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"How stupid can a person be?" – Students coping with authoritative dimensions of science lessons

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ABSTRACT

Current mainstream practices of education tend to have an authoritative and serious side through their emphasis on the transmission and reproduction of canonical knowledge. Simultaneously, there are calls for dialogical approaches that provide students with opportunities to express their understandings and thereby increase engagement in learning. Yet there is little educational research on the students' ways of coping with the authoritative dimensions as these arise. In this study, we use data from an outdoor science setting where the teacher is not physically present to identify students' ways to act upon authoritative feedback. Our study shows that dialogic interactions among the students, which might be considered unacceptable behavior or off-topic activities, allow students to (temporarily) regain some level of control over the authoritativeness of teaching. The students use abusive language, humor and derision to oppose and degrade authoritativeness conveyed in the teacher's evaluative feedback in ways that would not be accessible to them with the teacher present. Simultaneously, disrupting the authoritative role of academic learning reinforced its serious nature, which manifests itself in the way that the students follow the teacher's instructions and improve their level of performance as if the negative emotions had been coped with in affectively meaningful ways.

1. Introduction

Institutionalized teaching is inherited with an authoritative dimension and the kind of knowledge transmission where "someone who knows and possesses the truth instructs someone who is ignorant of it and in error" (Bakhtin, 1984b, p. 81). Despite of efforts to advocate the educational ideal of dialogic teaching—characterized by the acknowledgment and emphasis on the students' views and voices—the appliance of truly dialogic classroom practices remains challenging (Calcagni & Lago, 2018; Reznitskaya & Gregory, 2013). For example, grading practices and textbooks are utilized to evaluate students in relation to knowing or not knowing the authorized facts, with less concern being directed on the students' voices and ambitions (Roth & McGinn, 1998). The authoritative dimensions are particularly present in science and mathematics education, which are less open to accept different readings and different versions (truth) than other fields such as social sciences (van Eijck & Roth, 2011). Bakhtin's work on dialogic nature of speech, as well as people's means to oppose the monologic forms of knowledge, is particularly concerned with science and religion; they both pretend to know eternal truths, whereas in other fields, multiple perspectives are more easily accepted (Bakhtin, 1984a, 1986). It is therefore not surprising that particularly in science education the authoritative dimensions of teaching (knowledge) is often paralleled and manifested in the dichotomy between students' mundane conceptions and the canonical scientific views as the

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right answers to be aimed at (Burgin & Sadler, 2013; Rees & Roth, 2017; Sharma & Anderson, 2009).

Authoritative discourse that emphasizes students' lack of proper knowledge may lead to students' experiences of teaching as oppressive and to becoming alienated from the (school) learning (Roth, 2009). The lack of opportunities for students to draw from their everyday experiences and ideas and to use their own voices has been linked to disengagement from learning and to a decrease in motivation and academic performance (e.g. Aguiar, Mortimer, & Scott, 2010; Lyons, 2006; Morales-Doyle, 2018). Studies show that negative affect (in the form of emotions) can arise in situations where students face evaluative feedback from the teacher or have difficulties to find the right answer or the correct way to proceed with the given task (Bellocchi, 2018; Bellocchi & Ritchie, 2015; Brown & Melear, 2006). As a result of the authoritativeness and its manifestation in classroom interactions, science teaching in particular is often perceived as overly serious, emphasizing cognitive rationales deprived of laughter and fun (Roth, Ritchie, Hudson, & Mergard, 2011). Whereas the negative consequences of authoritative teaching have led to the promotion of student-centered teaching methods and dialogical approaches (e.g. (DeWitt & Hohenstein, 2010; Reznitskaya & Gregory, 2013), very little research exists about how students are coping with the authoritative dimensions and their possibly negative affective tones *as they arise* in science lessons.

In this study, a case from science education was taken to investigate how students cope with authoritativeness as it is manifested in the evaluative feedback from the teacher and how the negative affect of frustration is dealt with during their reactions. We draw on data from a science lesson in which eighth-grade Finnish students conduct field research where, because the teacher is not in close proximity, students expressed themselves openly regarding their relations to the learning task and the teacher.

2. Theoretical background

A number of studies suggest that dialogic teaching that acknowledges students' views and voices in the collaborative process of producing knowledge benefits students' engagement, interest, and academic performance (e.g. Aguiar et al., 2010; Calcagni & Lago, 2018; Lyons, 2006; van Booven, 2015). Conversely, solely authoritative discourse in classrooms with single undisputed truth can be perceived as unrelated to and even suppressing and alienating to certain student experiences (Roth, 2009). Alienation from school life is a major challenge for educators, policy makers and educational researchers to be dealt with. The core of the school alienation can be traced to the institutional setting; learning as the main objective of schooling and teachers representing the school authority form, along with peer community, the main domains from which the students alienate (Hascher & Hadjar, 2018). In this respect, what students experience and how they cope with alienating aspects of authoritative dimensions of learning turns out to be an important element for understanding the processes that can be alienating for students. In this study, a case from science education was studied to investigate a broader issue of coping with authoritativeness. Whereas in science education some particular authoritative aspects of knowledge are emphasized, the authoritative dimensions of teaching are generally ingrained in the institutionalized forms of schooling.

The authoritativeness is often produced in classroom talk that follows a turn-taking pattern where teacher queries and corresponding student replies are completed by teacher evaluations (Aguiar et al., 2010; Mehan, 1979; Scott, Mortimer, & Aguiar, 2006). Thus, even though there may be two or more participants in a verbal exchange, the encounter is monologic when the truth of the outcome is pre-established—such as in the late period of Plato's Socratic dialogues (Bakhtin, 1984b). In classrooms, dialogic opportunities for students are usually allowed to happen in a controlled and limited context. Typically, classroom interaction between the teacher and the students is built upon turn taking patterns that are maintained by initiations, responses and evaluations of both the teacher and students (Mehan, 1979). To interact within this tacit, normative rule system, the students must learn how to orient their behavior “to appropriately engage in classroom interaction from the point of view of the teacher” (p. 124). If the students deviate from this normative order, sanctions are often imposed by the teacher. Particularly students' unexpected questions and initiatives create a tension between the teacher's demands and plans and the pursuit of dialogical approach (Aguiar et al., 2010; Scott et al, 2006). Instances where students oppose teachers and defy their control in direct ways are perceived as manifesting disciplinary problems and antiacademic behaviors that relate to low academic achievement and low motivation (Arens, Morin, & Watermann, 2015; Phelan, Yu, & Davidson, 1994). Unsuccessful classroom management from the teacher's part is considered to cause disturbances that may cause negative emotions especially during practical science activities (Itzek-Greulich & Vollmer, 2017), whereas good classroom management is suggested to prevent disturbances and misbehavior and resulting in motivating atmosphere with socially shared expectations and smoothly orchestrated activities (Steffensky, Gold, Holdynski, & Möller, 2015). Furthermore, the quality of the teacher-student relationship is suggested to be central to prevent the development of alienation (Hascher & Hagenauer, 2010).

The nature of science teaching in particular includes elements that can be perceived authoritative and that can foster the alienation. The declining lack of interest in science and science careers has been recognized as one of the main concerns (Barmby, Kind, & Jones, 2008; Osborne, Simon, & Collins, 2003). Part of the difficulty to increase and maintain interest in science learning has been attributed to students' everyday experiences and perceptions of their life as being so different from the authoritative truth that particularly exact sciences are perceived to transmit that students are alienated and feel like outsiders in science education (Barton, 2009; Lyons, 2006; Roth, 2009). It has been suggested that the monologic nature and authoritativeness is partly ingrained in the nature of scientific knowledge (Bakhtin, 1986; Kolstø, 2001), cultural forms that are more consistent with those of middle- and upper-class students (Eckert, 1989). Although the nature of scientific discourse among the scientists is often contested, process-like and thus is far from constituting a single truth (e.g. Latour, 1987), science is communicated through particular rhetorical means to achieve persuasiveness; and the scientific discourse comes across to outsiders as authoritative and unquestionable (Sharma & Anderson, 2009). Even teachers have epistemological beliefs of scientific knowledge as authoritative and unquestionable, without a need to be

argued for (Smith & Anderson, 1999). Thus, the contextualization of dialogic science discourse in school context is particularly difficult to achieve compared to, for example, social sciences where multiple perspectives are easily accepted. Whereas the authoritative perspective of learning science requires students to replace or refine their misconceptions or change from their vernacular culture to the scientific one, the dialogic approach considers science learning as a collective process towards appropriation of the scientific discourse (Hsu & Roth, 2014), for example engaging in argumentation (Ford & Wargo, 2012).

