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What Can a Teacher Do to Support Students' Interest in Science? A Study of the Constitution of Taste in a Science Classroom

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Abstract In this study, we examined how a teacher may make a difference to the way interest develops in a science classroom, especially for students from disadvantaged socioeconomic backgrounds. We adopted a methodology based on the concept of *taste for science* drawing on the work of John Dewey and Pierre Bourdieu. We investigated through transcripts from video recordings how such a taste is socially constituted in a 9th grade (ages 15–16) science classroom, where there was evidence that the teacher was making a positive difference to students' post-compulsory school choice with regard to science. Salient findings regarding how this teacher supported students' interest are summarized. For example, the teacher consistently followed up how the students acknowledged and enjoyed purposes, norms, and values of the science practice and so ensuing that they could participate successfully. During these instances, feelings and personal contributions of the students were also acknowledged and made continuous with the scientific practice. The results were compared with earlier research, implications are discussed, and some suggestions are given about how these can be used by teachers in order to support student interest.

Keywords Interest · Taste · Norms · Values · Aesthetics · Exemplary teaching · Science education

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Introduction

In their now decade-old review on attitudes towards science, Osborne et al. (2003) conclude that "It is somewhat surprising that so little work has been done in the context of science classrooms to identify what are the nature and style of teaching and activities that engage students." Similar claims are made in reviews by Krapp and Prenzel (2011), Potvin and Hasni (2014), and The Royal Society (2008), arguing for the need of research on how teaching may stimulate student engagement in science. Moreover, in the recent review by Potvin and Hasni (2014), it was shown that student interest in science is predominantly studied through secondary reports in the form of questionnaires and interviews, and the authors therefore call for alternative approaches. In this study, we address these calls by examining how a teacher may make a difference to how interest develops in science classroom action. Our study is especially motivated by how science education can counterbalance the restricted science career opportunities afforded to some students' because of their socioeconomic backgrounds.

For our purpose, we adopt a recently developed methodology to study how a *taste* for science is constituted through classroom interactions (Anderhag et al. 2014). The concept of *taste* is used as an operational proxy for what is usually referred to using other constructs such as *interest* or *attitudes* relative to science. *Taste* is particularly relevant for studying science interest as socially constituted. For our purpose, we also choose a lower secondary science classroom where there is evidence that the teacher is making a positive difference to disadvantaged students' post-compulsory school choice with regard to science. This is an exploratory, qualitative case study, which, with all its limitations in terms of generality, is presenting evidence of engaging ways of teaching, which should be of interest to science teachers and to science education researchers to examine further.

Taste, Interest, and Related Constructs

Taste is here defined as how people through talk and actions make distinctions about what kind of language, objects, and people belong and do not belong in a certain practice. Pierre Bourdieu (1984) demonstrated how such distinctions are used by social groups to recognize themselves as such and to draw distinctions between themselves and other groups. According to Bourdieu (1984) and John Dewey (1929/1996; 1913/2012), people for example learn to appreciate certain kinds of music or wines not merely by realizing that they are enjoyable, but also through learning a whole new world of distinctions about how to talk, act, and feel in relation to music and wines as part of whole practices together with others. A certain kind of taste, for example for classical music, is thus not just a private matter but typically involves bit-by-bit processes of learning certain socially accepted normative distinctions cognitively as well as aesthetically with others. To be appreciated in certain camps as a person of taste for classical music, it is not enough to profess that you like it; you must also know and be able to contribute to numerous distinctions about different composers, their styles and characteristics, and how to evaluate them in appropriate ways. It is by taking part in such practices that our taste and our character is constituted and evaluated by others. These observations by Pierre Bourdieu and John Dewey are here applied to the constitution of a taste for science through school science practice.

Hence, according to the socio-cultural and pragmatist understanding adopted here, *taste* is a concept that may help science education researchers to approach problems related to questions about science interest (1) as practices shared in action with others, (2) as about aesthetically learning new ways to value and feel in those practices, and (3) as being continuous with learning cognitively as well as normatively because (4) these practices involve developing new distinctions through language and action (Anderhag et al. 2014; Wickman 2006).

This is the place to make a caveat. Taste is a concept that mainly has been used in sociology, although there are important exceptions in the educational literature, especially among those emanating from Bourdieu (e.g., Backman 2009). In science education research, typically more individual and psychologically oriented concepts are adopted, such as *interest*, *motivation*, *attitudes*, *affection*, *engagement*, and so forth, although also the more holistic terms *values* and *aesthetics* are regularly used. Our purpose here is not to replace the terminology of the field, or deny the variation in interest among individual students, but rather to use the concept of *taste* for our specific aim to complement other studies examining how students come to enjoy science class, choose science careers, or see it as a concern in their everyday lives. We will shift continuously between these various concepts so as not to detach our argument from that of others and to make justice to and continuity with the more current conceptualizations used in the field for similar aims. The pragmatist Hans Joas (2000, p. 2) maintained that in giving new answers to old questions you have to move "to and fro between competing conceptual frameworks, probing and penetrating each of them, making each reciprocally permeable." The fuzziness but also the continuity of the concepts of this field needs to be acknowledged and not hidden. Fuzziness is the healthy sign of an area in development, as research is not just about facts, but also about finding new ways to talk and distinguish appropriate facts in relation to our purposes, questions and what we value (Schwab 1949).

Prior Research on Interest in Science

Although the theoretical frameworks and accompanying interest constructs have varied historically (see e.g., Krapp and Prenzel 2011), educational researchers generally have recognized the importance affection and values have for student engagement and learning in science (Koballa and Glynn 2007). Consequently, attitudes towards science have been a major research field since the 1960s (Bybee and McCrae 2011; Osborne et al. 2003). A variety of factors have been associated with student interest in science, but research usually refers to the complex interplay between on one hand the individual and on the other hand some area of the science content, the school context, or the home background (e.g., Tytler et al. 2008). From previous studies, we know that some science domains and also areas within specific domains are more interesting to the students than others (Jidesjö et al. 2009; Osborne et al. 2003; Schreiner 2006) and that students regularly distinguish between school science and the science they meet outside of school (Osborne and Collins 2001; Osborne et al. 2003; Tytler et al. 2008).

Typically, student attitudes are conceptualized as mental and personal rather than as social and shared, but there are many exceptions. Significant in this regard is the finding that interest in science does not involve only attitudes to the conceptual content, but also attitudes to the scientific norms as they are projected through its practice (Taconis and Kessels 2009). These norms are often described by the students in negative and stereotypic terms. For example, the science classroom practice is often referred to as fact-oriented, male-biased, primarily for the smart kids and generally of no personal importance (Lyons 2006a; Osborne et al. 2003). Moreover, since cultural background, including ethnicity, gender, and social class, has been shown to influence the extent to which students continue with post-compulsory science (Bertilsson 2007; Gorard and See 2009; OECD 2007, 2010; Tytler et al. 2008), it is evident that specific student groups are recurrently excluded from the practice of science.

Although it is accepted that norms and values are important for the development of a science interest, the normative aspects of learning science have, however, often been overlooked when student attitudes and attainment have been examined (Anderhag et al. 2014; Carlone et al. 2011; Corrigan and Gunstone 2007; Wickman 2006). That is, studies of students' interest in science have primarily focused on factors correlated with personal attitudes towards science and not so much on how student possibilities to participate and continue with science *is constituted* as part of classroom practice. Since norms and values are essential parts of identity formation and consequently become important aspects of whether students can identify themselves with the science practice (Aikenhead 1996; Bishop et al. 2006; Brickhouse et al. 2000; Carlone and Johnson 2007; Costa 1995; Schreiner 2006), it is possible that some of the alienation and disinterest students describe towards science is linked to students' difficulties in understanding how to make the distinctions the current classroom taste values and reproduces. However, at the same time, we know that for some students partaking in school science is less problematic, which may suggest that they can make sense of the distinctions of taste made in the science practice. One important source of this understanding is the home of the students, where parents share knowledge and dispositions facilitating their children's acquaintances with the norms and values associated with science education (Adamuti-Trache and Andres 2008; Bertilsson 2007; Lyons 2006b). That is, some students are familiar with how people inside this specific practice act and talk, and what they value (Lemke 1990; Wickman 2006), whereas others are not, and their only possibility of getting access to this taste is to learn it in school.

The Impact of Teaching on Students' Interest

So, what can a teacher do to support student interest in science? Through mainly secondary reports, we know that students with positive experiences of science often refer to an engaging or passionate teacher (e.g., Boe et al. 2011, Maltese and Tai 2008). According to Krapp and Prenzel (2011), student attitudes are usually framed as resulting from the following: (1) the quality and type of instruction, (2) issues relating to developmental psychology, and (3) identity formation. Irrespective of explanatory framework, interest is regularly distinguished as *individual* or *situational*. The former has been suggested to be resistant and of great importance for content learning, whereas the latter is related to temporary events arousing interest. The situational interest is also regarded to be the easiest to influence by teaching (Hidi et al. 2004). Although temporary events may stimulate interest, for example a spectacular experiment is usually reported as interesting by the students, they do not necessarily have any constructive outcome for a more permanent interest in science. Moreover, one cannot expect that activities that students have reported as enjoyable, for example laboratory work, automatically will lead to an enduring interest in science (Abrahams 2009; Hofstein and Lunetta 2004). Nor should it be expected that students perceive science activities, such as laboratory work or reformed curricula, in some universal way (Andrée 2007; Carlone 2004).

This is in line with the findings of Carlone et al. (2011) who showed how two similar exemplary practices regarding student outcomes differed in terms of whether the students perceived science as something they could identify themselves with. The most evident explanation to this difference was what and how *norms* were projected and perceived in the two practices. Carlone et al. (2011) therefore argued that from an equity perspective, a focus on how exemplary practices succeed in fostering high-achieving students may be misguided. Also, normative aspects of how science is instructed and understood need to be investigated (Carlone et al. 2011).

Although exemplary science teaching does not as a matter of course generate an enduring interest in science, Tobin and Fraser (1990) reported four major trends exemplifying exemplary science teachers, namely those who (1) used management strategies that facilitated sustained student engagement, (2) used strategies designed to increase student understanding of science, (3) utilized strategies that encouraged students to participate in learning activities, and (4) maintained a favorable classroom learning environment. In the more recent studies by Waldrip and Fisher (2003) and Waldrip et al. (2009), exemplary teachers were identified through their classroom interactions with students and through students' perceptions of their learning environment. The characteristics of the interaction and the learning environments were located using questionnaires and vindicated through student interviews. The interviews showed that exemplary teachers were successful in creating an inclusive environment in which students will to participate and learn was stimulated. Moreover, these teachers also tried to engage their students in the learning process. Similar results have been achieved by Yung and Tao (2004), Tytler et al. (2004), and Xu et al. (2012), who also reported that effective teachers stressed the need to utilize links with students' lives, interest, and community.

A recent large-scale study on students' and teachers' conceptions of good science teaching, for the most part, corroborates these findings (Yung et al. 2011). The findings were based on a video survey, where teacher and student conceptions of what it was in a video that reflected good science teaching were collected. Although recognizing the difficulties of teasing out the respondents' beliefs, the authors emphasized that their findings represent "grass-roots" opinions of the stakeholders inside the classrooms, which often is not reported. Somewhat similar issues are raised by Xu et al. (2012) and Fitzgerald et al. (2012) both of whom focused on the practices of exemplary teachers but also stressed the importance of contextual dimensions when studying teaching in the science classroom. In a recent longitudinal study based on interviews, Likert-type questionnaires and classroom observations, Logan and Skamp (2012) also showed how straightforward things like clear instructions, humor, and a relaxed atmosphere where the note copying was kept to a minimum all affected students' situational interest positively.

