A: wow.
- 05 V: REAlly.
- 06 A: thats a lot.
- 07 (0.47)
- 08 V: three point seven million in (0.44) bris in
queensland gUEss how many in `brisbane; *



> 09 D: twenty two million.
 10 (1.06)
 > 11 [(0.99)
 [(V grimaces *, student laughter))



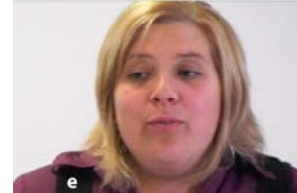
> 12 V: [NO:oo
 [(*, student laughter continues))



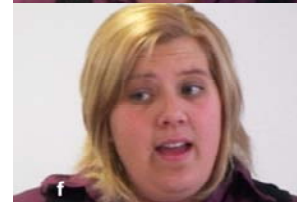
13 T: (dont be silly?) *



14 V: 'with (0.22) more than HALf * of these people
 (living?) in brisbane



15 (0.29)
 > 16 T: n=that a lot?
 17 V: =yea that is a lot *



Terra says, “Don’t be silly” (turn 13), and thereby marks the previous comment as something that is so much out of the ordinary that it could not be real. A member articulates another member’s comment as “silly.” But it is precisely the grotesque (“silly”) that allows it to be funny as well. In this episode, the 20 million actually expresses “a lot,” even though it does so in an exaggerated way. Repeatedly in the episode, there are markers that make the size of the population stand out. In turns 03 and 04, two students comment “What?” and “Wow.” Then, after Victoria has ascertained the reality of the population size, another student comments, “that’s a lot” (turn 06). Victoria then continues, first repeating the number of people living in south-east Queensland and then leads offering a query as to the number of people in Brisbane, the major agglomeration in this area. A student utters “twenty million,” an offer to complete the question–response pair. There is a longish pause, several students begin to laugh and Victoria, simultaneously, grimaces. Another second later, Victoria produces an initially emphasized, drawn out “No” all the while students continue to laugh. Precisely when continuing to speak, her facial expression becomes serious again as she suggests that more than half that number of people live in Brisbane.

Another such situation in the lesson emerged when Victoria, after saying that there are 13 bridges in Brisbane and another three under construction, asks for the total number of these structures. Dean takes the next turn saying “thirty-four,” to which Victoria responds

with a grimace. Several students, in turn, laugh out loud. Again, there is a sequence of events that – beginning with an exaggeration, or rather, an evidently false response to a question – ends up in laughter. In a similar way, student laughter emerges when Victoria, following the arches of an arched bridge with her index finger on a photo projected against the screen, suggests that cars “obviously are not driving along this way.”

Reproduction and Transformation of IRE

All of the above instances of laughter are situationally created when student utterances design to complete question–response pairs take unexpected turns that produce laughter. The jokes are on (at the expense of) the teacher, but, in and with her laughter, Victoria also marks these as acceptable – thereby remaining in the same key/script rather than changing it as teachers might do in other situations (e.g., Gutiérrez, Rymes, & Larson, 1995). The witty responses and the laughter that follows, while undermining the seriousness of schooling generally and the science lesson particularly, come to be accepted. Moreover, these are not only accepted but allow the IRE sequence and its serious purpose to unfold. The seriousness of science thereby is strengthened, for the very function of the IRE pattern is to assert the correct answer and therefore the single truth – even in cases where “societally charged issues such as class, ethnicity, or discrimination dominate a teacher’s original presentation of a topic” (Poole, 1994, p. 143). The pattern “appears to inhibit holistic approaches . . . to curricular topics” (p. 144) and therefore multiple perspectives and the questioning of the opinions that scientists express, for example, in the media. That is, all the while undermining the seriousness and bringing the fullness of life into the lesson, the jokes and laughter reaffirm the IRE sequence and subsequences themselves, thereby moving the lesson to the place where it is intended to go: as Victoria has announced, the purpose of the episode is to “refresh the memory of those who were away” (turn 06). In these instances, wit, joke, and the responding laughter become part of the IRE sequence as it unfolds. Although one may be able to imagine situations in which the effect of laughter is such that it totally undermines the achievement of the lesson, in many classrooms that we have observed, humor and laughter become an integral part of the lesson. In these instances, the seriousness of the sciences is interrupted, punctuated, and the fullness of life is reasserted. Science becomes relativized, one of the human endeavors that are subject to joy, ridicule, humor, and wit just as any other pursuit in the fullness of life. These aspects of human nature make it apparent that the difference between science and non-science is undecidable.