The authoritative dimensions of learning include the coexisting authoritative aspects of academic knowledge and the authoritative ways of transmitting it; parallel to the alienation from school having domains of alienation from the academic learning and from the teachers (as well as from classmates) (Hascher & Hadjar, 2018). This is so because the institutional authority of the teacher conveys the authoritative dimension of academic content to the students so that the two forms of authority are interconnected. Through their institutional positions, teachers end up with the upper hand in the power/knowledge spectrum and students tend to accept academic knowledge—particularly that of science—as authoritative, certain and serious (Burgin & Sadler, 2013; Kolstø, 2001). Moreover, theses authoritative dimensions are transformed and reproduced in the institutional practices and within classrooms in manifold ways. Much of science teaching in particular relies on scientific inscriptions like textbooks and their quality (Kesidou & Roseman, 2002), and teachers as well as students trust in the authority of the textbooks (Goldston & Kyzer, 2009; Lee & Kim, 2014). Also grading practices are a central part of institutionalized education and they are suggested to have an authoritative function of hampering the realization of dialogical discourse and easily subduing students' individual voices and increasing the distance from their everyday lives (Roth & McGinn, 1998; Sharma & Anderson, 2009). Teachers, from their institutional positions that confer authority, also choose the extent to which dialogical interaction may occur. Through the particulars of their in-class relations, teachers and students reproduce the authoritative power spectrum of institutionalized teaching in general and the authoritative power of the academic knowledge in particular. During school trips to out-of-school locations like museums or botanic gardens, the tendency for dialogic interaction might increase, but the teacher or the educator is still in control of the interaction (DeWitt & Hohnstein, 2010). Moreover, in out-of-school environments, the discourse is likely to be directed into authoritative direction (Zhai & Dillon, 2014), and teachers fear of losing control (Glackin, 2017). What could be fun, and often has been planned as such, often turns out to be not so much fun for the students (Roth, van Eijck, Reis, & Hsu, 2008).

Attempts to increase the dialogic teaching while at the same time ensuring the learning of academic content and keeping the class in control make a teacher (and a researcher or a policy maker) face difficult choices. When and how to give evaluative feedback to incorrect answers? When and how much to give space for students' initiatives? What kind of learning settings design and arrange? Whereas knowledge and evidence on the outcomes of the choices accumulates, students' reactions to the authoritarian dimensions of teaching remain little researched. In the present study, we investigate students' ways of coping with the authoritativeness from the viewpoint offered by Bakhtin (1984a) in his analysis of feasts and carnival in the medieval society. His analysis of books written by the French author François Rabelais describes people's relationship to the authoritative structures and ways to oppose and resist the seriousness of institutional powers. The times of feast and carnival gave ordinary people “a temporary suspension of the entire official system with all its prohibitions and hierarchic barriers. For a short time life came out of its usual, legalized and consecrated furrows and entered the sphere of utopian freedom” (Bakhtin, 1984b, p. 89). Whereas Rabelais' books concerned medieval culture, Bakhtin notes that the authoritativeness of the institutional order is not bound to history: “Rationalism and classicism clearly reflect the fundamental traits of the new official culture; it differed from the ecclesiastic feudal culture but was also authoritarian and serious, though less dogmatic” (p. 101). Whereas medieval carnivals and feasts momentarily overturned the power of church and king, science represents the official truth and rational seriousness of modern culture. Thus, humor and laughter, when permitted or even initiated by the teacher, can—analogically to the Bakhtinian sense of carnival—arouse positive affections and momentarily suspend the opposition between the students and the teacher (Roth et al., 2011). It has been shown that the moments of carnival can arise during students' interaction in classrooms, providing students with access to alternative truths and ways of speaking to the ones proposed by the teacher's and academic aims (Blackledge & Creese, 2009; DaSilva Iddings & McCafferty, 2007). Whereas in these studies the carnival sense arises with no apparent stimulus among the students or is initiated by the teacher, this study investigates the student's reactions to and ways of coping with the authoritative dimensions of teaching as they arise during learning activities.

3. Methods

In this study, a case from science education was studied to investigate how students cope with the authoritativeness innate in formal teaching, deriving from the authoritative dimension of the academic knowledge (science) and reproduced in the teacher's authority as science educator. The study arose from a larger research project on learning during outdoor education and how students' observation and interaction processes unfold during fieldwork. We followed students on field trips where they worked independently and out of earshot from the teacher. But they were connected with her through cell phones, which allowed the phenomenon to be particularly visible, thereby enabling them to be studied.

3.1. Participants

One teacher and two classes of students from one Finnish secondary school (grades 7–9) participated in the study. According to OECD (2016), in Finland there is very small variation in performance between different schools. The particular school was selected for the research project on outdoor learning because the ecology units of their biology courses mostly consisted of fieldwork. Approximately one third of them followed a curriculum with science emphasis during one additional hour per week. But the students in the data fragments below did not have the science emphasis in their curriculum. The teacher had a Master's degree and was qualified

Fig. 1. The student group working in the nearby suburban forest area.

to teach biology and geography in Finnish secondary and upper secondary schools. She had 30 years of experience and for a long time she had been developing biology curricula that emphasize outdoor learning. The pedagogical choices used in the outdoor-intensive model are described in more detail elsewhere (Kervinen, Uitto, & Juuti, 2018). In brief, the regularity and structural components like ongoing assessment practices were combined with the freedom of the students; and there was an emphasis on the trusting and positive relationships with students.

3.2. Data collection

The data used in this study was collected from the ecology unit of an eighth-grade biology course (age 13 to 14 years). (Formal ethical protocols were applied and consent forms for the participation and the use of data were obtained.) During the course, the lessons consisted of fieldwork where the students worked in the recreation area (an urban forest nearby the school) most of the time independently in small groups without the direct presence of the teacher (Fig. 1). The educational goals of the course were consistent with the Finnish national core curriculum (FNBE, 2014). During the first part of the course (8 lessons), the students were given tasks and small inquiries related to the ecological phenomena in the forest. There were single, 45-minute and double, 90-minute lessons, which affected the contribution of the tasks and other pedagogical choices. The lessons usually started with short instructions in the classroom, after which the students and the teacher walked 5–10 min to a nearby forest. In the forest, students worked in groups of three or four, and, depending on the task, provided the teacher with brief reports. The teacher occasionally gave further instructions through a whole class WhatsApp group. Also, in some lessons the students reported their answers in the WhatsApp group. Most of the small tasks were evaluated, each contributing 10% to the final grade (the rest of the grade consisted of the individual plant collection task and the larger inquiry in groups). During the latter part of the course (8 lessons), the students worked in the same groups to perform a small inquiry based on their own research question about the forest.

The first author (biology educator) met with the students in the beginning of the course to explain the research and gather questionnaire data (not used in this study). The video recording started during the second lesson. The researchers—the first author and a research assistant who were operating cameras—did not participate in the teaching. Students also were audiotaped with an external microphone for each student, which allowed the videos to be recorded from some distance so as to minimally interfere with their activities. In the post-course interviews, the student groups were shown short clips of the video recorded lessons, asked about how were they feeling and what they were thinking during the fieldwork, as well as more generally how they found the outdoor learning and related freedom as well as the grading of the tasks. When asked about the presence of the researchers and cameras after the lessons and in the group interview, the students reported no effect on their activities and told to have forgotten the recording process quickly. For example, when the students were shown short clips of the video data in the group interview, they laughed upon realizing that all of their conversations had indeed been recorded. All agreed on that the recording had no effect; for example, Mark stated that he “completely forgot the recording at some point in the beginning,” and Max confirmed that “as you could see, we didn't talk particularly nicely there.” According to these repeated remarks from the students themselves, it is justifiable to assume that the recording and the relatively distant presence of the researchers did not affect the students' interactions in a way that significantly changed its content or altered the atmosphere from what it would normally have been.

3.3. Data sources

The data sources used in this study consist of video- and audio-recorded lessons of two groups of four students, fieldnotes on the topics and the tasks of the lessons, and group interviews with the students after the course. The students were videotaped using two cameras (see Fig. 1). The video and audio recordings were synchronized. Raw transcripts of the lessons were produced in the Transana 3.10 software. Selected episodes were subsequently transcribed using a conversation-analytic system (Selting et al., 1998).