There are also studies on how teaching fails to engage students and can exclude them because of their background. An interesting example is provided in the study of Carlone et al. (2011) mentioned earlier. In the two fourth grade classrooms examined, both defined as exemplary practices, the students were shown to express positive attitudes towards science and also developed similar levels of scientific understanding. The classrooms differed, however, in terms of the meanings that were constructed about what science is and who it is for, which was shown to be important for students' conception of themselves as members of the community of science. In one of the classrooms, the majority of students perceived themselves as having some characteristic of a science person and so being included in the practice of school science. In the other classroom, however, the same level of familiarity with science was not expressed and a group of students also described themselves as excluded due to their unconformity to the classroom norms of what characterizes a science person (Carlone et al. 2011). Classroom observations showed that these norms encompassed what scientific knowledge is, how it should be constructed, and how it should be communicated. In the classroom where feelings of alienation were expressed, it was for example demonstrated that students that could distinguish the preferred way of talking, that is, using a scientific vocabulary in Standard English, were more often recognized by the teacher than students that did not. Although having the best intentions, the teaching of this classroom was also shown to support the idea of science persons as those who figure out things by themselves and do not necessarily share or get ideas from others (Carlone et al. 2011). These *cultural meanings* (p. 475) regarding the proper way to act and talk in the science classroom also became shared among the students.

Participating in science classroom activities was thus not only a question of making cognitive distinctions, but also making lingual and procedural distinctions that are acknowledged, ultimately by the teacher, in the specific classroom practice.

Another study, often cited in Sweden, is that of Bergqvist (1990) and Säljö and Bergqvist (1997) of a 5-week optics unit with students 13–14 years old. The lessons used a kind of discovery approach (Klahr and Nigam 2004), where students were expected to inductively extract theory about how light is refracted from observations using lenses, prisms, etcetera mounted on a so-called optical bench. The teacher encouraged the students to try different manipulations and "discover things" and "to see what happens" (Bergqvist 1990, pp. 51–52). However, the effect for many students was just the opposite, and the experience of students instead became one of "demoralization with respect to their own work" (Säljö and Bergqvist 1997, p. 396).

In the context of our paper, this demoralization could be understood as denying the students access to the distinctions necessary to include themselves in the discovery undertakings envisaged by the teacher and so to develop a taste for science. For example during the first lesson, which served as an introduction, students had high expectations and expressed how intrigued they were by the different colors into which the light was refracted through the prism and compared it to disco lights. Nevertheless, the students' first enthusiasm did not help them in distinguishing what to do to accomplish desired outcomes so as to see what happens (e.g., students saying "we're doing lots of things but still nothing's happening," although light was refracted), to use appropriate language (calling a mirror "this one") or to understand what outcomes were final and could be enjoyed as accomplishments in this science class (Säljö and Bergqvist 1997, pp. 395–396; Wickman 2006). As a result, the students' first enthusiasm for the disco lights eventually turned into disappointment and the students commented that the practical was "boring" and that maybe they were "stupid" (Säljö and Bergqvist, pp. 395). The only feedback from the teacher was good-humoredly distinguishing their actions as inappropriate. Hence, no specific norm, other than a tacit one indicating that the students were doing things incorrectly, was acknowledged during the activity. Here, distinctions about what is happening were not considered as being about learning certain inclusions and exclusions of occurrences as relevant or not, but rather as something that can be easily discovered directly from nature.

Considering learning such distinctions as a question of constituting a taste allows us to see the conventional side of such distinctions: that they are not merely a fact and that they can be learned in multiple ways. The choice is based upon our values and habits and so can be considered to be a matter of taste. Most importantly from this example we see the connection between learning to make cognitive and normative distinctions, and experiencing the aesthetic and emotional side of science (Wickman 2006).

This example and earlier research illustrate the importance of the teacher in helping students traverse the zone of proximal development, that is between the capacity of problem solving as determined by their own background and that which can be accomplished through the guidance of a teacher or more capable peers (Vygotsky 1978, p. 86). It also points out that closing this gap includes learning to make distinctions about what counts as science, and a student, of science and that making such distinctions are necessary to learn to participate and enjoy science and so to develop a taste for science. However, how to teach students such distinctions is not self-evident. At the same time as we know what kind of instruction, classroom activities, and subject content students regularly value and enjoy, the situated and highly contingent process of how interest is constituted in such activities, and the details of how teacher action can support students in this, are less examined.

Theoretical Framework

In this paper, we take a pragmatic perspective on language and learning in which the meaning of a word, utterance, or action is not ready-made once and for all, but determined through its situated use and consequences in a social activity (Cherryholmes 1999). According to such a stance, we learn new meanings all the time (cf. Lave 1996). Hence, interest for something is continuously learnt through the situated consequences that a specific interest brings to a person. This position is in line with Dewey's (1913/2012, p. 43) notion that "interests are signs that some material, object, mode of skill (or whatever) is appreciated on the basis of what it actually does in carrying to fulfillment some mode of action with which a person has identified himself." As the consequences of your interests cannot be fully decided by yourself in advance, but by the eventual reactions of others as part of some more or less successful undertaking, the constitution of interest, as it is pragmatically understood, is about the constitution of a taste (Anderhag et al. 2014). Here, we are interested in what a teacher can do to initiate, direct, and support this eventually self-governed process of making scientifically relevant distinctions through their physical and social consequences.

The Bourdieuan framework may initially seem to conflict with this situated approach since the *habitus*, of which taste is an essential part, is operationalized as embodied dispositions structuring action, thus seemingly connoting something static and deterministic. However, when recognizing the empirical project in which the concept of habitus once was developed, similarities with the pragmatic stance become apparent (see e.g., Aboulafia 1999). Recurrent in the works of both Dewey (e.g., 1922, 1958) and Bourdieu (1998, 2000) is the questioning of the distinction between an internal subjective mind and an external objective reality. Both authors argue that in this worldview there has been a tendency to operationalize mind and practice as separated, a notion they both overtly questioned and which Bourdieu attempted to overcome by using the concept of habitus. In the Bourdieuan framework, human action is understood as the *habitual* doings of the subject in *relation* to the objective structures the individual has experienced through lived life. According to Bourdieu (1984), these structures (e.g., the cost of education, norms and values of the school system, gender-biased occupations) continuously restrict or facilitate action and so become part of the individual's habitual ways of perceiving and acting in the world, that is the objective structures become internalized or embodied. Habitus is thus a set of dispositions resulting from the embodiment of the objective structures the individual has encountered trough upbringing and education.

The concept of *habitus* thus has important similarities with Dewey's concept of *habits*, which Bourdieu himself acknowledged (Bourdieu and Wacquant 1992). Both notions recognize the social and habitual nature of meaning-making. This does not entail that embodied dispositions predetermine certain actions, but rather that the habits (Dewey 1922; Garrison 1997, p. 91) or the habitus (Bourdieu 1998; Pahl 2008, p. 192), as they are recognized by others, constitute *potential* for certain actions. In this framework, Bourdieu (1984) has convincingly demonstrated (1) that taste is learnt and embodied through upbringing and education; (2) that norms, being empirically evident trough the participants distinctions of taste, are associated with specific social groupings and settings; and consequently (3) that taste may affect the extent to which people are successful in, and also are given access to, different practices. Hence, in different social practices, taste preferences are usually shared in terms of distinctions about what is interesting and what is not, what is good and what is bad, right or wrong, and nice and ugly, and so on. Being socially situated, aesthetic and normative judgments on everyday phenomena such as politics, sports, and food dishes are therefore important in terms of to what extent the individual can participate or not in certain quarters. For the same reasons, aesthetic and normative distinctions regarding such things as experimental design, laboratory equipment, or accuracy of measurement would seem important to participate in science.

Since it is well-known that the normative expectations of the science classroom may conflict with those of the students, for example with respect to whom science is for and what the knowledge should be used for (Aikenhead 1996; Carlone et al. 2011; Schreiner 2006), preferences of taste is of relevance when learning science. Studies have shown that aesthetics is a common feature in a range of different science educational settings. Aesthetic judgments, which concern what people like and dislike, are for example used by small children doing science in elementary school (Jakobson and Wickman 2008), by secondary school students studying biology (Arvola-Orlander and Wickman 2011), as well as by teachers and students in university biology, chemistry (Wickman 2006), and physics courses (Berge and Danielsson 2013; Hasse 2002). In order to be interested and learn science, the students do not only need to learn the science content but also how to articulate and relate to the aesthetics and the norms of the practice, that is to participate by talking and acting science (Aikenhead 1996; Jakobson and Wickman 2008; Lemke 1990; Östman 1994; Östman and Almqvist 2011; Wickman 2006).

Taste thus encompasses cognitive, aesthetic, and normative aspects of participating in the science classroom; components which have all been shown to be of great importance for students' interest. Therefore, as argued by Anderhag et al. (2014), students' distinctions of taste when learning science and the accompanying values they attach to these distinctions can serve as an action-oriented operational proxy in classroom studies to consider what is commonly approached as interest in interviews and questionnaires. Since taste becomes observable through the distinctions people make as part of practices, it is possible to study its constitution in classroom action. Although both Bourdieu and Dewey acknowledged taste as continuously developing through social encounters, neither of them studied the actual constitution of taste empirically. Consequently, irrespective of the social practice chosen, we know little about how interest, or taste for that matter, is constituted in action.

Aims and Research Question

In summary, in order to contribute to the study of the constitution of interest in science, we analyzed how taste is constituted in the classroom through the distinctions made and how they are valued in relation to the aims and purposes of the activity. We specifically asked what a teacher was doing in these regards, and further, asked them to consider the consequences that their actions appeared to have for their students' opportunity to participate in and enjoy science classes. Our study was guided by the following over-arching question:

- How may a teacher support students in developing a taste for science?

As we were particularly interested in what this support may look like with students that are disadvantaged regarding science career choices, we examined this in a classroom with a teacher where the school for several years has produced a significantly larger proportion of students applying for the Natural Science Program than expected considering the socioeconomic background of the students. As this is a single case study, the specific findings regarding the constitution of taste for this class are discussed in relation to prior research on interest to illuminate the more general overarching question.

Material and Methods

Study Setting

The school used as a site for thism study was identified using a previous study in which we examined whether there are exceptional schools in Sweden that compensate for their students' socioeconomic background with regard to their choice of applying for the post-compulsory Natural Science Program (NSP) in upper secondary school (Anderhag et al. 2013). In Sweden, the application for upper secondary school is an important educational career choice. In the study, we used a logistic regression model and data from Statistic Sweden, covering the whole population of 106,483 ninth grade students in Sweden. To examine the possible implications of socioeconomic background variables such as, immigrant background, household income before tax, parental educational level, and students' choice of the NSP in upper secondary school were considered. The outcome of the regression analysis was used to locate schools deviating from the predicted outcome, that is, to find schools where students apply to the NSP in greater or lesser extent than predicted. Hence, in schools shown to deviate, the background variables (e.g., educational level of the parents, which was clearly associated with the choice of NSP) alone could not explain the relatively high or low application frequencies. That is, something in the school is likely to have had an effect on the student choice. Of a total of 1,348 schools, 158 deviated significantly from predicted outcome and 85 of these were exceptional schools that deviated positively. That is, only in 85 out of 1,348 schools more students than what would be expected considering the background variables of the students applied for the post-compulsory NSP in upper secondary school (Anderhag et al. 2013). This demonstrates the strength of the association between the backgrounds of students and their future career choices, even in a relatively egalitarian society such as Sweden. At the same time, it demonstrates that lower secondary schools can make a difference.