Naming the teacher’s spouse as a correct but socially incorrect response can be considered to be a move that threatens the speaker’s negative face, where negative means being able to pursue one’s interests without interruptions or interferences (Politi, 2009). Here, the teacher intends, as seen in the realization of the lesson, to get through her curriculum. One part of this enacted curriculum is the review of some major articulations of the previous lesson to prepare the students for the content of this lesson on engineering. This achievement is potentially threatened. But, in laughing with the students, Victoria both participates in producing the situation as a humorous one and, most importantly, recovers by reasserting the lesson itself. Her laughter allows the situation to be overturned from a threat to an assertion of the formal IRE structure and the lesson content.

Laughter in the Production of Intimacy, Complicity and Solidarity

In our database, we find numerous recurrences of topics that are associated with

laughter. These moments, such as the repeated use of the expression “engineers are incredibly good looking” become something like an “in-joke,” which, as an in-joke, re-affirms and transforms complicity, a sense of community, and solidarity. Some instances are designed for laughter, both with respect to the content and the process of the science lesson.

Teacher Comedy Designed for Laughter

There are instances in classrooms where teachers act to explicitly design an instant of humor that is to be greeted by laughter. This also is the case in the lessons we observed in this study. For example, immediately following the previous fragment, Victoria begins to produce a summary of what either has been said or constitutes the memory refreshing. In Fragment 5, she at first assigns another turn to Patty, who utters, “They are problem solvers” (turn 37). As before, Victoria repeats not only the words but also the pitch contour, which falls toward the end so that the utterance may be heard as a declarative statement, “They’re problem solvers.” This repetition is immediately followed by a particularly expressive and emphatic (see emphasis on bEAU) evaluative adjective, “beautiful “ (turn 38). The teacher then moves into a summary, marked as such in several ways. First, the opening word “okay” is uttered with a rising and descending contour, which may be heard as in the gloss, “okay, we have sampled enough student comments and we have arrived at the end.” Second, she uses the inferential adverb “so,” which we may be heard as per the gloss “so what I hear you say is that.” Third, Victoria makes a resolute body movement, where the hand progresses from up to down and inward, in the way an orchestra conductor moves his/her hand in an emphatic manner that completes a musical movement. Victoria then makes several declarative statements, “engineers are very cool people” and “we like them because they build buildings for us.” She adds to the second statement “that don’t fall down,” to which one student responds with a laugh. But here, neither Victoria nor the other students follow suit, so that there is no shared aspect to the instant. Whereas this one student may have found the description funny (which we do not know with any certainty), it is not one that is more generally marked as humorous. But immediately thereafter, Victoria actually produces an instance designed for humor. The situation arises as the teacher describes the purposes of the bridges designed and built by engineers, “so that we can get over the river quicker.” Victoria then moves into a performance designed for humor. As the photograph shows (turn 41, image b), she lifts up her hands and arms, sinks her head between shoulders talking about crossing the river by boat evidently going slow.