In this study, we exemplify students' interaction and teacher-student communication from a lesson where the communication through mobile phones between the teacher and the students had a significant role in communicating and evaluating the answers. The lesson concerned mushrooms, which are typically included science curriculum in the Finnish primary school as part of identifying species and learning about their relationships in ecosystems (FNBE, 2014). During the lesson, students were instructed to take pictures of mushrooms and send them to the whole class WhatsApp group with three types of information: (a) the name of the species or the group, (b) arguments for the identification, and (c) the information that needs to be taken into consideration when considering

eating the mushroom. Students, who had no prior instruction on mushrooms, carried with them an information sheet concerning different mushroom groups and their attributes to help with the identification.

3.4. Data analysis

The analyses of the study are based on the interactional analysis of students' interactions (Jordan & Henderson, 1995). In interactional analysis, the samples from the selected lesson were analyzed in joint sessions. The analysis began by identifying important themes in the data source, focusing on the possibilities for students' interaction that the absence of the teacher provided. After discussing the emerging sense of what is going on in the videos, we formulated tentative hypotheses. As required by the method, we then scoured the entire database to find evidence that disconfirmed or was consistent with the tentative hypotheses (Roth, 2005). Repeated meetings were held to discuss emergent understandings generally and any alternative understanding specifically. The present report is the result of this iterative process of joint analysis, writing, and discussing the emergent understanding.

Our analyses were designed to produce an adequate account of student's interactions that we observe. To analyze an interaction, the minimum unit of analysis that makes sense is a pair of communicative turns. The value of an (verbal or written) 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 (Vološinov, 1973). At the heart of a dialogue are the relationships between the utterances (Bakhtin, 1984b). These dialogic relationships, such as agreement/disagreement, affirmation/supplementation, and question/answer "link together represented, objectified utterances and therefore are themselves objectified" (p. 188). Thus, analyzing the relationships between pairs of utterances, that is, analyzing the way in which members to the conversation hear what is being said, allows us to understand what was treated as factual instead of trying to interpret the (private) thoughts of the speakers. In the following example, Tom points to a beer can, referring to it as a very rare observation with a particular phrase and accent (turn 17; very rare also referring to a Pokémon game, very popular in Finland at the time of the data collection). Rather than interpreting this locution, suggesting that Tom has made a joke about the beer can, the role of the statement from within the exchange itself is brought out by following how the subsequent speaker responds to it (turn 18).

Example 1.

17 Tom: ((*notices a beer* can)) There's a veri rare ((*in English overacting the Finnish accent*))

18 Max: ((*laugh*)) Ye-ah. It is a koskenkorva boletus ((*Koskenkorva is a Finnish vodka brand*))

19 Tom: ((*laugh*)) [Koskenkorva boletus

20 Max: [Err (.) extremely intoxicating

21 Jeff: ((*laugh*))

Max's laughter (turn 18) is the first reaction after Tom's statement. Laughter is not randomly produced as an interactional resource. Laughter, and other forms of parody, is an event within a more encompassing event makes salient (a) an invitation for others to laugh and (b) the recognition and acceptance of that invitation (Jefferson, 1979; Roth et al., 2011). Max's laughter can be heard as an acceptance of an invitation to laugh in Tom's statement and an agreement that it was nothing serious but some sort of parody. He then makes an affirmative statement ("Ye-ah"). After this, the next sentence ("It is a koskenkorva boletus") can be heard as a response and expansion to Tom's initiation of parody and joke. To this, Tom then reacts with laughter (turn 19), which indicates that what Max said was perceived as joke. Tom also repeats the words "koskenkorva boletus." In this case, although it might appear that he produces a mere repetition, pure repetition does not exist in language and every repetition constitutes difference and has a function (Roth, 2015; Vološinov, 1973). With his laughter and repetition Tom both confirms the joke and joins to it. Once the joke has been mutually confirmed, Max's statement (turn 20) can be heard as an expansion of the joke. Jeff then joins the conversation by laughter (turn 21), reaffirming that Max's expansion was heard as joke.

3.5. Analytic stance

The preceding example shows how the analysis of the speaking turn pairs unfolds the humorous nature of the dialogue and interaction in the example. The significance of humor and laughter for the dialogic interaction and its implications for learning will be further theorized and discussed in the latter parts of this study. The analysis exemplifies how this analytic approach does not require special interpretive methods; rather, it requires the analyst to hear the participants in the manner they hear (understand) each other (Garfinkel & Sacks, 1986). In the following sections, students' interactions in the selected episodes are analyzed in this manner to show how dialogical possibilities unfold in the absence of the teacher. Because dialogical interactions and, for example, tension between the authoritative teacher statements and the students' uptakes thereof 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, but some of them are highlighted in the selected lesson because of the specific significance of the mobile communication. Our results, however, are not limited to a particular lesson because all interactional resources that interaction participants produce are inherently cultural-historical and ideological, thereby transcending the individual case (Rawls, 2002; Vološinov, 1973).

3.6. Observations on classroom order

This study explores the students' ways of coping with authoritative dimensions of teaching by taking a case from science lesson where the students work in the physical absence of the teacher. The presence and actions of the teacher alone greatly affects the classroom order (Mehan, 1979). To contextualize the study, we show how the interaction unfolds differently depending on the presence of the teacher and it is the absence of the teacher that allowed some aspects in students' reactions to become visible, not for example the characteristics of the particular teacher.

3.6.1. Interaction in the absence of the teacher

The influence of the teacher was visible in the students' interaction also without her physical presence. For example, the students discussed the demands of the tasks set by the teacher and many times referred to the evaluation of the tasks executed by the teacher in the end of the lesson. The next example shows how—despite the physical absence of the teacher—a dialogic discourse with the teacher is present. However, it is maintained and controlled by the students who can react without minding the teacher's reaction and maintain the final word in the dialogue. The fragment is a single utterance from the lesson where the teacher collected answers (identifications of mushrooms) and gave feedback through mobile messages. Before the fragment, teacher had asked, “what is the identification based on and what should you consider when eating the mushroom.” Forty seconds after reading the teacher's message and having started to talk about providing more information and arguments, Max, who is reading the messages, utters several phrases without apparently directly addressing anyone (Example 2, turn 07).

Example 2.

07 Max: Well fuck I don’t wanna put anything (.) ((*changing voice to mumbling*)) what should you consider when eating ((*changing voice back to normal*)) fuck off ((*in English*)) (.) I can’t take something like this ((*almost inaudible*)) (..) ((*louder*)) Our journey [continues]

Max starts with stating that he does not want to comply with something. This phrase arises from something that has happened before, that is, the teacher's text message that appeared on the students' phone. Max asynchronously replies to a previous electronically communicated utterance. That the utterance was indeed replying to the teacher can be seen from the subsequent phrase, “What should you consider if eating…?,” which are the exact words that had appeared on the screen. The change in Max's intonation when he repeats the teacher's words can be heard as a change from his own voice to the voice of the teacher and then back to his own voice. Intonation here is a means to distinguish and make audible reported speech from authentic speech (Roth, 2014; Vološinov, 1973). The next part (“Fuck off”) can be heard as a commentary in the voice of Max, which elaborates on the preceding phrase in the direct discourse of the reported speech originally produced on the teacher's part. That is, although there is only one speaker, there are indeed two voices conversing with each other (Vološinov, 1973). Here, the dialogue of the two voices is articulated aloud so that it could be heard and recorded, and thus constitute an external form of internal dialogue between the two voices involved (Bakhtin, 1984b). As the utterance continues, further elaboration of the preceding phrase can be heard, where the voice suggests that the speaker “cannot take anything like this.” But the final part of the utterance appears to be appeased, for the voice suggests that the (learning) journey continues.

Bakhtin (1984b) shows how what appears to be a monologue of a single person may actually constitute an internal dialogue and polemic with an invisible *other*. Following the same kind of logic, Max's utterance can be heard as a dialogue between the teacher's voice, which he impersonates, and his own voice. This voice also explicitly anticipates the teacher's response, giving voice to the words previously chosen by the teacher. In this example, the dialogue with the anticipated teacher takes place in a single utterance. However, in many instances during the fieldwork activities without the presence of the teacher, the dialogical exchange with the (anticipated, electronic) teacher utterance continues among the students as they react to teacher's messages or each other's commenting on some teacher request.