To further ground the final choice of school, we selected schools where a comparatively high proportion of the students in the 85 exceptional schools over a 4-year period recurrently applied for the NSP in upper secondary school. We considered this to further establish that the single year observed in the Anderhag et al. (2013) study was not an occasional incident, but a stable accomplishment. In the school ultimately chosen, 22 % of the students over a 4-year period applied for the NSP, as compared to the national mean of 15 % for the same period. We also established that the present science teachers of the school worked in the same school during the statistical sample period. In order to get in contact with the science teachers, we informed the principal of the school about our findings. The principal directed us to one of the three science teachers whom he considered to be outstanding. When we had talked with all the teachers and interviewed eight students from their respective classes, we decided to complete our study in the classroom of the teacher initially recommended by the principal. He was an experienced male science teacher that had worked at the school for almost 20 years.

The students that were part of the study were thus chosen because their teacher could be a possible influence on why students from this school chose the NSP to the extent they did. The choice to complete our study in a ninth grade classroom (the teacher also taught seventh and eighth grade science) was motivated by these students who were likely to have had thorough experience of this teacher's teaching in science. Accordingly, the data were collected during the second and last semester of the ninth and final grade in lower secondary public school in a suburb of a large city. The recordings were made in their school laboratory, which was similar to those of many Swedish lower secondary schools. Since we wanted to capture instances where the teacher and the students interacted, we asked the teacher if it was possible to attend lessons where the students would have the opportunity to be active in talk and action. Together with the teacher, we decided to attend the introductory lesson of the next unit where he was about to introduce electricity. During this first lesson, the students were going to work with simple electrical circuits and this would give us ample opportunity to record teacher and student action. During the observations, the students (ages 15–16, with an even mix of boys and girls with heterogeneous backgrounds) worked in pairs building simple electrical circuits by connecting wires, bulbs, and switches to a battery. The assignment, which served as a repetition and an introduction to a 5-week unit on electricity, was briefly introduced by the teacher. The written instruction handed out to the students was straightforward and contained nine different tasks where the students were asked to draw and connect a combination of a different number of bulbs and switches to a battery. The assignment was scheduled for 80 min, and when 20 min remained, the students and the teacher jointly summarized their results at the whiteboard. At the end of the lesson, the students and the teacher together constructed a paper roll speaker in response to a student question from the previous lesson.

Twenty four students and the teacher were recorded. We audio recorded and filmed the students with digital equipment as they were working in pairs. One camera followed the teacher. The audio recordings were transcribed verbatim. The video data helped us identify analytical cues specifically non-verbal interactions such as gestures and expressions. This data was also used to interpret students' emotions and feelings when making aesthetic judgments.

We first considered comparing this positively exceptional school with an average one or a negatively exceptional one, to establish teacher differences. However, for ethical reasons, we chose not to. In contacting successful schools, principals and teachers were often happily surprised, welcoming us to study their school. Typically, the teachers did not know that their students had chosen science in upper secondary school to an exceptional degree considering their background. As informed consent is an ethical requirement for our study, we could not find a way to ask the unsuccessful schools to participate, as this would have meant informing them that we were interested in the shortcomings of their teaching. For this reason, we instead restricted our comparison to earlier studies of successful and less successful teaching.

Analytic Approach

To answer the research question regarding how the teacher in this classroom supported the students' constitution of taste, we adopted an analytic approach developed by Anderhag et al. (2014) building on practical epistemology analysis (Kelly et al. 2012; Wickman and Östman 2002; Wickman 2004). The unit of analysis is action (including talk) as part of an activity with a purpose. Epistemology is here defined pragmatically in line with Rorty's (1991, p. 1) notion that knowledge is "a matter of acquiring habits of action for coping with reality." Studying practical epistemologies thus concerns how students' and teachers' actions, habits, and customs are transformed when coping with what occurs in the classroom. The aim of such an analysis is to understand what these actions tell us about how and what students learn by participating in the specific interactions of a certain curricular setting. Here, our interest is specifically how the teacher is supporting the students' situated constitution of taste (learning habitual distinctions of inclusions and exclusions) for science, and not learning generally.

The methodology first entailed identifying situations in transcripts where taste could be observed to be constituted. These were situations where an *explicit gap* regarding what was an appropriate distinction was negotiated and evaluated by the students and the teacher. The following short exchange between two students and a teacher illustrates the concept of gaps. The example comes from a previous study (Anderhag et al. 2014) where the students were measuring the volume of metal weights by observing what happened when they immersed them into a graduated cylinder filled with water.

Karl: Hassan, since you got a good view there, check how high it is!
Hassan: It has gone, like, two lines up.
Karl: [laughs] You can't say it like that.
Teacher: Then you have to calculate how much two lines…
Hassan: Two millimeters.
Teacher: What is the value of each line?

Here, Karl and Hassan were looking at the graduated cylinder to see how much the water surface had risen after immersing the weight. They noticed a gap regarding "how high it is" and in order to proceed these students needed to decide how high the water level was. As evident from the example, Karl did not agree on the cognitive distinction Hassan made regarding "how high it is" and overtly excluded his contribution. According to Karl, "it" cannot be described as "gone, like two lines up." Karl also related this exclusion to laughter and, thereby, construed a relation in terms of an aesthetic judgment. By making the students pay attention to the value of each line on the cylinder, the teacher was shown to support the students to talk more accurately about how to measure the change in waterline. The teacher thus assisted the students to fill in the gap related to "how high it is."

An *explicit distinction gap* here thus meant transactions where the students did not immediately agree about what should be included and excluded, but talked with the teacher about alternatives in deciding and evaluating distinctions (Anderhag et al. 2014; Wickman and Östman 2002). Hence, distinctions, which were not further reflected upon by the teacher or the students, and which were simply enacted, were excluded from analysis, as they may just have represented taste (for better or worse in relation to norms) already in place in the classroom. Second, as we are particularly interested in the role of the teacher in supporting the constitution of students' taste for science, we focused on those explicit gaps in which the teacher jointly with the students negotiated and evaluated appropriate distinctions.

These initially indeterminate situations were then analyzed with respect to how the students and the teacher construed relations drawing on their experiences (past and current) to fill the gaps so that they could continue with their undertakings. A *relation* designates that the students or the teacher did or said something in which they made certain connections between objects, events, emotions, or actions (Wickman and Östman 2002; Wickman 2006). The following short excerpt illustrates the analytical concepts further. At one moment of this study, the student Lo had coupled an electrical circuit and drawn a conventional diagram of this circuit, which she showed to the teacher. The teacher told Lo that her diagram was a bit small and that she should make it bigger. After redrawing her diagram, Lo again called upon the teacher:

1. Lo: Is the size better now?
2. Teacher: Yes, it's a little bit better although it is possible to draw this big as well [shows with his hands].

In turn 1, there was an explicit gap where Lo asked what was distinguished as the appropriate size of the diagrams in this class. In turn 2, the teacher established relations between the diagram and the norm "better." He first established a distinction through the relation between Lo's "better" and "a little bit better." He then established a relation between "better" and "draw this big as well" as a possible distinction that might help Lo better constitute the taste regarding appropriate distinctions of diagram size in this classroom.

The analysis of how the gaps and relations contributed to the taste constituted together with the teacher in this classroom was made in five steps according to Anderhag et al. (2014). These steps permit an analysis of how transactions together with the teacher occurring in this classroom contributed to the constitution of taste (through gaps and relations). Below, we explicate how these analytic steps helped us answer the research question of this paper.

First, we analyzed the purposes and aims of the activity as given to the students. When these student-oriented purposes became intelligible and students could act according to them, the purposes were said to become *ends-in-view* to the students (Johansson and Wickman 2011). In this step, we examined how the teacher was helping the students to understand what the activity was all about, so that they could proceed and so participate. Namely, we were interested in how the teacher was making the purposes of classroom activities ends-in-view to the students, when gaps regarding these purposes occurred. Only when students could understand the purposes, were they able to proceed purposefully. All the remaining steps are made in relation to how they align with these student-oriented purposes as ends-in-view.

Second, we asked how the teacher helped his students to construe relations, when dealing with an explicit gap of distinction, with regard to (a) how to use language (in a multi-representational sense [Kress et al. 2001], including not just words, but also other signs such as diagrams, or symbols, etc.), (b) how to take action (using various procedures necessary to accomplish the task, for example, how to couple cables), and (c) how to relate to themselves as participants in science and the classroom undertakings in relation to the purposes of the activity. How was the teacher helping the students to discern distinctions of taste regarding a–c to fill gaps, and how were these distinctions helping students to proceed in line with the purpose of the activity?

The majority of teacher-student exchanges during the practical dealt with some aspect of pursuing with the assignment. Those that did not could be about a diverse range of things such as short responses like "yes," "no," or interactions spanning for 10–15 s where the teacher and the student talked about today's lunch, or why the student was late to class, and so on. Initially, we systematically analyzed the material for teacher-student interactions where taste was distinguished. Situations where taste was distinguished were then analyzed and discussed by the three authors and were internally validated. The excerpts presented in the paper were chosen because they were representative, both in quality and quantity, of how this teacher supported his students to construct relations in terms of taste for science.

Third, in analyzing the taste constituted in this classroom, it is not enough to establish how the teacher helped the students to cognitive and procedural proficiency, as successful students still may not enjoy what occurs in class (Carlone et al. 2011; Lindahl 2003). An analysis of the constitution of taste must also encompass the constitution of aesthetic distinctions as associated with the classroom activities and their purposes. Here, aesthetics is not understood as art, but in its traditional sense as dealing with *what* people find pleasure or displeasure in, and with *what* people like or dislike, and so with what people consider beautiful or ugly. Aesthetics so construed is about the emotions, feelings, and values people experience as being involved with various objects and in certain events (Gardner 1996). The aesthetic evaluations people make become evident through their aesthetic judgments (Wickman 2006). These judgments encompass a whole range of lingual (e.g., beautiful/ugly, fun/boring) and other kinds of expressions (e.g., smiles, laughter) working in concert. Together, these various expressions are used to assess the aesthetic value, negative or positive, a person ascribes to the objects and events as part of an activity with a purpose. Further, aesthetics also includes humor, for example, making jokes (Anderhag et al. 2014). To analyze the constitution of taste in this regard, we examined how the gaps and relations of this class also encompassed the constitution aesthetic judgments and humor concerning norms about what should be included and excluded. Particularly, we look at the role the teacher played in supporting students in this development in relation to the purposes of classroom activities. How did the teacher help the students to aesthetically experience relevant objects, actions, and events of classroom practice in relation to purpose? How were aesthetic judgments and humor orienting the students towards or away from purposes?