Episode 5 (immediately following Episode 3, Fragment 4)

```
> 35 V: <f>.hh> madi? *
    36   (0.19)
    37 M: the=re pROblem solvers.
    38 V: they=re PROblem solvers. 'bEAUtiful. (0.27)
        ^okay so engineers are very cool people. we like
        them because they build bUILDings for us, that
        dont fall dOwn,
```



- 39 M: <<laugh>hh>
 40 (0.64)
 > 41 V: they build BRIDges for us so that we can get
 over the rIver quicker instead of going on a
 boat bARge and sitting on the boat barge going
 <<ral, monotone>wow thats awesome.> ((170 Hz)) *
 > 42 ((student laughter)) hhhhhhh
- 43 V: ↑ ((240 Hz)) forty minutes later ↓okay lets go *
 > 44 A: <<laughing>.h .h .h .h h> ((some begin to talk))
 ((Alda))
 45 S: <<p>i dont think (that good?)>
 46 V: ↑ ((400 Hz)) <<f>'what ty:pes of enginEE:rs;
 bUIld bridges.



The performance is greeted by student laughter. Victoria continues, her pitch jumping upward by nearly 30 percent, “forty minutes later, okay, let’s go.” She grins and several students laugh. Others begin to talk. In this instance, the teacher herself designs a situation to be humorous or funny. She thereby allows humor, which overturns the seriousness of science, into her lesson; she makes the inversion part of the lesson, and thereby actually reasserts the domination of life by science. Here, her comedic performance asserts the importance of engineers to contribute to everyday life by building bridges that allow more efficient crossing of the river. Parody, comedy, and other comic performances work with exaggeration, which does not announce itself as the goal of the performance but as a means to render manifest and highlight certain features that are already invisibly present (Bergson, 1900). There is a tension between what is initially seen and that which the parody or comic makes us see, a fold that announces itself so that the performance can render it visible. It is a dialectical tension of absence – from the salient – and presence. It is a tension that Kant describes to be released in laughter. Like laughter on the part of a speaker (Jefferson, 1979), parody together with the grin is a technique for inviting laughter. In the humorous situation featured among our examples, the recognition point follows the enactment of the slow, puttering movement of a ferry across the river and the teacher’s smile. The grin is a teacher design that invites laughter from the recipients achieved interactively with the class.

Laughter as Meta-Comment on the Lesson Process

Laughter has an important role not only in the reproduction and transformation of scientific knowledge in a science lesson but also in the social evaluation of the lesson process itself. In the following episode, humor is a form of meta-comment on the situation. The student response to a teacher query is marked by means of a contradiction. On the one hand, Victoria articulates students’ responses as sounding excited – elation/joy correlates with increase in pitch mean, perturbation, and variability and with increased speech intensity, mean, and variability (Scherer, 1989) – but her prosody, on the other hand, expresses the opposite. Victoria thereby produces a form of commentary on the nature of student participation and engagement in the science lesson.

Victoria has been reading from and elaborating on the activity notes, the introduction

into the curriculum. Her gaze sometimes goes back and forth from left to right, as if she were looking for the transition between the lines; her reading thereby comes a bit stop-and-go. Every now and then, students articulate, on signal, the next word from the text. In the present episode, this signal comes in the form of a drawn out “and” at the end of a listing including the words “bridges” and “roofs” (turn 01). Without pause, students utter “rockets” in an equally drawn out manner. As the pitch analysis shows, there has been little variation in Victoria’s talk. The students latch onto her pitch – a sign of alignment and solidarity with the previous speaker (Roth, 2010) – and then articulate the word “rocket” in a drawn-out manner and with an unchanging pitch. Victoria – the lay voice analyst – tells us how this can be heard: as not being excited. She does not state the situation in this manner but says the opposite. The effect is achieved by repeating the students’ word not only in form – allowing us to hear the word “rockets” – but also prosodically. Her pitch does have the same contour and is almost identical, descending in the very early part of the utterance from just over 300 Hz to between 270 and 280 Hz. As if her comment were a signal, several join in and articulate the word again, also drawn out, with little pitch variation. There are other sounds produced, and then laughter can be heard.