One particular aspect about the dialogic interaction was that the students had possibility to state the final word in the (anticipated) dialogues. For example, the ending of Max's utterance, “our journey continues,” can be heard as a final word that “must express the hero's full independence from the views and words of the other person” (Bakhtin, 1984b, p. 229), that is from the teacher's requirements. Yet, just a few seconds after that utterance Max actually takes a photo a new species and writes the information that was originally lacking, and the teacher therefore required. Therefore, even if the student state the final word in the dialogue, their eventual actions may still implement the teacher's demands. The similar observations of simultaneously opposing the teacher and

fulfilling the requirements were observed across the data and are analyzed in the findings section.

3.6.2. Face-to-face interaction with the teacher

During the course, the student groups interacted face-to-face with the teacher briefly in the classroom before the lessons, during the fieldwork activities when the teacher occasionally visited or met with the groups as well as in the classroom during the inquiry project in the latter part of the course. Similar observations on the interactional setting can be made from the data from different instances of face-to-face interaction and the data does not provide difference concerning the aspects described below. The following example (Example 3), observed during the fieldwork in the end of the mushroom identification lesson, shows how some dialogical aspects remain the teacher retains her authoritative position. The exchange takes place shortly after the students have come back to the teacher for their answers to be evaluated.

Example 3.

01	Teacher:	so you can't claim that something is mustavahakas ((*Finnish, Hygrophorus camarophyllus*)) if you don't have enough identifications there
02	Tom:	well peter ((*student from another group*)) only had the name
03	Teacher:	they didn't they had they presented these from here these identifications as arguments
04	Max:	yeah let's just go it doesn't matter
05	Teacher:	it does matter (.) see you have pretty good images
06	Max:	because I have to prepare for the math exam and it's much more important than some mushroom ((*walks away*))
07	Teacher:	okay (.) well from this you'll get ((points)) in any case ((*looks at another answer message*)) (..) Tom still stays here for a while because Tom wants to put some more effort (..) ((*Max comes back*)) from this you- this you have kind of quite right
08	Tom:	this is some boletus
09	Max:	yeah
10	Teacher:	and how do you know it's some boletus

In the beginning (turns 01 and 02), the teacher emphasizes the need for arguments after having rejected student's former identification. After Tom's rejected insistence concerning another's group's answer, Max suggests going away saying "it doesn't matter" and starts walking away. Teacher's answer (turn 05) can be heard as conflicting Max's statement. After Max explains his reasons and implies that "some mushroom" is not so important (turn 06), the teacher's utterance (turn 07) can be heard as turning her focus away from the conflict and back to the task with the remaining students (particularly Tom). Despite of his statements, Max soon returns and joins in the discussion about their identification (turn 09), the dialogue continuing by the teacher asking for the arguments.

In comparison with the previously exemplified interaction without the physical presence of the teacher, the above example shows how the teacher maintains the last word and controls the situation from an authoritative stance even if the students could disagree with her without an apparent disapproval. As whole, the exemplified face-to-face communication follows the principles of teacher making the initiatives (e.g. turns 5, 7, 10) and evaluating (e.g. turns 1, 7) students' responses (e.g. 8–9). In this way the face-to-face communication follows the typical classroom turn taking protocol, that students need to orient themselves to in order to manage within the normative classroom order (Mehan, 1979). In the example this is seen when Max, after announcing to leave, returns and keeps on following the teacher's demands without the teacher really telling him to. Yet, the lack of apparent disapproval after Max's statement in turn 04 allows the communication between the teacher and the students to be heard as being of relaxed nature rather than strict or admonitory.

The preceding examples show that the teacher maintained the final word and authority in the face-to-face interaction. In contrast, when the teacher was physically absent, the students interacted as if they anticipated a dialogue with the teacher, with its authoritative dimensions, but could express freely and retain the final world at least temporarily in their mutual interaction. This difference allowed students' reactions to become particularly visible, enabling them to be studied.

4. Findings

This study was designed to investigate how students cope with the authoritative and serious dimensions of the teaching and academic content as they arise during a science lesson. We investigate our research question in a fieldwork science context where students work independently and out of the earshot of the teacher but receive feedback from her through a mobile messaging system. Behaviors otherwise perhaps invisible are thereby allowed to surface in the interaction of the students. This mirrors the differences in discourse that occur in everyday workplaces, where employees may use abusive language to relieve frustrations and emotional tensions with respect to superiors (Kühl, 2019). We describe how students deal with the authoritative nature and seriousness of learning academic knowledge in the context of ordinary school science. We show how these reactions, whereas they oppose and overturn the seriousness and authoritativeness of science on that occasion, simultaneously allow students to continue with their scientific task and even improve their activities in the line of teachers' feedback and demands.

In the following subsections, we describe and analyze three kinds of opportunities that arise for the students in the dialogic discourse to react to the authoritativeness and cope with the negative emotions that arise: (a) how swearing, mocking and making fun of the teacher serve as safety valve for students to oppose the authoritativeness while still complying with the academic demands; (b) how laughter and fun is used in a double reversal way to overturn the authoritative and serious dimensions learning and at the same time to support the enactment of science content; and (c) how, through disparaging and mocking the teacher, students find ways to own knowledge and reverse the power of authoritative truth, empowering themselves in completing the task.

4.1. Abusive language and mocking the teacher

Swearing and opposing the teacher are typically considered as disciplinary issues that are related to for example low motivation, among other things (Arens et al., 2015). In most instances, the teacher restricts the use of abusive language. We may ask, what functions such talk could have during learning when it is not chastised or limited by a teacher present on the occasion. In this section, we show how swearing and mocking the teacher are opportunities to oppose the authoritativeness of the teacher in the way that carnivals and feasts allowed opposition to the power of the king (Bakhtin, 1984a). Following Bakhtin, we show how the *carnival sense* of life that even exists in the sciences is created for a brief moment, during which the "laughing truth, expressed in curses and abusive words, degraded the power" (pp. 92–93). However, even if the students can oppose the authoritative teacher, the authoritative power simultaneously is reinforced in a way that students may continue with the task as if the authoritative dimension had not suppressed them or caused a disciplinary problem.

Already in Fragment 1 in the previous subsection, we could notice swearwords in the internal dialogue (i.e., "*fuck* don't wanna put anything") that are also addressed to the teacher (i.e., "fuck off"). Cursing was abundant in students' talk during the lesson (i.e., when the teacher was not present). There were 95 instances of "fuck" and "fucking" during the 30 min of intensive activity after the student group had arrived in the forest. On the other hand, only one swear word ("fuck I don't know" as a beginning of an answer to teacher's question about a new mushroom) occurred during the 5 min when the group was talking about their mushroom identifications face-to-face with the teacher at the end of the lesson. This contrast implies that a there is a difference in the manner of talk when the teacher is absent or present. However, the language, in this instance the use of swearwords, should not be regarded to be solely a matter of style of expression and communication but as serving a particular social function in the interaction (Vološinov, 1973).

The following fragment shows how the abusive language that directly addresses the teacher arises from students' reactions to and manifested frustration with the evaluative feedback just received: "check the attributes of *Russulas* from the [information] sheet." Before that there was an argument over the instructions for the identification of a mushroom as a *Russula*. Students then react to the message.

Fragment 1.