Fourth, a critical component generally, was not merely the taste as projected through what was included and excluded in relation to actual classroom purposes, but also how students' personal taste was allowed to take part (Anderhag et al. 2014), and how it was dealt with by the teacher. Thus, the question was how did the teacher deal with students' personal contributions and make them continuous with the other distinctions and norms of the classroom? how was the teacher letting the personal taste that students contributed to the classroom transactions be part of the taste as constituted in the classroom in relation to purposes?

Fifth and finally, there are norms of importance in assessing the value of classroom transactions beyond those distinguished in the classroom activity. Of importance here is the science curriculum norm and the norm of science proper (Anderhag et al. 2014). The undertakings in this class and the distinctions and taste constituted in the classroom also needed to be related to such norms. We could imagine a classroom where the teacher successfully supported all the four first steps, but still that the science distinctions that students were afforded to learn in class were not helpful with regard to their further use and continuity as determined by the curriculum and other contexts where science is used. Hence, we also asked if the students' learning about electrical circuits had this curricular scientific continuity beyond the purposes as given to the students.

As we are ultimately interested not in the single interactions, but in what this teacher was doing more generally in this class, the teachers' ways of dealing with various interactions were categorized in terms of his more general habits (Wickman 2004). In this study a *habit* is understood as the action patterns identified (cf. Wertsch 1995) from the recurrent ways this teacher was dealing with the five aspects identified above in the previous paragraphs. These actions patterns were found by categorizing the repeated ways in which the teacher was supporting students in noticing and filling gaps with relations. Categorizations were discussed by all the authors and they were also presented to the research seminar. Categories were based on those for which the authors reached consensus and we present thick descriptions to allow the reader to share our interpretations (Wolcott 1994). It should be observed that we are not interested in these habits as personal attributes of the teacher, that are repeated on every occasion and in a mechanical fashion, but rather as an exploration for suggestions as to how a teacher may interact to support the constitution of students' taste for science.

Findings

To begin with, the teacher informed the students that the lesson would be an introduction to electronics. The teacher told the students that it would be too difficult to "just jumped into" this subject, so they would begin by repeating some of the electronics they did in the seventh grade. Consequently, during the lesson the students were going to draw and build simple electronic circuits by coupling light bulbs, wires, and switches to a battery. The teacher did not give further instructions, but, as this was very much a repetition from earlier years, let the more general principles for how to construct circuits and make them work grow out of the transactions during the lab. Eventually, in subsequent lessons, they would discuss and build more complicated circuits by using, for example, transistors and light-emitting diodes. The teacher told the students that at the end of the lesson he would show them something exciting:

He would build a speaker in order to answer a question from last week, namely if it was possible to get (the sound of) Michael Jackson out of a toilet paper roll connected to a CD player (this final demonstration was not analyzed).

After this presentation, the students were asked to pick up the lab instruction and the materials described therein. The written instruction was straightforward and contained nine different tasks, where the students were asked to draw and connect a combination of different numbers of bulbs and switches to a battery. Every task had a specific outcome, for example: "Draw a circuit where one bulb goes out while the other two continue to shine when you press the switch–connect this!" Hence, the teacher tried to make the student-oriented purposes of this lesson explicit to the students, namely that students should draw and build a number of different functioning electric circuits as specified in the instructions and according to certain norms. Although it will become apparent that there were norms for how to make drawings and connections, the task at the same time was open as there were several possible solutions to produce the same outcome especially for the more complex tasks.

It is worth noting that the purposes given to the students asked students to solve a problem, using their knowledge in electronics, to accomplish an outcome, which potentially gave students and end-in-view to assessing when they had accomplished the task. The teacher did not just give students instructions to follow a given procedure and "see what happened." We analyzed how the teacher supported the students in situations where a gap occurred concerning the relationship between the purposes and distinctions of language and procedures. This relates to analytic steps 1 and 2 concerning the constitution of taste in this classroom. The analysis of the remaining steps is presented in subsequent sections.

Purposes and Distinctions of Language and Procedures

For students to become interested in science, that is for them to experience it as something they want to take part in, during the current lesson or in the long run, they need to be able to make appropriate distinctions along the way. When this is not possible, students get stuck, cannot make further distinctions, and so cannot continue with constituting a taste for the science of the lesson, and possibly other lessons building on it. Here, we examine how the teacher in the electronics class helped students make distinctions of inclusions and exclusions regarding language and procedures in such situations of indeterminacy.

All groups made the first circuits with little assistance from the teacher. Hence, to begin with the student-oriented purposes (as described in the written lab instruction) were consequently also ends-in-views, in that most students could purposefully take action. Although students learnt new subject content together, they could solve these situations by making distinctions without the support of the teacher. However, when the students successively encountered tasks with increasing complexity, all groups eventually needed help in order to distinguish how to proceed. Due to the contingent situations of various groups, the teacher adapted the details of his responses. But in general terms, the teacher supported the constitution of distinctions with respect to the following categories:

1. Language

    a. Representing circuits
    b. Terminology

2. Procedures

   a. Ways of reasoning about the functioning of the current in a circuit
   b. How to prudently use wires
   c. How to divide the task into steps

It was also characteristic of the teacher to return to the purposes given in the instructions when the students got stuck during the activity, reminding students about what the task was all about, and relating the distinctions just mentioned to purposes. In this way, the teacher supported the students to make the purposes of the more complex tasks ends-in-view, as can be seen in the exchange below where Loke and Tor had asked for help with the seventh task:

3. Loke: We haven't done seven, because we didn't understand it.
4. Teacher: No. But seven then, there both of them shine. And then you press one switch then one of the bulbs goes out.
5. Tor/Loke: Yes.
6. Teacher: Then it means, when you press it then in some way the current has to take short cuts around that bulb, but just one of the bulbs. So like when you press the switch the electrons feel "But ...., I take this way instead, I don't care for, you go around." I use to think like this; sometimes it's almost easier if you draw first, sort of. You think like, yeah, here's a battery, a bulb. You start in that end. Try to draw first and see if you can get it together logically. Like that. Then afterward you can do the wiring because sometimes you just get confused by the wires. Wires are nasty things. [the students start to draw a circuit which they comment and point to]
7. Loke: All right, we do like this. You have a battery like this.
8. Tor: So that one goes out.
9. Loke: Put it in like this, circle, with one in between. But one with a parallel circuit, here's the switch.
10. Tor: Yes.
11. Loke: A battery here, like that.
12. Tor: And one bulb in between.
13. Loke: Battery, bulb, same .....
14. Tor: [laughter]

The teacher here was repeatedly returning to the purposes of this task. In turns 4–5, the specific outcome was addressed by the teacher and also acknowledged by Loke and Tor, namely that they initially should make a circuit where both bulbs shined and when the switch was pressed one bulb would go out. The teacher supported students to argue in relation to the logic of an electric current in a circuit (distinction category 2a), that is how they should argue to accomplish the purpose (turn 6). The teacher specifically supported the students regarding ways to argue about how a switch affected where the electric current would go and that according to the purpose it should just pass one bulb. After this description, the teacher again reminded the students of the purposes, that they should proceed in steps and first make a drawing and then the actual coupling with wires (distinction category 2c). Also, he gave the students arguments and reasons for this: it is easier if you do the drawing first and get it together logically. The actual wires easily confuse the logic of the reasoning. Hence, the teacher is not giving the students the answers of how to make the circuit work; rather, he gives them more general advice about how to make lingual and procedural distinctions in proceeding with these kinds of tasks, and a taste for why certain ways to use language and procedures are to be valued. As evident in the excerpt, after the teacher had left, the students started over with the task by drawing the circuit (turns 7–14). Apparently, the advice of the teacher helped students to make new distinctions that furthered their undertakings in relation to the purposes given, and so gave students an end-in-view.

Often, the teacher pointed out one or just a few distinctions at the time, but related them to purposes. On one occasion, the teacher tried to make the students Erik and Jan distinguish that they needed to reduce the number of wires in the circuits, and so he helped students to see how they could accomplish the requested outcome of the task (distinction category 2b). In the transaction, Erik and Jan had failed to make a functional circuit, and after testing alternative ways to connect the wires, they asked the teacher for assistance:

15. Teacher: Would it be possible if you put two bulbs there? [pointing at their drawing]
16. Erik: That's what we've done.
17. Teacher: No, you haven't done that. But if you do like this [all the wires students used] then, sometimes wires just confuse you.
18. Erik: Yes.
19. Jan: So we remove some wires.
20. Erik: Yes, okay.
21. Teacher: Sometimes wires just are in the way.
22. Erik: Mm, they're in the way.

In turn 15, the teacher suggested an alternative placement of the two bulbs. Erik and Jan did not distinguish this as an alternative, but as identical to what they already had done (turn 16). To help the students to distinguish the two options from each other, the teacher proposed another distinction regarding how to handle the number of wires. The wires sometimes were a source of confusion and in the way (turns 17, 21), which the students also agreed upon (turns 18, 22) and understood the consequences of for their specific task (turns 19–20). Here again we have an example of how the teacher was in effect teaching the students to make more general distinctions about how to use wires, and so encouraging a taste for procedures that are less confusing.

The next example shows how the teacher advised the students Astrid and Tove to divide the task into steps (distinction category 2c) and also reminded them of the appropriateness of including a procedural distinction between serial and parallel to solve the task (distinction category 2a). The group was still stuck on the seventh task although the teacher had earlier given them some support. This example again shows how the teacher did not give students the answer to the task directly, but tried to support their lingual and procedural distinctions to help them distinguish how to reason and go about more generally fulfilling the outcome. In turn 23, Tove laughingly stated that she did not understand anything and called out for the teacher:

23. Tove: Oh, I don't understand anything! [Laughter] [Teachers name]!
24. Astrid: We have some problem.
25. Tove: With the seven.
26. Teacher: Okay, you're still stuck here. Do you want some more hints then?
27. Astrid: Yes.
28. Teacher: Mm. You can connect two bulbs in some way, either you can connect, in order for the first one to work they need to be placed in a serial. And right now this one is connected in parallel. Then it won't work.
29. Astrid: [inaudible]

30. Teacher: No, do like this: set up a battery, two bulbs that are serially placed.
31. Tove: Mm.
32. Teacher: And remove the switch, insert it last. Then I believe you can figure it out. Like that.
33. Astrid: First we're going to insert this one then.
34. Tove: Mm.
35. Astrid: Yes, but that's for sure. Y-e-s! Here it is! So!
36. Tove: There you go, h-e-y!
37. Astrid: Yes!
38. Teacher: How does it feel?
39. Astrid: It feels good!

As with Loke and Tor in turns 3–14, Astrid and Tove were not able to connect so that one bulb went out when starting with two bulbs shining. In turn 28, the teacher acknowledged two ways of making a circuit, making a procedural distinction between *serial* and *parallel*, and parallel, as it were, was distinguished as excluded from this task. In turns 28 and 30, the teacher then distinguished suitable steps to accomplish the purpose: serially couple two bulbs with a battery and finally the switch, the rest you probably can figure out for yourselves. The students came up with the solution of placing a wire between the two bulbs and the battery. The teacher followed up the consequences of what the students were doing and shared their final accomplishment of task seven (turns 38–39).

As in this last conversation, the teacher was careful to introduce correct terminology in transactions with students, correcting them when they for example used "north pole" instead of "north end" about magnets or, as the following excerpt exemplifies, were confusing the symbols for battery and condenser in drawings.