Episode 6

```

01 V: trusses have a high strength to weight ratio (0.74) that makes me
      sound smARt (0.75) can span longer distances than bEAM bridges and
      are usually used in many strUCtures including=including bridges
      roofs A:n:d
02 Ss:  rocke::ts
03     (0.63)
> 04 V: you sound so excited (0.22) * rocke[e::ts)
> 05 T:                                     [rocke:ts
> 06 M:                                     [rock[e:ts]
> 07 S:                                     [momo]mo ((laughter))
08 V: <<ff>trUSs bridges>

```

In this instance, the humor is produced by the compilation of a repetition of the word associated with a description that expresses precisely the opposite of what the prosody seems to indicate. In repeating “rockets” in the students’ manner, Victoria actually articulates the truth. At the same time, she describes this expression in a way that says the opposite by commenting that they sound excited. The two-sidedness of the comment, the contrast, the indeterminateness between truth and non-truth creates a humorous moment, as can be taken from the students’ expressions that includes laughter. At the beginning of this episode, there actually is an instance that could have been the starting point of a humorous exchange, but, as we suggest above, it does not lead to laughter. Thus, she comments, separated by considerable pauses, “that makes me sound smart.” This could have been heard as a self-elevating comment. But in this instance, consistent with the facial expression that remains very serious, there is no laughter.

Another example of a comment about the lesson that leads into an instant of laughter arises when Victoria and a teacher assistant realize that one of the teacher workbooks has gone missing. Victoria asks the students if any one of them has the workbook. She then suggests, “it’s got all the answers and I want it back.” Several students laugh out loud, to which Victoria joins in. There is an exchange between Alda and another student about whether one of them has it and Alda clearly says that he has not. Victoria asks, “Are you

sure?" And again, students laugh. In this instance, the missing teacher manual constitutes the occasion for humor. There is a degree of irony: the missing teacher manual has the answers, students could copy it and the anticipated task would require little work because the answers already exist. But, as in other instances, it is not the situation *in itself* that creates laughter. As Victoria speaks, there is a flicker of a smile crossing her face and then a quick flicker of a raised eyebrow follows. She ends with a very serious facial expression. Several students laugh, and Victoria breaks out in a cackle, "hehehehehe," her face exhibiting a humored expression. Here, the serious face is interrupted twice, once by a wink of a smile and once by the raising of the eyebrows. Both are possible invitations, reified as such when students accept by laughing, and their laughter, in turn, is reified as a suitable response by the teacher's laughter.

Laughter and School Science

Many approaches to science education – e.g., conceptual change (Treagust & Duit, 2008) – emphasize that its purpose is to help students to move from any one of a multitude of "alternative conceptions" to *the* "scientific conception" on a particular topic (e.g., see content standards in Hazen and Trefil, 1991, or NRC, 1996). The trajectory of learning, therefore, is from multiple possible modes of understanding in everyday life to *the* singular mode of understanding a topic or concept. The present study shows that laughter may have an important function in the production of the lived curriculum because it is a way of dealing with the seriousness of the world that makes claim to the sole truth. That science is serious (business) is one of the important cultural messages available to students in society. This is a particularity of science – as perhaps of the other STEM subjects of technology, engineering, and mathematics – as other subjects such as the arts, music, physical education, literature, and poetry place a great emphasis not only on subjectivity but also on conceptual plurality and multiplicity and multi-voicedness. Precisely because laughter questions single voicedness it may undermine and – as this study shows in a double reversal – at the same time support the enactment of science by reproducing and transforming positive emotions in teachers and students alike. What, some readers might ask, do the results we report add up to?

On the one hand, laughter threatens the seriousness of science lessons by asserting the humorous aspect of life. In doing so, it helps science classes become more life-like and less alien to learners. Just as researchers of scientific literacy (e.g., Wellington & Osborne, 2001; Avraamidou & Osborne, 2009) have argued that wider use of everyday discourses in science classes makes the formal content of science more accessible to learners, more life-like classroom interactions that include episodes of laughter might connect learners better with the ideas of science. On the other hand, laughter thereby stabilizes the seriousness of science. If science were just like everyday life, then there would be no need to teach it. Moreover, the work of real science does have tedious dimensions, which students do find out about when they have opportunities for doing an internship in a laboratory (e.g., Hsu & Roth, 2010). This has implications for the ways in which teacher education classes are conducted. Rather than over-emphasizing formal and serious models for conceptual change, for example, a focus on creating and analyzing life-like conversations about particular science topics might help diversify new teachers' modes of interaction for the achievement of scientific literacy. At the same time, pretending that science is all fun would constitute a serious lie about the nature of science, as much as it would be a laughable

claim to say that science is all serious.