327 Max: [Well is it- (.) Fuck I told already those ((*yells*)) (0.3)
attributes (.) It's straight thick gills. What more do you
[want
328 Tom:
[Show (..) What did she say ((*looks at Max's phone*))
329 Jeff: Sad story ((*in English*)) (..) [what a fuck is this ((*pointing*
to a mushroom))
330 Max: [Check the attributes of
Russula from the [paper
331 Tom: [Well we read and it [says (.) what the heck wait
332 Max: [Well uh-huh. Is that now- (.)
Now we find that Krista ((*the teacher*)) and stab her in the
face
333 Jeff: Wou

Max's first unfinished sentence ("well is it-") can be heard as a thought that is unfinished for some reason. In the rest of the utterance he directly addresses teacher's messages about the attributes ("Fuck I already told *those attributes*") and refers to the attributes that they had provided ("It's straight thick gills"). "What more do you want" can be heard as addressing the teacher ("you"). In addition, it may also be perceived as referring to the perceived evaluative nature of the teacher's message and that what students had provided was inadequate ("what more"). The use of swearwords and addressing the teacher's feedback may be heard as if the evaluation is perceived as negative and disappointing. Tom's utterance confirms that they are addressing the teacher and her message ("what does *she* say"). The comment ("Sad story") can again be heard as perceiving the situation as disappointing. Yet, Jeff immediately points to a new mushroom showing that he is still making observations according to the task and that despite discussing the negatively perceived evaluation from the teacher, at least part of the students' focus simultaneously is on the science learning task. Max reads again teacher's message (turn 330). Tom's answer, "well we read and it says," may be taken as an answer to the teacher, explaining that they have already read the attributes, followed by a hesitation of some sort ("wait what a heck"). In the next turn, Max confirms Tom's statement that they already read the attributes. He then refers to the teacher again, not directly addressing this time, and states that they are going to "find Krista and stab her on the face."[1] Jeff's comment "wou" may be heard as a response to Max's suggestion. It does not agree or disagree with Max but implies that in what Max said there was something not expected, giving rise to this reaction from Jeff. After the fragment, Max and Tom turn their focus back to performing the task as they start to look more attributes from the paper and write a new message to the teacher, eventually after a minute sending the attributes about *Russula* following the identification guide ("bright colored caps and white gills, the light stem snaps when broken"). In the end of the lesson, the teacher evaluates these latter arguments to be enough for the students to exhibit the ability to make appropriate observations and use correct terminology, something that was a learning goal of the lesson.

Abusive language towards teacher or mocking her occurred throughout the lesson—in the same way that they may occur in informal settings in the workplace where superiors are not present (Kühl, 2019). The teacher was called "stupid" when she asked to bring mushroom which the students were already far away from and she was referred as "bi[tch] (.) teacher ((*laughter*))"—referring to an abusive term but changing to "teacher." When the students approached the teacher at the end of the lesson and discussed if their answer now was satisfactory, Tom stated that "Well, I would say to that (.) I would really say that (.) dammit I'd want to shoot you god dammit ((*laughter*))." The use of words and the dialogue referred to a popular Finnish YouTube video[2] and was accompanied by laughter—both of which relativized the content of the statement by implying the lack of seriousness. In all of the examples, however, the use of terms (stupid, bitch) and talking about or "shooting" or "stabbing in the face" unlikely would be possible and allowed in the face-to-face communication with the teacher.

Even if the student's use of abusive language can be heard as reflecting the ab sence of the teacher thus a general possibility for

[1] This paper is not about whether the students really mean, "to stab the her on the face," but the focus is in the situational *function* that a seemingly cruel utterance has in moving the situation ahead. However, as also the analysis of the function as a momentary carnival opportunity implies (see also the following sections), the undertone in the abusive language was rather joyous and humorous than serious and negative or really making threats against someone.

[2] In the video two Finnish men have a dispute about bringing garden waste to a public ground. https://www.youtube.com/watch?v=ziJVJlill6g

free expression, many of the instances where such language occurred were directly related to the interactional context between the two parties. In the post-course interview the students remembered the instances of frustration as they sometimes had difficulties to complete the tasks the way teacher requested, Max stating that the teacher "makes everything much more difficult than would be necessary [...] because she is a typical teacher." In Fragment 1, the students react to teacher's message as if it was negative feedback and evaluation of their former answer (turn 327). The uncertainty of the needed attributes, the right answer, is expressed in disappointment, frustration and questioning of the teacher's demands. The negative evaluation from the teacher not only comes from her authoritative position but also mediates the scientifically correct form of answer. The situation reaches its culmination when Max states that they would go "find that Krista and stab her in the face." After Jeff's reaction, students started to look for more attributes from their paper, and the opposition and frustration is put aside for a moment. The cruel expression against the teacher is something that Max would not likely be able to use in face-to-face communication without threatening the institutional authority of the teacher and potentially causing a disciplinary problem. In the absence of the teacher, however, the conflict is not actualized. Just as in the workplace, the (informal) situation away from the teacher constitutes an occasion where the negative emotions can be shared and dealt with that the formal institutional relations have produced (Kühl, 2019). Within the *carnival sense* of life, Max can use abusive language towards the teacher because it is not really serious. Whereas the carnival sense is authorized temporarily, it will be followed by the seriousness and established order of the official system (Bakhtin, 1984a). Accordingly, the students' follow up with the required better arguments for their identification. Similar short or longer lasting appearances of abusive language towards the teacher appeared throughout the lesson, for example, at one point Jeff urges others to "send a picture of that- fuck to that bi[tch] (.) teacher ((*laugh*))." Even if insulting, these brief abusive moments were accompanied by laugher or did not seem to interfere with continuing with the task and even improving in it.

It has been suggested that "[t]he organizing center of any utterance, of any experience, is not within but outside—in the social milieu surrounding the individual being" (Vološinov, 1973, p. 93). The language and the (social) life of its users are not indistinguishable, but every utterance has its situational function. By using swearwords abundantly during the science lesson, students not only change the style of their expression from the classroom talk, but also the swearwords are said and heard in the *social milieu* of the students. Indeed, Vološinov (1973) analyzes a conversation recorded by Dostoyevsky, where a single swearword is repeated six times, showing how the dictionary sense of the word itself is irrelevant compared to *how* is it uttered and *how* is it heard. In his work on Rabelais, Bakhtin (1984a) shows how laughter, curses and abusive, words are manifested in the *carnival* sense of life that opposes the official culture of seriousness and restrictions. Practiced during feasts and in the marketplace, typically informal occasions relative to the institutional aspects of everyday life, the carnival sense forms "the second life of the people" (p. 11). The "second life" emphasize the material, bodily aspect of life, "lowering of all that is high, spiritual, ideal, abstract" (p. 19). It is characterized by ambivalent carnival laughter, that is triumphing but at the same time mocking and deriding and that defeats "power, of earthly kings, of the earthly upper classes, of all that oppresses and restricts" (p. 92). Following Bakhtin, we can hear student's swearing as carnival sense that and *marketplace speak*, that contrasts and opposes the institutional seriousness and restrictions of the official school. We may suppose that continuous cursing is something that—in the same frequency and for the same function—the students would not be allowed to use in within the institutional rules of classroom or the presence of teacher. However, in her absence, the authoritative position is degraded in curses and by means of abusive words.

Inherent to the carnival sense is its temporality and brevity. Being a "temporary suspension of the entire official system with all its prohibitions and hierarchic barriers" (Bakhtin, 1984a, p. 89), the carnival and feast was legalized and permitted but only for a certain amount of time. It served as a safety valve for people to temporarily enter "the sphere of utopian freedom" (p. 89), and strict authority and seriousness followed the sharp contrast. In the strict authority of the classroom environment, the abusive language might be perceived as a disciplinary problem, whereas in the absence of the teacher it is temporarily possible for the students. In the above-analyzed example, Max and Tom start to follow teacher's requirements by soon providing more accurate attributes and show improvement in line with the learning goals of the lesson. As if the brief instance of insult had been enough of the carnival for the moment, relieving negative emotions, the students not only get back to their scientific task but also follow its seriousness by improving their performance. This again mirrors workplace situations, where employees return to the formal setting after the derisive remarks in the lunch or coffee room (Kühl, 2019). In typical classroom interaction, students' deviations from the normative classroom order will usually be sanctioned (Mehan, 1979), or at least create tensions between the teachers demands (Aguiar et al., 2010). Here instead, the abusive language—within the temporary carnival sense—allow students to enter "the sphere of utopian freedom" (Bakhtin, 1984a, 1984b, p. 89) without a conflict with the authoritative requirements.

4.2. Laughter and fun in questioning the seriousness of science

Emotions of enjoyment and joy generally support students' engagement in learning (Ainley & Ainley, 2011; Pekrun, 1992). Laughter, as interactional activity, may have great importance to the lived curriculum and interaction during science lessons (Roth et al., 2011). These authors analyzed classroom interactions where the teacher, by her speech or gestures, either made laughter permissible or even invited students to laugh. In this section, we show how the students, in and through their dialogic interaction, controlled the use of humor and laughter without having to care about teacher's reactions or approval. Through laughter, the students were able to autonomously question and overturn the seriousness of science learning; and they were able relativize the one-truth perspectives represented in the evaluative authority of the teacher (Roth et al., 2011). The laughter may thus actually play into the hands of science teaching by simultaneously having the function of reasserting the serious and monologic nature of its truth.