40. August: The lines are the batteries
41. Teacher: Yes.
42. August: I know that. These ugly things.
43. Teacher: Yes, those lines need to be same, different lengths.
44. August: Yes but that one is, this one is.
45. Teacher: No, that's later [later they are going to use symbols having lines with the same lengths].
46. August: Okay.
47. Teacher: When we use another component, it is the same
48. August/Ulf: Is it?
49. Teacher: Yes, because later we will use another component having lines with the same lengths.
50. August: Mm
51. Teacher: Which is called condenser, then you cannot make them, you have to make them with different lengths.
52. August: The bulbs were a cross, right?
53. Teacher: Mm. Circle with a cross.

August and the teacher were discussing the proper way to draw a battery. When doing so, the teacher commented on August's drawing, symbols having lines with the same lengths were excluded (turn 43). The teacher did not simply correct August's drawing as erroneous but rather, gave him a rationale for why it was necessary to draw batteries in a specific way: later on they were going to use and draw condensers represented by lines with the same lengths (turns 49, 51).

In the last example to illustrate the habitual ways of the teacher to support the students with lingual and procedural distinctions, Astrid and Tove had just completed the final task and were now showing their drawings to the teacher in order to get his opinion on whether it would work as intended:

54. Teacher: I'll just need to think a little. Here all three shine.
55. Tove/Astrid: Mm.
56. Teacher: Mm. And if you press that switch then…
57. Astrid: …that one goes out.
58. Teacher: that one. And if you press that switch, then…
59. Astrid/Tove/Teacher: …these two go out.
60. Teacher: Yes. Elegant! Then the thing is, it may sound a bit boring bringing it up but, uhm, when you make circuit diagrams like these then you would want, not like these, but rather as straight and as nice and as boring as possible. There is some sort of, uhm, if it were very advanced diagrams then you would not want to have twisted wires. Can you be prepared for something?
61. Astrid: Draw on the whiteboard?
62. Teacher: Yes, and then it's clever if you have one of these straight, all wires are straight and only with ninety degrees angles.
63. Astrid: But you can do like this, or?
64. Teacher: Yes. Uhm. If you only curve it. Like that.
    […]
65. Teacher: So preferably not the wires, the bulbs in the corners either, it has to come out wires like these.
66. Astrid: Yes. Is that…
    […]
67. Astrid: Really high standards on these drawings
68. Tove: Mm
69. Astrid: I think it'll be fine like this, and then you put one…
70. Tove: That's right
71. Astrid: Like that!

The teacher here did not simply answer yes or no to the students. Instead, he again returned to the desired outcome and using the drawing of Astrid and Tove reasoned in concert with them to distinguish ways to proceed in checking how the circuit would work when finally coupled (distinction category 2a). The teacher then started discussing the norms for making the circuit drawings (distinction category 1a), which was recognized by Astrid as "really high standards" (turns 67). The teacher included wires that are as *straight as possible* (turn 60) and with *90° angles* (turn 62), whereas *twisted wires* (turn 60) and *bulbs in the corners* (turn 65) were excluded. The students and the teacher then negotiated the consequences of these standardized distinctions for what needed to be changed in Astrid's and Tove's specific drawing (turns 63–71). Again, the teacher gave a reason for this standard: it was more clever (turn 62) and it worked (turn 60) when you have more advanced diagrams. Here, the teacher taught the students additional general distinctions that were conducive to purpose in the classroom and became ends-in-view, and hence a taste for procedures that can be construed as "clever."

Apart from the now mentioned general distinctions of this practical, the size of the student drawings was repeatedly discussed. Examples can be found in turns 1–3 and 116–134.

Purposes and Distinctions about Ways-to-Be

Distinctions of taste, and their negotiation, did not concern only favored language and procedures, but also preferred ways-to-be as a student in this class. What kind of student identities were distinguished in this class and how were the achievements of students evaluated in relation to such norms about ways-to-be? Only rarely did the students themselves construe relations of ways-to-be in terms of exclusion. Quite the opposite, on several occasions, the students distinguished themselves, in relation to the purposes of the task at hand, as competent persons and thus as included in the activity. This was observable as consummative evaluations, for example, "we are awesome," "we are the aces," "we are great," or "brains," when reaching consummation. Also, the teacher made overt distinctions on ways-to-be and this was often done with humor, for example by calling students assisting other students groups as "The professor" and "Ms [as being a teacher] Svensson." Jokingly stated or not, the activity was often distinguished as a business which required certain dispositions of the participants.

However, being included in this activity was not exclusively distinguished as having a stereotypical scientific brainy disposition. In two of the groups, the students also related the skills required for the assignment to that of an electrician, including science as appropriate for vocational careers. For example, Lo expressed disappointment over Ivar's lack of contribution to the coupling, saying: "Aren't you suppose to study electrician [sic] at high school? You should know this stuff!" Another example was Erik, when receiving positive feedback from the teacher on their first circuit, colorfully expressed his educational plans: "Told you man [to his peer about him being right about the circuit]! Hell, I'll study electrics (a vocational upper secondary program for becoming an electrician) in high school!"

However, failure was not distinguished as a personal disposition but was generally made visible through utterances of frustration, for example by cursing or saying things like "I don't get it." It was all right to ask questions, and they were well received by the teacher. It was obvious that students habitually referred to themselves as being persons that make appropriate distinctions in this class, and thus that the taste constituted was one that embraced students' ways of being. Nevertheless, there were situations of indeterminacy where gaps occurred regarding the relation of students' ways of being and what was practicable in relation to purposes in the class. However, these situations were typically initiated by the teacher, although acknowledged by the students. In the following example, the students Ella and Selma reacted with joy and with some surprise when they succeeded in wiring a parallel circuit. They initially decided that this particular task required a parallel circuit and then acted accordingly. Several gaps were noticed and consequently several procedural distinctions were made before they accomplished the desired outcome, which was expressed with satisfaction in turns 72–73.

72. Selma/Ella: Y-e-s! [they have succeeded in making the circuit]
73. Ella: It works!
74. Teacher: How does it feel when it works?
75. Ella: Really good!
76. Teacher: Are you pleased with yourself?
77. Ella: Yes, usually I'm not that good at this. So.

Ella, who distinguished herself as someone who usually is not good at these things, felt really pleased with herself. Although the question about how it felt to succeed was initiated by the teacher (turn 74), Ella acknowledged that she did not see herself as usually being good "at this," but here she had another kind of experience (turn 77). At the end of the assignment, Ella and Selma returned to the fact that they succeeded in completing the tasks. In turn 78, they had just finished the ninth and last circuit, which the students and also the teacher considered to be difficult, and were now about to put away the material:

78. Ella: And the nine it was…
79. Selma: That one.
80. Ella: Grand! ...., could you believe we made it?
81. Selma: Yes.
82. Ella: I tend to get a bit anxious about this kind of lessons. Not a brain head.

In turn 68, Ella stated that since she was not a brain head, lessons like this usually made her uncomfortable. Hence, in Ella's view, being a brain head was an important disposition in order to master lessons like this one. Nevertheless, this lesson helped her make appropriate distinctions to finish tasks, and so a taste that afforded her to reconstitute the way she looked at her own capacity, in relation to the ways to be that were valued, at least in this specific science class was developed.

In the following excerpt, Astrid had just drawn and explained the eighth and ninth task on the whiteboard and the teacher had evaluated the outcome of the lesson. During this summary, some of the distinctions that were made during the group activities were again acknowledged:

83. Teacher: But it works, it may look a bit weird, here three wires connect, it looks like there are three wires that connect, but in practice you insert them into the holes at the bulbs, making a pile. Can you draw this in several ways?
84. Students: Yes/Mm.
85. Teacher: Well yes, you could place the battery here and the bulbs and the switch could be moved and crisscrossed, but it is rather the logic. Then a question of conscience: do you remember that you've done this before?
86. Students: Yes/Mm.
87. Edith: Not the last part.
88. Teacher: No maybe not that. But the actual assignment, the wires and the bulbs.
89. Students: Yep.
90. Teacher: Yes. Then my hope is that when you did this in the seventh grade it was very difficult and very new and now you're in the ninth grade and now it's supposed to look like: check it out, it worked. And what has happened is that your brains have grown a little.

In turn 69, the placement of the wires in the diagram in relation to the real one, which most students had problems distinguishing during the assignment, was judged as perhaps being odd-looking. After this, the teacher wondered whether it would be possible to draw the diagrams in other ways (turn 83). When this rhetorical question/gap had been filled by the students in turn 84, the teacher established an additional relation between the activity of making circuits and the logic of the electric current (turn 85). That is, the important thing was not the way the components were placed, but rather the underlying logic directing the alternatives (distinction category 2a). The teacher then sums up by humorously giving credit to the students for the way they had changed since the last time they did electronics in the seventh grade: they now had bigger brains. In that way he opens up the question about the taste regarding ways-to-be in this classroom and at the same time acknowledged that the accomplishments of the students meant that they fulfilled this norm.

The distinctions of taste regarding ways-to-be favored by the teacher did not encourage a cool or laid-back way-to-be in this classroom. Rather, he challenged the students to be persons that dared to be in line with the taste of the classroom. The following excerpt, where the teacher and the students discussed the outcome of one of the tasks, exemplifies this:

91. Teacher: If you press that one, then the current suddenly has two ways to choose between: either that one or like this. Which way do you choose?
92. Karin: The one with less resistance.
93. Teacher: Yes. Electrons are just as lazy as we are. Here's two ways to go….
94. Edith: …but, this will be, shines brighter?
95. Teacher: Yes, but that's not that strange, is it, here the current is supposed to go through two bulbs.
96. Edith: Yes, no that's not strange.
97. Teacher: There the current is to enter one bulb. So it should shine twice as bright.
98. Karin: Yes.
99. Teacher: If the bulbs are the same.
100. Edith: Yes
101. Teacher: Now they aren't.
102. Edith: Yes they are!
103. Teacher: Almost.
104. Karin: Yes but look! [at the bulbs]
105. Edith: Y-e-e-y!
106. Teacher: And then the figures are very nice, they're just a bit teeny-weeny tiny though.
107. Karin: Which ones?
108. Teacher: Do you think you dare to draw bigger figures?
109. Karin: Yes! Yes! [Laughter]
110. Teacher: Do you dare to draw?
111. Edith: What? Are they tiny? I think I've drawn hugely!
112. Teacher: Do you dare to draw one that is as big as this, so and so sort of [shows with his hands]?
113. Edith: A bulb this big?
114. Teacher: No, circuit diagrams this big [giggles]
115. Edith: Ah right, yes.

Initially, relations regarding the behavior of the electrical current were established (distinction category 2a). The flow of the current was a question of resistance (turns 91–93), which the teacher clarified by the laziness of the electrons (turn 93). After the teacher and the students had agreed that the number of bulbs connected could explain the brightness of the light (turns 94–98), they argued whether the bulbs were similar. The teacher then made distinctions concerning the size of the drawings (turns 106, 108, 110). Generally, the students drew small diagrams which were not the right way to do it in this activity. Hence, the size of the drawn circuits was a gap that the teacher regularly made visible (distinction category 1a). Tiny was excluded whereas big was included. Karin and Edith acknowledged this distinction as a way-to-be by laughingly responding "Yes! Yes!" (turn 109) and saying "Ah right, yes" (115) when the teacher humorously opened up the gap as a question of being daring (turn 108, 110, 112). In turn 115, Edith, who initially thought the teacher meant the size of the bulbs, filled the gap.