Laughter, however, inherently involves ambiguity; it therefore has the potential to question the content and process of science education. Although it is a central aspect of culture, laughter has not received the proper attention it deserves among science educators. Yet without laughter, we cannot understand the evolution of literature or culture (Bakhtin, 1984a). Laughter is a powerful source of cultural transformation. The importance of laughter to the lived science curriculum, content matter learning, and as an indicator of the recognition between correct and incorrect scientific knowledge has only been recognized recently (Roth, 2009). In asserting and reasserting life, it also asserts its serious dimensions. Laughter is both a threat and a reassertion of science as a serious pursuit with pretension to truth. Laughter works particularly well in public places including classrooms as we show here, because, like irony and critique, it needs the spectator to which it orients itself (for evaluation). The joke is a joke on the other, to be witnessed by a third person. Our investigation exhibits some of the fundamental characteristics and functions of laughter in the enactment of science lessons. First, laughter is an interactive achievement that indeterminately arises from the situation, and each instance, as any other instant of life, therefore has a non-repeatable element. Second, laughter may have a dialectical function in both questioning/challenging relations of knowledge/power and, simultaneously, reaffirming them. Third, laughter creates intimacy, complicity, and solidarity between members of the class where members are differently located in institutional terms.

Jokes have already been recognized as a means of contesting the cultural standards enacted in school (Gutiérrez et al., 1995). Therefore, one might also be inclined to analyze laughter in terms of the institutional relations between participants, that is, for example, in terms of institutional relations of power. Here, power is understood as the potential an individual has to influence others, their actions or thoughts, and therefore, the influence that an individual has on the trajectory of an interaction (Norrick & Spitz, 2008). Power, considered in this way, is not something that is static or that an individual can “have” but is something that interaction participants achieve. Power is, therefore, at best a category that has after-the-fact rather than predictive validity. Humor, jokes, and laughter are resources for the production of differential power and conflict or, conversely, for the production of solidarity and intimacy. Whereas for Freud (1905/1992), jokes bypass reality, they also provide relief from the seriousness of life. For Bakhtine [Volochinov] (1977), however, jokes reflect ideological struggles and tendencies. The ruling classes tend to emphasize seriousness, when the sciences assert themselves in everyday life as the only way of going about the problems of society. Laughter may have the same effect as some jokes, which, when made at the expense of a student, may be along racial (Gutiérrez et al., 1995) or gender differences (Roth, Boutonné, McRobbie, & Lucas, 1999). However, whether there are such tendencies or whether there are cultural differences in the participation of producing laughter would require an empirical study in its own right.

There are different devices for producing and recognizing intimacy, such as, for example, laughing over rudeness (Jefferson, 1974). In the present study, intimacy was reproduced and transformed with laughter in references to the teacher’s husband, and jokes at the expense of the teacher. Uttering the name of the teacher’s husband, for example, may constitute a form of transgression, bringing into the classroom discourse something that may be considered not only irrelevant but also pertaining to the personal

realm of the person in charge. However, laughter bypasses the prohibition and, as indicated in and through the teacher's participation, makes her an accomplice in the transgression made at her expense. The transgression is socialized, and contributes to the production and reproduction of the IRE pattern – to the transformation of the IRE and its reproduction.

Our results show how a teacher may use parody to produce a public social evaluation of student engagement in the science lesson. Here, parody addresses and attacks especially certain negative aspects, certain weaknesses and imperfections that it overturns and inverts. The associated laughter is as universal as the serious; it addresses itself to the whole world, history, society, and the conception of the world (Bakhtin, 1984b). It is a form of truth that extends itself to the world as a whole, to all its aspects, a certain revelation of the world through the lens of play and laughter. In her parody of the students' engagement, the teacher also modifies the distance that might exist between her institutional position and that which the students occupy in this class and school. She laughs with her students, and thereby reduces the distance between their institutional positions. In those instances that are marked by laughter, the traditional opposition between teacher and students is at least momentarily suspended. This is not unlike in the carnivals around the world, where, for a moment of time, the traditional oppositions between the ruling classes and those ruled are overturned.