The preceding analyses show how humor is initiated and accepted as an interactional resource among the students (see also Jefferson, 1979; Roth et al., 2011). In the lessons recorded, there were numerous instances of humor and laughter. For example, from

the time that the students first time started to focus on their task to the moment when they met the teacher in the end of a single lesson, 54 utterances contained audible laughter. Laughter was related to joking about mushrooms or their attributes (e.g., “it is full of holes ((*laughter*))”; “((*laughter*)) that looks like a properly cooked pancake”) or other incidents that were thereby treated to be funny in some way (e.g. Mark saying to Max who had touched him a little close to a small elevation in the forest “You accidentally saved my life ((*laughter*))”). The humorous talk was initiated within other activities and talk, and disappeared just as quickly when it was followed by talk about the task and related things. Several times, the humor and laughter were part of a reaction to teacher's messages and preceded by the authoritative nature of the teacher's requests and the students' actual performances. For example, when sending their final message about the identification of the *Russula* (see Fragment 1) with the extra attributes that were requested by the teacher, Tom and Max made known through laughter that the statements concerning the need for yet other attributes, such as a “Latin Chinese Korean name” and “for how many yens it has been sold in China this year,” were to be taken as jokes. Or when the students were discussing teacher's requirements and waiting for new messages, they laughed at her slow typing of messages (see next section). In the following fragment, we show how the laughter was manifested, as if the students had used them to deal with the evaluative feedback from the teacher. Students had received a message from the teacher saying that the former justifications they provided for the identification of two species (“they are of different color”) was not a good argument.

Fragment 2.

90	Tom:	((*reads a message*)) Tom that is not an argument. Look at your mushroom guide and you also need internet. Without arguments you won’t be squeezing points ((*idiomatic expression in Finnish meaning getting points*))
91	Max:	[Fuck
92	Jeff:	[Yeah Tom make better arguments
93	Tom:	Squeezing ((*in Finnish “herua”, a word with a meaning of getting something and a double slang meaning of getting sex,*)) (.) squeezing points ((*laugh*))
94	Max:	((*laugh*))
95	Tom:	Squeezing points
96	Max:	Won’t (.) be squeezing ((*without the word ‘points’ having a more obvious meaning of getting sex*))
97	Tom:	Well (.) well we looked

The teacher message was intended as instruction to use the provided paper and Internet and states that without proper arguments supporting their claims, the students would not get points. The message contains a Finnish idiomatic expression meaning that they will not get points (“You won't squeeze points”). In the post-course interview the students told how the point-based evaluation of certain task was an important motivating factor, and otherwise they “probably would not have completed them [the point collecting tasks] but would just have told [the teacher] that we did.” The significance of receiving points may at least partly explain the frustration after the evaluative feedback, further aggravating these situations in an emotional sense (see also Fragment 1).

In Fragment 2, Max's and Jeff's reactions (turn 91 and 92) can be heard as acknowledgment that teacher's demand for more arguments is something troubling or frustrating in a negative way (“fuck”) and something to take in to account (“yeah Tom make better arguments”). Tom is the one who has sent their original messages and to whom the teacher refers in her message, a reference repeated in the suggestion to make better arguments. He then repeats one word from the teacher's messages (“squeezing”) following repetition of two words “squeezing points.” Tom repeats a word from teacher's message that has a double meaning in Finnish (i.e., getting sex) and laughs. Tom's laughter can be heard as an invitation for others to laugh and take his utterance as humorous pick of the slang meaning of the word, whereas Max's laughter in the next turn can be heard as an acceptance of this invitation (see Jefferson, 1979). The repetition of the joke by Tom and Max (turns 95–96) can be heard as confirmation of the joke in as part of the shared social interaction (Vološinov, 1973). After this, Tom utters an incomplete phrase (“well we looked”) that can be heard to respond to the evaluative demand in teacher's message. The dialogue continues with the students discussing the message exchange with the teacher (see next section) and also finding new mushrooms.

The teacher's message with evaluation (“that is not an argument”) and the students' first reactions reinforces the authoritative positioning, where the scientifically correct way of thinking is demanded by the teacher's evaluative decision of giving or not giving points and students' role is to change their thinking as required. In the classroom environment, despite of how students will react to

the evaluative feedback, it is the teacher who controls the verbal exchanges (Aguiar et al., 2010; Mehan, 1979). In the classroom, teachers often control the acceptability of laughter in learning, either by her acceptance-exhibiting behavior or by inviting students to laugh (Roth et al., 2011). Here it is Tom who picks up a word from teacher's messages and offers it up as a joke. Instead of immediately following teacher instruction and starting to think of better arguments, he reacts to the authoritativeness through humor. Instead of answering to the serious tone of teacher's demand, again, a *carnival sense* of life appears in the midst of the science lesson. Just as abusive language in the previous section, the joke now can be heard as carnival laughter that "builds its own world in opposition to the official world, its own church versus the official church, its own state versus the official state" (Bakhtin, 1984a, p. 88). Not only do students joke and laugh, but also the humor takes place at the expense of the teacher, turning something that the teacher has said into a joke. The seriousness of the official and institutional system, the evaluative teacher, is derided through laughter—which thereby functions as something like a valve for relieving negative emotions (Kühl, 2019).

Unlike in the classroom environment where the teacher is physically present (Roth et al., 2011), the students in this study were able to decide for themselves when to suspend the seriousness of science learning—when to make jokes and or even deride or insult the teacher. Even the laughter and jokes made without the reference to the teacher (see the examples in the beginning of the section) allowed the seriousness of learning to be regularly put aside. Yet, several times humor and laughter occurred when the tension between the authoritative dimension of the teacher's requests and the students' performance manifested itself, as if students had used them to deal with the evaluative feedback from the teacher and degrade its suppressive power and consequent negative affect. Instead of being discouraged by the feedback, students temporarily turned to a carnival sense of life, with its festive liberation from the seriousness of science and science education. They did so at a time they had chosen before attending to the task again and considering the feedback and instructions. After the times of carnival of degrading laughter, students simultaneously were able to continue with the task and eventually improve in it. For example, in the case discussed in Fragment 2, the students eventually provided the required scientifically specific arguments and received points for their answer. However, whereas the teacher determined the requirements, it was the students who decided how to use humor and laughter to deal with the evaluations. Even if the teacher's requirements were eventually fulfilled, the students had the final world on how to react to and cope with the evaluation and requirements when they arouse in the interaction, without the potential conflict caused by their reactions disturbing them in attending to the task.

4.3. Expanding and reversing the knowledge of scholastic truth

The two preceding subsections show how the carnival laughter and abusive language of the students allowed an overturn of the authoritativeness of the science learning and the restrictions of the classroom. As in other studies, the "festive folk laughter […] means the defeat of power, of earthly kings, of the earthly upper classes, of all that oppresses and restricts" (Bakhtin, 1984a, p. 92). In addition to abusive language and laughter, the third dimension in students' opposition was more directly related to the authoritative nature of scientific knowledge. In this section, we show that despite the teacher's control and mediation of authoritative scientific knowledge, the students found ways to exhibit knowledge of their own and reverse the power of the authoritative truth. Following the works of (a) Foucault (1977) concerning the intricate relationship of knowledge and power and (b) Bakhtin (1984a) on the power of laughter and ridicule to degrade the institutional power, we show students reverse the power of authoritative truth and empower themselves when completing the task.

The teacher's messages were throughout the lesson evaluative in a way that from them the students could know if their previous answers were enough to get the points and how they should improve. Even those teacher suggestions that were not explicitly evaluative—e.g., something more instructive like "turn the mushroom around and look underneath" or "what kind of gills" or "check the attributes of *Russula* from the sheet"—where treated by students as evaluative and as indicating deficiency in their previous performance (e.g., see the analysis of Fragment 1). Although the students had the instructional sheet on mushrooms and the mushrooms in front of them, it was the teacher who determined how much argumentation was enough for the identification and whether the pictures were good enough, being the gatekeeper to the correct scientific answer. Foucault (1977) shows how knowledge reinforces and interacts with power—to claim that the something is true is also to make a move to hold power because truth can only be produced by power. Thus, by making evaluative statements about students' answers, in this instance in the form of mobile messages, the teacher claims and reinforces her power as well as the power of the correct scientific answer.