Interestingly, the teacher did not blame students' ways-to-be for results, for example saying that they were lazy or without talent. Rather he blamed the resistance of materials, for example in accusing wires for being nasty, confusing you and being in the way (turns 6, 15–22). It was almost as if he gave students an excuse while at the same time giving them directions of how to proceed. In this way the focus is not on the students but on more general norms about how to distinguish to be able to proceed with the task.

Purposes and Aesthetics

The constitution of a taste for science, as analyzed here, does not merely encompass the development of distinctions of appropriate language use, procedures, and of ways to be. Just as importantly, it involves the constitution of aesthetic distinctions where students learn to like and enjoy doing the inclusions and exclusions according to the purposes of classroom activities. Here, it is important not to examine simply whether students had fun during the lesson regardless of what they enjoyed, but whether the aesthetic distinctions they made concerned the objects of this science class, and most importantly, how the teacher supported the constitution of such an interest in moments where gaps occurred in relation to how to proceed and so to the purposes of the lesson. How did this teacher support students in constituting the aesthetic dimensions of taste in relation to the purposes of this class?

Judging from the aesthetic judgments students made when working without the teacher, the students generally seemed to enjoy making the distinctions current in this class. However, there were moments when there were gaps of indeterminacy regarding aesthetics, and where the teacher supported the students in construing aesthetic relations. These moments may be categorized in two ways which the teacher habitually used:

- Evaluating inclusions and exclusions in relation to the distinction categories regarding language and procedures (anticipative aesthetic judgments of distinctions)
- Evaluating the fulfillment of the tasks (consummating aesthetic judgments of distinctions).

Both of these habitual ways of the teacher represented an encouragement of students aesthetically experiencing distinctions according to the purposes of the class. Often joking and humor were part of making these aesthetic distinctions.

The first way of supporting students' aesthetic experiences through anticipative aesthetic judgments typically involved the teacher construing negative aesthetic judgments to the language and procedures leading astray in relation to purpose, whereas those distinctions that were conducive to purpose were referred to using positive aesthetic judgments. We have already met such situations in earlier excerpts, for example when the teacher humorously referred to the wires as confusing and "nasty things" (turn 6). Hence, the threat represented by the wires, of possibly doing the wrong thing when not used prudently, was thus referred to by the negative aesthetic judgment "nasty." Such an aesthetic judgment should not be understood as a simple report about the feelings that the teacher had about wires generally, but as highly situated, teaching the students about the feeling they can *anticipate* if they did not use wires prudently. At the same time, it was teaching students how to feel and talk aesthetically about wires (distinction category 2b) as part of this activity and in relation to its purposes. In this way these distinctions of taste also came to encompass aesthetic experience.

Other examples of anticipative aesthetic judgments were when the teacher talked about distinction category 1a concerning how to draw circuits. When telling the students about the preferred way to draw circuits in turn 46, the teacher used the aesthetic judgments "boring" and "nice." He related "boring" to "it may sound a little boring bringing it up" and so suggested that this was what the students themselves might now feel, when they after all had accomplished a circuit diagram that would produce the desired outcome. So the teacher, in the same turn, then related distinction category 2b to both “nice” and “boring,” and so made students understand that this nevertheless was the preferred way to proceed in this classroom. That students actually understood this was later confirmed by turns 69–70, where students agreed to use the aesthetic judgment “fine” in drawing the circuit in this prescribed way.

The students typically acknowledged the teacher’s aesthetic distinctions of taste, which also became continuous in students’ own action. The aesthetic distinctions of the teacher’s taste, but also the playful manner in which they were usually delivered, were thus recurrent in student-student exchanges. In the following passage, Ivar and Lo jokingly and with irony negotiated what characterized a good drawing:

116. Lo: I redrew yours because it was so ugly. So that he can see what you have drawn.
117. Ivar: Oh, you’re so nasty. [Teachers name]! Can you come here afterwards?
118. Lo: No, no offense.
119. Ivar: I think it was very nice.
120. Lo: Mm. Very nice, tiny as hell as well.

Lo distinguished Ivar’s drawing as “ugly” (turn 116) because it was “tiny as hell” (120) and thus not possible for the teacher to interpret. Ivar, who took the criticism with good humor, did not agree with this distinction. Whereas Ivar found his drawing “very nice,” Lo distinguished it as not fitting the norms of the activity and therefore redrew it. This conversation demonstrates how the students were engaged in understanding the conventional distinctions of these drawings (“tiny”), giving reasons for trying to find consequences that distinguish which way of drawing to be preferred (“So that he can see what you have drawn”) and using anticipative aesthetics to discuss this (negative aesthetics “so ugly” for exclusions and positive aesthetics for inclusions “very nice”). It can be noticed that Ivar also used the aesthetic judgment “you’re so nasty” to exclude the way Lo talked about this and thus this way-to-be in this class.

The teacher often used positive aesthetic judgments to evaluate students’ work when they had partially, but not yet fully accomplished a task. This was, for example, the case in turns 2, 60, and 106 about how to draw circuits. In turn 2, the teacher used “a little bit better,” in turn 60 “Elegant,” and in turn 106 “very nice” about student drawings to tell them that there were important aesthetic qualities in their drawings, which should not be changed because they were according to the taste developing in this classroom. The teacher and the students then continued to negotiate what more was needed to distinguish a fully acceptable completion of the task, and so a sense of fulfillment. Except for encompassing anticipative positive and negative aesthetic judgments, negotiations were often full of humorous transactions and playfulness (e.g., turns 108–115 about “Do you dare to draw?”). The teacher was not observed to use negative aesthetic judgments about what the students had accomplished; the negative aesthetic judgments were reserved for what they could anticipate from further elaborations of the task.

The second major way the teacher aesthetically supported students was by asking them about how they *felt* when completing a task (cf. turns 74–77, 138–139). A typical example of such consummating aesthetic judgments of distinctions were the excerpt below, where Karin’s group had just finished the second task when she, with a happy voice, told the teacher that they had managed the first two tasks. The teacher then evaluated their work with a positive aesthetic judgment saying “Neat,” and then wondered out loud how this felt thus, an emotional dimension of doing science was distinguished:

121. Karin: Yes! [Teachers name], now we have managed two!
122. Teacher: Sorry?

123. Karin: We have managed two now.
124. Teacher: Neat, and how does that feel?
125. Karin: It feels so damned good [laughter]

We can see how Karin used the aesthetic judgment “It feels so damned good” and laughing happily to answer the teacher’s question. Similar questions from the teacher to the students about how they felt finishing a task can be found in the earlier excerpts 23–39 (turn 38: “How does it feel?”) and 72–77 (turn 76: “Are you pleased with yourself?”). Also here, the students with happy smiles acknowledged the good feeling of accomplishing the tasks and about themselves in such moments (turn 39: “It feels good!” turn 77: “Yes, usually I’m not that good at this. So”). The teacher did not merely check the consequences of his support for the students’ actions, as described earlier, he took it a step further and asked how the students felt taking part and accomplishing this activity. It is as if the teacher checked that students were learning this aesthetic content of class by living it through and experiencing that the positive aesthetic anticipations associated with the distinctions of taste in this class were realized in the end.

Student Contributions to Classroom Taste

Our research suggests that the teacher actively supported the students in numerous ways to learn the norms current in this class to finish the tasks. An important question here is how the teacher allowed students to personally contribute to the taste constituted, as this is usually considered to be one important component of developing interest in a subject. Our analysis suggested three ways in which the teacher supported this: (1) by permitting alternative ways of solving this task as a whole, (2) by opening up the categories of distinctions so that individual students could accomplish them in various ways, and (3) by allowing students to question his distinctions and thus contribute to the taste developing in the classroom. We here give examples of these kinds of situation in turn and how the teacher supported students contributions.

First, that this lesson was an open inquiry was particularly apparent for the more complex tasks, where students needed help from the teacher to make relevant distinctions. An example of this is the way the teacher acknowledged student contributions in turns 54–60. When the students asked the teacher to help them see whether their drawn circuit would work, through his assistance the teacher made apparent that he did not know the answer by heart. Together with the students, he had to reason about the functioning of the current in the circuit to know whether it would work or not. Using the appropriate distinctions and considering if the circuits produced the outcome theoretically as well as empirically was the way to evaluate these circuits, not if they were made according to a single ready-made standard. The teacher did not give students rote answers, but let them solve the tasks in their own way, as long as the desired outcome was produced by making appropriate distinctions (categories 1a–b, 2a–c). As how to solve these tasks is not determined by scientific facts alone, or solely by the teachers preferences, it is also a question of students making contributions to the fulfillment of tasks, and so to the taste for science developing in this classroom.

Second, apart from the tasks as a whole, the categories of distinctions were in some ways open so that individual students could accomplish them in various, but still acceptable (tasteful) ways. An example is how the teacher supported students’ distinctions about how to draw circuits (category 1a). There were distinctions of what constituted a beautiful or better drawing (turns 1–2, 60, 106, 116–120), but the personal style of students was not the important criterion according to the teacher. Instead, the teacher gave students reasons for the distinctions he privileged in relation to the purposes of the activity, thus tacitly accepting the student’s personal inclinations for drawing as included in the taste constituted in this classroom. Hence, students were allowed to draw also using their individual dispositions. The teacher acted as if all students could achieved the standards if they were given rationales in relation to purposes. In the following exchange between the students Harry and Moa and the teacher they discussed the size of their diagrams:

126. Teacher: Do you think that I can make you [Harry] draw a little bit bigger as well? Like this [shows with his hand]?
127. Moa: Can you also make me draw bigger? [Moa sits in the group next to Harry, who works alone]
128. Teacher: Yes.
129. Harry: Yes. Because why?
130. Teacher: Because why, because when it gets a little more advanced further on, some more stuff…
131. Harry: Yes.
132. Teacher: … then it will be so cluttered, then you can't see.
133. Moa: Yes but my writing is small as hell, you know that. My writing is pretty small. Have you thought of that?
134. Harry: But [Teachers name], you can clearly see this!
135. Teacher: [responding to Moa in turn 133]: Lo had the same thing, she also writes like this…
136. Moa: …all teachers complain…
137. Teacher: …you don't have to economize on your notebooks, they're…
138. Harry:…it is non-environmental friendly to throw away.
139. Teacher: That is so, yes.
140. Harry: That's no good. [Teachers name]
141. Teacher: No
142. Harry: So you're encouraging us to ruin the environment. [laughter]
143. Teacher: [Takes a deep breath and slaps his own hand]
144. Harry: Yes precisely!