The distance between teacher and students – in part the result of the asymmetry produced in the IRE turn-taking routine – is also reduced when a student provides a response that is obviously outrageous or wrong, leading into laughter. There are repeated instances in our database of such instances. In these situations, the cooperation of the teacher is required, though it falls upon the student to take the role that is not unlike that of the buffoon or harlequin. There are certain figures (e.g., buffoon, harlequin) that take on the role of questioning seriousness, power, and official order. These are associated with the special times of the year where the powers provided opportunities of release, for example, carnival and feasts. With these times also coincided certain recreations at the university and schools (Bakhtin, 1984b) when laughter was allowed. In this class, Terra was one such student as she was often involved in laughter episodes. This involvement itself is part of the public marking and production of a special relation with Victoria.

In this study, laughter was co-extensive with the production of solidarity and intimacy not only between Victoria and particular students but also as a special form of the classroom climate. These are not just feelings that exist independent of the science lesson but constitute the very essence of this lesson, as the productions not only have content but also produce the very situation (Roth, 2010). In the *joint* production of an episode of laughter solidarity and intimacy are exhibited. That is, there is not only humor, solidarity, and intimacy produced so that participants feel good or for any other psychological and social reason. The situation as a whole and – because of the dialectical relations between individual and collective – each participant is subject to the same characteristic. Science lessons are not one-sided in their emotional tenor, merely serious, but take on aspects of life in general. It is precisely when science lessons take on the same characteristics as life more broadly, when they are serious and humorous, when they embody the generative principles of life, that they reflect a greater truth than when they are one-sidedly serious. As such, laughter may be an integral aspect in the production of a positive classroom climate that supports students' learning – though the direct linkage between specific instances of laughter and the learning of specific science content remains to be shown.

Science education scholars often ask those of their peers interested in the social aspects and functions of classroom interactions, “But this is a general phenomenon. What does it have to do with science content?” To these questions, we answer, “Everything.” This is so because without the enacted curriculum, that is, without classroom processes, there would be no formal schooling in science. But, more specifically, our data shows that laughter is integrally related to learning and understanding. For example, the laughter that follows the naming of an engineer, here the spouse of the teacher, exhibits understanding of the ambiguous nature of the response, which is both technically correct and improper; in addition, this naming has social function of reproducing and transforming intimacy, part of the learning environment that fosters engagement, interest, and thus learning process. When the teacher shows by means of gestures where on the bridge a vehicle does not move, she produces a funny situation. The pun depends on the reality of the bridge and the impossibility for a car to move along the arches. Here, the pun rides on the recognition and therefore understanding of the structure of a bridge and how it is used as a resource for crossing a river. That is, science content knowledge is integrally related to the joke, which arises from an understanding of two contradictory moments.

In conclusion: Laughter is an important dimension of life and, as we show in this study, may play an important function in both overturning and reasserting the seriousness of science. Given the current paucity of research in this field, our study only opens what may become an important area of study in science education broadly. Science educators might be interested in studying questions such as “What are the long-term effects on science attitudes and knowledge when students/children are encouraged to laugh in the context of science?” (e.g., the *Mad Science* program advertises that its activities bring about laughter.) “What are the mechanisms by means of which designed-for laughter is brought about?” “What is the relation between short-term laughter and long-term appreciation of science?” “How do students relate to scientific facts and concepts when they become laughing matter?” “How do science activities intended to foster laughter (e.g., *Mad Science*) mediate children’s/students’ long-term trajectories in science?” or “What is the function of laughter in holistic (culturally sensitive) science classrooms that are not geared to prepare students for high-stakes testing?”

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