To challenge this power and the authoritativeness of science as such would need students to claim that the teacher does not know the "right answer" or which are the right requirements for the justifying the identification. The students did not challenge this power of the right answer directly, and indeed it would be hard to do in the institutionalized schooling system. Even if they mocked and derided and laughed at the teacher, they more or less maintained their focus on the task and their performance changed in the direction demanded by the teacher, as already shown above. However, while laughing at and deriding the teacher, the students at times placed themselves in a position where they claimed to have some other types knowledge that the teacher lacked. For example, when the teacher asked them to bring the mushroom that they had photographed several minutes before and elsewhere, they laughed at the delayed demand: "how stupid can a person be." When the teacher asked to turn the poisonous mushroom around, as part of their reactive dialogue, Jeff states the commonsense knowledge: "you don't touch *a fly agaric.*" The following fragment shows how students question the teacher's power by ridiculing her for her slow typing style. The students are looking for mushrooms, and Tom notices from his phone that the teacher is writing something.

Fragment 3.

81 Tom: Now she's writes and puts a hundred question marks in the end
((*everyone talking simultaneously*))
... ((*Max and Jeff simultaneously talking about a mushroom Jeff had spotted*))
86 Tom: She writes a novel because it has taken over thirty seconds already
87 Max: Well it's because she writes like this ((*shows typing with one finger*))
88 Tom: ((*laugh*)) Yeah.
89 Jeff: ((*laugh*))
...
98 Max: Oh no ((*laugh*)) fuck you have- You have a fucking intense internet fight going on
99 Tom: Well she doesn't understand. She can't use these devices
100 Max: ((*laugh*)) Tell her that this (.) Write there that this is now an internet fight

Tom sees that that the teacher is writing and states that she puts "hundred question marks in the end." The comment about the 100 question marks can be heard as a reference to the teacher's earlier message, where she asked for arguments to support identifications, which ended with four question marks. No one reacts to Tom's utterance right away, as Max and Jeff are at the same time talking about another mushroom. Tom, keeping his eyes on the phone, comments on the time it has took for the teacher to write, saying that "she writes a novel" (turn 86). Max responds to Tom's comment and gives another explanation for the writing to take that long, being that the teacher types slowly with one finger. Tom agrees to this ("yeah") and his and Max's laughter let us hear the Max's explanation as not serious, but humors. The teacher's presupposed style of typing is ridiculed, as they themselves write much quicker with two fingers. The evaluative message that teacher finally sends is received as if the feedback was disappointing and frustrating for the students (see Fragment 2). When a moment later Max addresses Tom referring to the Internet fight (turn 98), Tom mentions the teacher once more, stating, "she doesn't understand." Tom does not specify, what the teacher does not understand. Whatever is privately meant, the public statement can be heard as evaluating the teacher. Tom specifically and the group generally understand *something* that the teacher does not; he has some understanding that allows him to evaluate teacher's understanding. When Tom continues, "She can't use these devices," one can hear a reference to the previous ridicule of teacher's typing. But we can also hear one explanation for teacher not to understand. Because the students are better with the devices, they have some knowledge that the teacher lacks and have power to be evaluative towards the teacher (cf. Foucault, 1977).

In turns 98 and 100, Max brings in his previously introduced concept of Internet fights. The talk on Internet fight may be perceived as related to power by establishing a set-up where the knowledge is used for fighting over. A "fight" with a teacher may be heard as referring to the tension and opposition between teacher's demands and their performance (c.f. Fragment 1). A little earlier, when Max uses the term "Internet fight" for the first time, Tom addresses the teacher uttering "come to the school (.) schoolyard after school ((*laughter*)) (.) let's let's have fight (..) let's have a fight." By implying the physical fight instead of a one through and over scientific knowledge, Tom again can be heard as referring to a particular power/knowledge with the students having an advantage over the teacher. Furthermore, the "Internet fight" makes a reference to the particular way of communication through mobile messages, in which the students had just referred to teacher's inferior knowledge as she "can't use the devices." Thus—even if the students don't have the power to decide the correct answer—the mobile messages as a media of "fighting" over provides them an alternative form of power. As the teacher uses her power of institutional position and scientific knowledge for evaluation, the students use power of some other knowledge to evaluate the teacher. Yet, Max's laughter (turns 98, 100) lets us hear the concepts of "Internet fight" as humorous rather than serious, maintaining the laughing tone in talking. Accordingly, once more the students use this overturning of power temporarily (Bakhtin, 1984a), and regardless of the seeming opposition start to prepare a message with appropriate arguments.

Even if knowledge in the above-described fragment is not related to science, the students use it to turn the tables on the power/knowledge situation. As the references to the typing skills and physical fights imply, students attend to and experience science lessons from the fullness of their life, not solely through scientific content or the sphere of the classroom interaction (Roth, 2009). The

examples show that any knowledge can be used for students' empowerment, possibly allowing them to cope with the authoritative dimensions of teaching. However, close to the end of the activity, the students' command of knowledge and power manifestly also related to their task. In their final message about the identification of the *Russula* specimen, students provided extra attributes according to the teacher's requests ("bright colored caps and white gills, the light stem snaps when broken") and what eventually yielded them points. Right after sending the message, Tom utters the following statement, responded to by Jeff.

Fragment 4.

374 Tom: I ask her that is it now enough (..) Is the yellow swamp
russula ((*the identified species*)) now enough (..) and if she
says that yes then I ask WHY (.) so how- how do you know that
it's enough (..) ask her that how do you know that yellow
swamp russula is enough (.) [for you]
375 Jeff: [Don't ask that way ask-

Tom first says that he will ask the teacher if the identification is enough. He then states that if the teacher agrees, he will ask for arguments from the teacher. Strengthen by the repetition "How do *you know* that [the yellow swamp russula] is enough *for you*," the statement may be heard as an insistence from the teacher, just like the teacher has insisted arguments from the students before. The statement implies that its speaker too now has power to ask for arguments, and in that way evaluate teacher potential response. From the talk it is not clear why would he have this power. Neither his peers nor we can know whether he feels that they have done such a work providing the attributes that a teacher should also go through the trouble of making arguments. But the statement manifests a gain in power and questions and evaluates the teacher's potential answer, not again related to the scientific correctness but related to the evaluative, authoritative position of the teacher. Jeff comments to Tom suggesting not to "ask that way," without finishing his own suggestion. The comment can be heard as signaling that such a way to ask would be somehow improper or not good. This implies that this kind of statement likely would not have been uttered in the face of the teacher. Here, however, it could be said aloud without affecting or considering the teacher. For a moment, the power to evaluate the scientific correctness is reversed. Eventually, Tom asks if they attributes were enough (with six question marks in the end), but he never responds to teacher's response agreeing that "now you have good arguments but take the mushroom with you."

Shortly after the instance of empowerment, shown in Fragment 4, the students apply their increased knowledge of proper arguments again. At the beginning of the task, they had sent a picture of a fly agaric but had not succeeded in providing enough arguments ("not edible and recognized from the white dots"), to which the teacher had replied "turn the mushroom around and look underneath" while the students were already sending other answers. Walking back to the teacher, without any visible cue, students decided to recheck the attributes of fly agaric. Max asked Tom to "take the old picture of fly agaric and now let's put everything so that we at least get the two points." The group looked for attributes from the paper and from the Internet and resends on of their photos of fly agaric with proper arguments ("straight gills. poisonous cannot be eaten. in the stem there's a bulb and a ring the gills usually white"). Unlike the previous improvements in their answers, the new message of the fly agaric was not directly invoked by the teacher's demand. Instead, the need for the elaboration was raised fifteen minutes after the original message and teacher's answer. At this point of the lesson, the students not only opposed the teacher with the power/knowledge they had but also applied it to improve in their science task.