In turns 126–132, the gap of Harry's "why do we need to draw bigger circuits"? was filled by the teacher with a relation giving the rationale that bigger size was a means for avoiding that the more complicated circuits "will be so cluttered, then you can't see." In effect, the teacher was saying that drawings should be big enough, so you can see the details of the couplings. Harry can be seen trying to adopt this distinction of the teacher to his specific drawing, and Harry himself found it being up to the standards (turn 134). Now Moa distinguished herself as being a person who normally was not doing what the teacher was now requesting. She distinguished herself as a person who generally writes "small as hell" (turns 133) and created a relation of this way-to-be as not belonging in the science classroom and school generally (turn 136: "all teachers complain"). However, the teacher told Moa that she was not alone in this, and that she was just as welcome as Lo in the class (turn 135). He did not question Moa's capacity to draw of a size so you could see well enough. Rather, the teacher gave a new non-personal reason for why you might make a too small drawing: "you don't have to economize on your notebooks" (turn 137). This raised some jokes between Harry and the teacher. All in all, this meant that the teacher constituted a taste of being in this science classroom as one about using rationales, and not about students' personal shortcomings. This allowed Moa to adapt and make her way of drawing continuous with that argued for by the teacher, a faith in the teacher's support which was demonstrated already in turn 127, where Moa asked the teacher to help her draw bigger. Hence, with just an alteration of size, her drawing could be included as one of taste in this classroom.

Third, the current taste, as distinguished by the teacher, was often questioned by the students. The teacher acknowledged these contributions and made them continuous with the advised taste in the regular way by giving reasons for distinctions in relation to the purposes of the task. For example in the transaction of turns 126–144 just related to, Harry questioned the distinction made by the teacher about the size of the drawing by asking “Because why?” in turn 129, and “But [Teachers name], you can clearly see this!” in turn 134. The teacher’s second rationale “you don’t have to economize on your notebooks” was later also questioned by Harry saying “it is non-environmental friendly to throw away.” The joke established a new rationale that belonged to the science classroom, namely that the teacher should not encourage an environmentally non-friendly conduct. The teacher acknowledged this distinction by jokingly slapping his own hand. In the exchange, distinctions of taste were negotiated and in this process the teacher and the students jointly construed norms for circuit diagrams. Hence, the teacher welcomed students’ questions by often accommodating them in a playful manner together with the students. Interestingly enough, these questions of the students were according to the taste of the classroom; they were all about the rationales and the purposes of this activity.

The student’s questions sometimes allowed student initiated subjects for discussion. At the end of the lesson, the teacher returned to a student question he got during the group activities, namely if students would have any use of this when they got older. In the conversation that followed, the student (Edith) concluded that the career prospects the teacher described, which was that of an engineer making three times more money than him as a teacher, did not sound like fun. The teacher then told Edith that he dropped out of engineering college after 2 years of study, and although having degrees in programming, computer science, and electronics, he felt that he wanted to do other things. The conversation on this topic came to an end after the teacher had stated that some people think electronics is great fun, others like to bake, and some likes to play soccer, concluding: “everyone is different, that is today’s lesson!” The teacher thus established relations between himself and being an engineer and from which he personally excluded himself, while at the same time acknowledging that everyone should find their way. Then, in turn 145, Edith’s question, distinguished as a smart one, was introduced to the class:

145. Teacher: Then I’ve got a smart question, let’s take it once more? Can you have any use of this? Are there people that put wires in holes?
146. Edith/Students: Yes/Mm/Yes
147. Teacher: Yes. There are actually. There are people that, maybe not three bulbs and two switches and two is supposed to go out, but are there people that constructs electrical things?
148. Students: Mm.
149. Edith: Yes but I mean what use can I have, since I’ll not work with that.
150. Teacher: No, no. But that’s not the way the school works, it’s not a vocational school. The reason you build bird houses in woodwork class is not because you are supposed to make a living building bird houses. You can do it if you want to, but that’s not the reason.
151. Edith: No.

Here, it was obvious that the teacher counted Edith’s contribution as “smart” and thus constituted in line with classroom taste not only to ask questions, but to question the point of the whole activity. In turns 145–147, relations were established between the future usefulness of today’s work and possible occupations: putting wires in holes and constructing electrical things. Edith, who questioned the way the teacher stated her question, distinguished herself as potentially excluded from the activity, since *she* would not build electrical things for a living (turn 149). In turn 150, by using an analogy to wood work class and building birdhouses, the teacher excluded the notion of all activities in school being a preparation for a future occupation. After turn 151, they left the subject and the teacher introduced the next part of the lesson. All these indeterminate situations, now related to, allowed students to introduce questions and subjects of relevance to them in relation to the purposes of this activity.

A Taste for Science Beyond the Classroom

Generally, the way this teacher supported students in moments of indeterminate distinctions was about learning a scientific taste. It was not a class where science was made fun regardless of content. The teacher did not support the constitution of distinctions that could be regarded as non-functional for future use in science. The teacher helped students constituting a taste where using scientific language and procedures (as here defined) were enjoyed. This was apparent from the examples so far given in several ways.

First, there was a progression in learning science, which the students were expected to have learnt. The content of an earlier class on electricity in seventh grade was revisited and made continuous with current content in ninth grade. Moreover, the rationales that the teacher gave indicated that norms were also useful later, for example when making more elaborate couplings.

Second, although the inquiry was not genuine in the sense that the students made completely new findings, it was genuine in the sense of being open and gave students possibilities to solve it in different ways. It was also scientifically genuine in the sense that students had to plan first using their drawings and theoretically argue for their circuits before trying them out. They did not just do something and saw what happened.

Third, the way the teacher supported students' distinctions was about how scientific lingual and procedural distinctions could jointly be used for the purpose of making circuits work. At the same time, the lesson was not just about producing the outcome by any means, but one of producing the outcome by making the scientific distinctions supported by the teacher in relation to purpose. Hence, the teacher supported the students to learn science, not only as facts, but as an art of making purposeful distinctions. This way of doing science felt good to the students, and, judging from the scientific content of their aesthetic judgments, they felt good specifically about what they accomplished scientifically.

Finally, it was clear that the taste constituted in this classroom did not just encompass those of the science pipeline. It is also about being an electrician, about students' future career choices, and of not wanting to be a scientist.

There is one possible exception to this pattern. Although the teacher corrected the students when using terminology or symbols erroneously, the teacher himself often joked and used a "non-scientific" parlance when he explained the scientific concepts. Electrons were described as "just as lazy as us" and therefore recognizing some routes in the circuit as "hard, narrow and sickening." This may have been to help students to understand how resistance and switches affected the electric current. It was hard to judge if this actually helped students' understanding, but the students themselves were not seen to adopt this animistic way of speaking with each other. It may also have confused the students reasoning, and thus does not appear to be a critical component in this teacher's repertoire to support the constitution of a taste that is current beyond this classroom.

Summary and Conclusions

The habitual support of the teacher, in situations where the students were not sure about how to make distinctions of taste, can be summarized as follows in the order in which they were analyzed. At the end of this section, we present concluding remarks giving suggestions of how the findings may be used.

Regarding distinctions of language and procedures, it should first be noted that in this activity the teacher explicitly stated student-oriented purposes and with his support they eventually became ends-in-views for students. Second, on instances where the students became stuck, the teacher clarified the purposes by distinguishing suitable ways to use language and actions in relation to purposes. Third, the teacher did not just give students the answers, but typically gave them arguments and ways of reasoning to accomplish the set purposes. Fourth, these arguments and ways of reasoning were not merely conceptual (the difference between serial and parallel, and how the current moves in a circuit), but also encompassed distinctions of how to make drawings in a conventional way, how to prudently use wires, and how to proceed systematically by dividing the tasks into steps. Hence, as it is not given fully from scientific facts how to proceed with this practical, and as it could have been done in other ways, it is also a question of taste. Fifth, these lingual and procedural distinctions were valued in relation to purpose; they were for example easier, less confusing, or clever. In this way, these distinctions helped students to develop a taste for certain conventional ways to talk and go about which were easier, less confusing, or clever. Sixth, the teacher typically did not give students an answer and then leave. Rather he stayed as long as it took to see that his support had the consequence that students could continue or even finish the task. In the classroom studied, the students were carefully assisted to distinguish how language, actions, and being are related to the aims and purposes of the task.

Our research suggests that a taste for ways-to-be in this class was very much already in place and students acted as if they embraced this taste. Nevertheless, on occasions, these ways-to-be were negotiated and it became visible how the teacher acted to support students when this happened. First, the teacher asked the students (turn 76: "Are you pleased with yourself?") and supported them (turn 90: "your brains have grown a little") to see how they were developing in relation to the classroom tasks and their purposes. Second, he also encouraged students to be daring rather than impassive. Third, there were no signs in this class of the teacher or the students treating each other differently due to gender, ethnicity, or social class. Rather, all students were supported by the teacher as individuals with their specific problems as part of the situation they had at hand. Also students like Ella, who experienced difficulties with science, were included in the taste of ways-to-be in this classroom. It was all right to be a student in need of help. Finally, the teacher did not attribute failure to complete tasks to students' ways-to-be, but rather to the complexity of the task and he gave them advice about how to make further distinctions.

The habits of the teacher in situations where aesthetics was negotiated can be summarized as follows. Most importantly the teacher supported students in learning aesthetically in relation to the purposes in this class. Aesthetics in this class was about distinguishing how to accomplish the science tasks. The teacher assisted students in two ways. First, he used positive and negative aesthetic judgments to evaluate inclusions and exclusions, respectively, in relation to distinction categories. In this way he taught students about how to value language, procedures, and ways-to-be in relation to how they could be anticipated to contribute to the fulfillment of tasks and so to a feeling of consummation. The teacher only used positive aesthetic judgments when talking about students' accomplishments, whereas negative aesthetic judgments were reserved to describe non-purposeful language and procedures to be avoided in continuing with tasks. Second, the teacher regularly asked the students how they felt when accomplishing a task. The consequence of this action was that the teacher checked that the aesthetic anticipations of doing the recommended distinctions actually resulted in a final aesthetic experience of satisfaction. Together, these two ways of aesthetic support from the teacher meant that the taste for doing certain distinctions in science class not only became purposeful, but also came to be valued and finally enjoyed by students. Regularly humor was part of the teacher's more personal repertoire to give students support. This seemed to play down the students' anxiety regarding the teacher's high requirements on their achievements.

No dramatic freedom was given to students to contribute in this class. They were not deciding the curriculum or working with their own initiated questions, and there was no grouping of students according to their background in any way. The same curriculum was for everyone. At the same time the teacher presented science as something which had room for all students, and to which all students were allowed to contribute through their way of solving open tasks, through their way of making distinctions continuous with purpose, and through questioning the point of certain distinctions. The teacher allowed students to contribute with more general topics to be discussed in relation to the class for example, environmental issues (although in a humorous way) or future career choices of the students. In this way the taste of science of this class was also actively constituted by the students, with the active support of the teacher. Finally, it was obvious that the taste constituted through the assistance of the teacher was a taste for science; students enjoyed using scientific distinctions to produce scientific outcomes in this class.

So, what lessons can we learn from this teacher in terms of what a teacher can do to support student interest in science? Based on the summary just presented, the following suggestions may be formulated for further examination by teachers and researchers:

(a) Present the purposes of the activity. Routinely follow up that these also are ends-in-views to students, which is usually the case if student action is oriented towards purposes. Also follow up how the activity is continuous with previous and subsequent activities.
(b) When students are stuck, jointly evaluate expected consequences of distinctions and so clarifying why a particular action is preferred in respect to purposes, or in other words; support students' reasoning instead of asking for correct answers.
(c) Before leaving assisted students, check that they continue in accordance with distinctions and so confirming that they are given an opportunity to experience how actions could be anticipated in contribution to fulfillment of task.
(d) Allow for student contributions of taste to be negotiated and made continuous with purposes. Refer student failure to problematic materials or complexity of task rather than shortcomings of student personality. Negative aesthetic judgments should thus be restricted to materials and actions to be excluded, not about the students as persons.
(e) Pay attention to students' feelings when working with assignments and ensure that they are positively related to scientific objects and purposes.
(f) When tasks are accomplished, check if students are satisfied so that steps (a) to (e) are conducive to an aesthetic experience of consummation.
(g) For (a) to (f) to be possible, an inquiry of a certain openness, where distinctions can be negotiated in relation to purpose, is required.