5. Discussion

This study was designed to investigate how students cope with the authoritative dimension of teaching, mediated and reproduced in the teacher's evaluative feedback. Whereas dialogic and student-centered practices have been suggested in the literature and shown to be important in engaging students in and reducing their alienation from school learning (Aguiar et al., 2010; Calcagni & Lago, 2018; Lyons, 2006), authoritativeness perfuses institutionalized teaching and in the nature of academic knowledge, and authoritative teaching practices also have their importance in achieving the cognitive learning goals (Scot et al., 2006; Sharma & Anderson, 2009). Our findings exemplify how the tension between the authoritative nature of teacher feedback and students' uptake thereof does not necessarily prevent a dialogical approach to teaching and learning. Even when the teacher is not physically present, the authoritative dimensions of teaching are present—both internally in students' dialogue and more directly in the form of evaluating mobile messages—pushing the students towards improving their performance. This study shows how—unlike typically in classroom interaction (Aguiar et al., 2010; Mehan, 1979)—the students controlled the ways to react to the authoritative dimensions of the feedback while simultaneously improving their performance in line of academic learning goals.

Our study exemplifies three specific ways for students to react to the authoritativeness of teacher's evaluative feedback: (a) using abusive language and direct mocking of the teacher, (b) drawing on humor and laughter to oppose and degrade the teacher's authority, and (c) exhibiting knowledge and power of their own to further overturn the authority. All of these interactional resources can be perceived as manifestations of the *carnival sense* of life, a "temporary liberation from the prevailing truth and from the

established order" (Bakhtin, 1984a, p. 10) and "temporarily suspension of the entire official system" (p. 89). These are also typical ways in which employees relieve negative emotions during informal gatherings in their workplace before reentering the formal contexts where these emotions had been created (Kühl, 2019). In the outdoor lesson studied here, the carnival sense was legitimized by the sheer physical absence of the teacher and the restrictions of classroom-like interaction.

The opportunities to swear and laugh and to evaluate teacher were used particularly under the circumstances where the authoritative dimension of teaching and institutional demands were experienced in the form of evaluative feedback from the teacher. However, the students then continued with their tasks and followed the teacher's instructions and suggestions every time it was practically possible. At the end of the mushroom lesson, when the students were arguing for identifications of specimen in a message, they looked up mushroom attributes, investigated the mushroom caps from underneath, and used scientifically relevant terminology (gills, stem) which was not case in the beginning of the lesson (e.g. "what the fuck are gills" as response to a teacher's questions about gills). The students' arguments became more precise and scientific and, in the end, they actively sought to provide them. Taking carnival as a *temporarily suspension* of official restrictions (Bakhtin, 1984a), we can understand how the opposition of the students had a temporal aspect in a way that simultaneously as they confronted the teacher's authority and stated the final word in their mutual interaction, they heeded the evaluative feedback and continued and improved with their task. Just like the feast and the carnival occurred only momentarily and their "legalization was forced, incomplete, led to struggles and new prohibitions" (p. 90), the evaluative power of teacher and the institutional seriousness of science remain, and the academic task continues while and after the opposition. Laughter, too, momentarily suspended the opposition between science teachers and students and thereby had a double function in that it both overturned and reinforced the seriousness of science learning (cf. Roth et al., 2011). When laughter is not perceived as an alien phenomenon to lessons, it may support students' enactment of academic performance by reproducing and transforming positive emotions. In this study, the student's reactions after evaluative feedback from the teacher overturned the authoritativeness, but only to be reinforced when the students actually followed the teacher requests. As carnival was legitimized by the reigning powers to allow people the momentary suspension of everyday life's restrictions, the students returned to the task and submitted to the teacher's requests and instructions.

The temporary nature of the three ways to cope with the authoritativeness shown in this study are important for learning in a primarily affective way—thus reflecting what happens in the workplace (Kühl, 2019). Our data shows that despite the opposition and ridicule the students continued with the learning task as if the negatively perceived and frustrating evaluation had not prevented their engagement. They not only continue the task, but also improve relative to the science learning goals and in the end of the lesson receive positive evaluation from the initially inadequate performance (see particularly Fragments 1, 2, 3 and the subsequent analyses). They actively exhibited knowledge of their own also about the science task and were empowered to apply it (see Fragment 4 and subsequent analysis).

As the authoritative sense of science education in particular is considered to be a challenge for the engagement of students (Lyons, 2006), understanding how students may react during authoritative experiences in constructive ways is important. Typically, students' deviation from a normative classroom order and inappropriate reactions are both defined and sanctioned by the teacher (Mehan, 1979). Studies show that students' frustration is common especially in inquiry-oriented science lessons, when students are faced with uncertainty of the correct answer or the right way to proceed (Brown & Melear, 2006; Gormally, Brickman, Hallar, & Armstrong, 2009) and that negative emotions during learning correlate with anxiety, hopelessness and have a negative effect on students' engagement and interests (Lyons, 2006; Pekrun, Elliot, & Maier, 2006) . This study shows that the laughter, ridicule, and insults against the teacher and the exhibits of students' own knowledge and power served as ways for students to oppose the authoritativeness represented in the evaluative feedback and continue with the task despite of the opposition. Whereas the negative emotions like frustration caused by evaluation might have turned the students away from the task, this study showed how students find ways to disrupt and cope with the authoritative roles of teaching and academic (scientific) knowledge, allowing the negative emotions to be put aside. The authoritative feedback is turned into positive to the extent that the learning may continue, and the students may access and understand science in affectively meaningful ways.

In this study, we use examples from an outdoor learning environment, where the students' freedom and possibility to independent interaction apart from the teacher was apparent. The dialogic exchanges were not controlled by teacher's choices but the opposite—the students who react to teacher's inputs. Whereas teachers tend to fear a loss of control particularly in outdoor environments (Glackin, 2017), the findings suggest that the moments of "lost control" may appear to students as affectively important ways to engage in the learning tasks while maintaining a sense of control of their own. In classrooms, teachers tend to control the potential for dialogic discourse most of the time (Aguiar et al., 2010; Lehesvuori, Viiri, Rasku-Puttonen, Moate, & Helaakoski, 2013). One might then ask whether the findings of the present study are applicable to any other learning settings than the ones in which the students work completely apart from the teacher. However, the findings concern the more typical classroom settings as well. This is so, because the turn-taking procedure can be affected when the teacher momentarily turns away from the students (Mehan, 1979), and there are moments in which students communicate with each other out of the earshot of the teacher. For example, Roth (2009), as well as Blackledge and Creese (2009), analyzed instances of group conversation that happened in the classroom but completely without teacher's awareness. Another study showed that the teacher's placement in the classroom alone had great influence on student's participation in the activities in different spots in the classroom (Roth, McGinn, Woszczyna, & Boutonne, 1999). It is likely that in classroom settings, students utilize moments of temporary freedom and absence of the teacher to interact about things that are not directly related to academic content and even oppose the teacher's authority. In typical classroom environments this kind opposition tends to be seen as off-topic, disciplinary issues or problematic identification with the school culture (Gilbert & Yerrick, 2001; Itzek-Greulich & Vollmer, 2017; Steffensky et al., 2015). The present study, however, suggests that students can use the brief moments of independent interaction in manifold ways to reduce tensions deriving from the authoritativeness of teaching—parallel to

employees meeting in the coffee or lunch room (Kühl, 2019). Abusive language might be commonplace in (some) students' everyday discourse outside of the classroom. Yet, the carnival sense of the swearing, derision, and humor is manifested only when they are used to oppose and overturn the authoritativeness the official and serious systems (Bakhtin, 1984a). Accordingly, our findings show that what might also be common style of speech in students' everyday lives is turns—within the carnival sense—into ways of coping with authoritative dimensions of teaching. Whereas we do not intend to endorse cursing in classrooms, we propose some reactions that overturn the seriousness of learning may simultaneously reinforce the engagement with academic activity.

Finally, it is typically the students' responsibility to orient their behavior to follow the normative order of the classroom (Mehan, 1979). Yet, the students are likely to have similar kinds of confronting thoughts during authoritative interaction with the teacher even if they are not able to externalize and express their affect under the restrictions of the classroom. In this respect, the present findings underline the importance of providing students with possibilities for expressing their own knowledge, views and identities in dialogical exchanges in classroom interaction (e.g. Morales-Doyle, 2018). Student-centered approaches emphasizing inquiry as well as opportunities for choice are to be promoted particularly in science education (Crawford, 2014; Stroupe, Caballero, & White, 2018). In teaching settings that underline students' independence and group work, more opportunities exist for interactions among students to arise. Rather than considering students' alteration from the academic tasks as “off-topic” or a disciplinary issue, educators and educational researchers should regard them as potential possibilities for students to experience and actualize their relationship to academic learning in affectively meaningful ways that may also support the purpose of learning.

Declaration of competing interest

None.

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