A caveat for further examinations is necessary. The steps described above are based on patterns that were recurrent in the classroom practice observed. This does not mean that there were no instances in the material where the teacher did not act as described in a–g above. For example, the teacher did not always, on every occasion, stay with students until they acted in accordance with distinctions (c) nor did he always ask students if they were satisfied when finishing a task (f). To some patterns, however, there were no exceptions, for example the teacher never made distinctions on ways-to-be that excluded students or referred failure to student personality (d). Moreover, the way the teaching supported students in distinguishing and developing a taste (a–f) needs to be understood in relation to the characteristics of the task that the students were engaged with (g). At the same time as the openness of the task encouraged student initiative, the teacher was very careful in making the students aware of distinctions that were conducive to the scientific aims. Consequently, these suggestions but also the findings in general are best appreciated as a description of one possible way in which teaching can support students in developing an interest in science.

Discussion

In this paper, we have used the concept of taste to examine what one teacher does to support students' interest in science. Our findings in many ways agree with earlier studies on what characterizes practices where an interest in science may develop. Namely, as being an enjoyable and inclusive practice where the students' personal contributions are acknowledged and where the students are stimulated to engage in their own learning process (e.g., Carlone et al. 2011; Tobin and Fraser 1990; Waldrip et al. 2009). Our approach adopting the concept of taste, however, can make a contribution to the field by illustrating what teachers and students *do* in the classroom to create such an environment. Taste acknowledges cognitive, affective, and normative dimensions of partaking in social practices (i.e., I understand science, I like science, I am included in the practice of science). The study thus also can contribute by demonstrating more closely what a teacher may do in order to support student affinity to and competence in the ways language, procedures, and identity are constituted in the science classroom, aspects all shown to be important for student interest, but which need to be accessed as bit-by-bit classroom transactions.

Although the study has demonstrated what one teacher is doing to support student interest, it also has obvious limitations. Regarding the school selected, we cannot know, for example, whether the teaching in science is the sole explanation as to why students from this school perceive science as a suitable educational career choice. However, the fact remains that students of this school repeatedly chose science in high school to a higher than expected degree and that they act as if included in this science class. Experiences from other practices in school such as math class, study counselor and so forth could also explain why the students repeatedly chose post-compulsory science at a higher rate than expected from their backgrounds. But generally, a positive experience of science would seem to be a necessary, even though not sufficient, condition to explain such an interest of disadvantaged students.

Nor can we know if the teacher's ways of teaching are the only reason for why the students act in line with the taste distinguished and towards the aims of the activity. Since the development of taste is a situated and highly complex matter, its constitution is also likely to differ between settings whether they are exemplary practices or not. Additional research from other settings and educational levels are therefore needed before any general conclusions can be made in regard to what the teacher may do, often in different ways, to support student interest. At the same time, the study in several ways demonstrates how the teacher supported his students' opportunity to participate in and enjoy science class. This is interesting since there is little that a priori implies that the laboratory task examined—apart from its openness—should be an activity where interest for science is constituted. From quantitative studies, we know that some contexts and subject areas are reported as interesting by students (e.g., Jidesjö et al. 2009). For example, the students worked with electrics circuits, a subject that is rarely described by students as something interesting or something they want to learn more about (Schreiner 2006). Neither was the activity contextualized through interest stimulating content like socio-scientific issues (Tomas et al. 2011; Zeidler and Nichols 2009) or the background, life, and personal interests of the students (Waldrip et al. 2009; Xu et al. 2012).

Even if the teaching studied indeed was important for what happened in the classroom, we cannot rule out the influence the specific activity may have had for students' enjoyment for what they were doing. The task of making electrical circuits had some similarities with the "Electronic challenge" task that has been developed and used in other studies (see e.g., Potvin et al. 2012), suggesting that the properties of the particular assignment (e.g., making electrical circuits, observing insects, and so on) and how it works in concert with the intentions and aims of the teacher should be important to examine more closely. It is well-reported, for example, that students find experiments fun and interesting but at the same time we have only a limited understanding of what it is in these experiments that students enjoy (Abrahams 2009). Therefore, the significance of the particular activity and also subject content for the constitution of student interest needs to be examined further. Such studies could increase our knowledge about what cognitive, normative, and aesthetic meanings are construed when teachers and students are engaged with specific tasks.

So, how are the most salient findings of our study related to previous research on what a teacher may do to support students' interest in science?

First, in order to be able to engage with tasks and so possible develop a taste for the subject, the students need to know what the activity is for. The highly situated process when students come to understand what they are supposed to do and why, or fail to do that, is observable as the student can take action towards purposes of the activity or not. In the classroom studied, the students were carefully assisted in distinguishing how language, actions, and being related to aims and purposes of the task. During these encounters, the teacher simultaneously checked whether the students could pursue according to the actions distinguished. Participating in this science classroom was not solely a question of learning content but also learning how to successfully proceed with action towards specific purposes. Aims were thus shown to be explicit and shared and also helped students to fulfill tasks, which often may not be the case (Abrahams 2009; Högström et al. 2010; Lindahl 2003). It has been argued that practices where students seldom or never understand what they are supposed to do and why, have an excluding effect in respect to participation and engagement (Säljö and Bergqvist 1997). In such practices, consequently, students have few opportunities to develop an interest in science. The active guidance of students towards participation and engagement with learning goals, which has been reported to be a salient feature in exemplary practices (Tobin and Fraser 1990; Waldrip et al. 2009), was thus realized by the teacher in our study by continuously reminding students how actions should be understood in relation to what they were supposed to achieve. This way of assisting students differs significantly with what has been demonstrated in practices that fail to engage students (e.g., Lindahl 2003; Säljö and Bergqvist 1997).

Second, rather than reproducing meanings that excluded students, for example regarding what is the preferred way of talking and being, as reported in the study of Carlone et al. (2011), these students' taste distinctions were acknowledged and made continuous with the classroom taste. Consequently, besides making purposes explicit, students were also made aware of how actions towards these purposes are valued. Norms of the classroom were thus explicit and open for negotiation, allowing individual student's a way of talking, acting, and being able to take part. Further, students and their actions were made continuous with norms and purposes of the practice. It is well-known that the norms projected in the science classroom may be important for why students turn away from science (Carlone et al. 2011; Schreiner 2006). The expectations that are placed on the student in terms of whom science is for may fit poorly with students' perception of themselves (Shanahan and Nieswandt 2010), and even if a student may report that they find science important and interesting, they may say that science is not for them (Archer et al. 2010; Carlone et al. 2011; Jenkins and Nelson 2005). Being an "insider" to science not only concerns content, or not even the extent to which content is appreciated, but also the feelings the individual has for science as a normative practice. Researchers and teachers should therefore not exclusively be concerned with how students enjoy content and understand purposes but also pay attention to how they recognize the norms of the practice. Student attitudes have often been accessed through secondary reports and as such sometimes understood as individual and mental rather then social and situated. However, as demonstrated in this paper, student recognition of norms and values can be observed in terms of their willingness to participate and pursue the activity further.

Moreover, the task of making electrical circuits was not adapted as such for students' already existing everyday interests, but on contrary it was a typical electrical practical in which certain things should be accomplished according to scientific norms (preferred ways of using language, procedures, and being). Notwithstanding this, the activity was shown to include all students by acknowledging and making personal contributions (e.g., "writing small," "why should we learn this") continuous with the task at hand and so also continuous with science proper. Consequently, as judged from this specific lesson, the norms of the science classroom do not necessarily have to be made available to students through, for example, an individualized curriculum or exciting events, but by simply clarifying to the students how their contributions in terms of acting, talking, and being relates to aims and purposes. In this classroom, it helped students to see science as purposeful and enjoyable and thus gave them a taste for science.

Third, participating in this science classroom amounted explicitly to aesthetic experiences and an important finding was the teacher's habit of having his students pay attention to their feelings when they worked with the assignment. Accomplishment with tasks was also a question of how it felt and not only about getting the facts straight, which is a well-reported student description of the science classroom (Lyons 2006a; Osborne et al. 2003; Wickman 2006). Besides encouraging his students to verbalize their experiences when reaching fulfillment, aesthetic judgments were used by the teacher to distinguish what feelings the students could anticipate when choosing some particular course of action. Consequently, the teacher not only supported the students to make conducive distinctions of taste, he also encouraged them to discover how it feels when distinctions of taste led them to consummation. The students thus learned how it felt to understand science, both as content and as a normative practice, which created anticipation of future encounters with science.

This raised a number of questions. For example, why does this way of teaching help students from non-privileged backgrounds? Do privileged students know all these distinctions of taste already? What is the difference between privileged and non-privileged students in their encounter with science in more traditional classrooms, where the teacher does not in the same way support distinctions of taste? We can only speculate, but we know that students from homes carrying a large cultural capital usually are well experienced in how to approach, discuss, negotiate and value things in a manner that will be acknowledged, and also rewarded, by the educational system (Bourdieu and Passeron 1990). This taste is developed and embodied through the multitude of everyday transactions that take place in a home, for example when daily concerns are discussed at the dinner table or when the parents help their children manage an intellectual or practical task (Bourdieu 1984). During these encounters, learning does not only concern facts, but also norms and aesthetics. There are, for example, usually better and poorer ways to pose an argument or solve an intellectual task and with the active help from a more competent family member, this can be experienced not only as a matter of fact but also as a feeling of consummation. Consequently, some students already have abundant experiences of how it feels to understand something intellectually, which is likely to be an advantage in terms of being able to successfully participate in science practice. Students without this background could thus benefit from not only being supported in how to make cognitive and normative distinctions of taste but also by being made aware of how it feels when an intellectual endeavor comes to consummation. Namely, how it feels to understand science, both in terms of making conducive use of content as well as acting purposefully in science practice. The teacher in our study is explicit on this matter, as shown, he repeatedly makes his students pay attention to how it feels when distinctions of taste result in intellectual and practical fulfillment. Although this is likely to be of great importance for how students identify themselves and their doings in science class (see e.g., Säljö and Bergqvist 1997; Wickman 2006), it is an empirical question that needs to be studied more closely.

Finally, further examination of how teaching in which norms, feelings, and personal contributions are acknowledged and made continuous with the aims of the activity could benefit students of different backgrounds needs to be completed. Although every classroom is exceptional in respect to how the teacher supports the students' opportunity to develop an interest in science, we believe that this teacher's ways of teaching can be adopted and modified by others. The teacher did not use any exceptional material or project any exceptional content knowledge. Rather, he repeatedly returned to the purposes of the tasks and made sure that the students understood the preferred ways to reach these. All through the activity, he acknowledged student contributions in terms of alternative ways to reach these goals as well as alternative ways for students to be when working towards the goals. As the study has shown, important aspects for learning and participating in science are something that can be distinguished and clarified as part of a caring and rather ordinary social interaction.

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