Chapter 6
Exploring Our Theoretical and Practical Understandings of Enthusiasm in Science Teaching: A Self-Study of Elementary Teacher Preparation

Brent Gilles and Gayle A. Buck

Introduction

Many attributes of effective science teachers have been identified. Such attributes include content knowledge (Arnon & Reichel, 2007), caring and compassion (Breault, 2013), and enthusiasm (Kunter et al., 2008). Although studies have shown that the latter attribute, enthusiasm, has a powerful impact on learning (Kunter et al., 2013), it is among the least researched (Schutz & Pekrun, 2007). Thus, although commonly referred to in regard to teaching science, it is not always well understood. The contemporary literature base provides understandings on students' enthusiasm for science (Howitt, Lewis, & Waugh, 2009; Kirikayya, 2011) and enthusiasm as an effective teaching strategy in K-12 education (Hudson, 2007; Turner, Ireson, & Twidle, 2010). In addition, research on this topic can be found in other curricular areas such as physical education (e.g., Mitchell, 2013) or mathematics education (e.g., Kunter et al., 2008). There is a gap, however, in our understandings of the impact of teacher educators' enthusiasm in science courses for pre-service elementary teachers.

As science teacher educators, we have emphasized the importance of being an enthusiastic science teacher – especially in situations where the students tend to fear or dread science (Kunter et al., 2013). The "we" being both authors who teach the course. Unfortunately, our students have been quick to point out that this attribute is not as evident in the teaching of *our* science courses for elementary PSTs. Thus, we turned our attention to seeking a practical approach to our science courses for PSTs that would foster an understanding and practice of teaching enthusiasm. The purpose of this study was for the first author to understand how to model enthusiasm in our

B. Gilles (✉) • G.A. Buck, Ph.D.
Department of Curriculum and Instruction, Indiana University, Bloomington, IN, USA
e-mail: bgilles@indiana.edu; gabuck@indiana.edu

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science course. The guiding questions of the study were: (a) how am I demonstrating enthusiasm in my science classroom and (b) how are my students, elementary PSTs, responding to this attribute of my teaching practice.

Background

In 1986, Brophy and Good identified core teacher qualities based on what research has shown to be the teacher attributes that foster student achievement. Teacher enthusiasm was one of those qualities. More recently, Kunter et al. (2008) also identified enthusiasm for teaching as one attribute of a high quality teacher. Enthusiasm has been widely used to describe an effective method for delivering information to students (Shuell, 1996). Enthusiasm, however, continues to have several different definitions (Kunter, Frenzel, Nagy, Baumert, & Pekrun, 2011). A current definition for teacher enthusiasm is behaviors or expressiveness that denote a teacher's passion and enjoyment (Keller, Goetz, Becker, Morger, & Hensley, 2014). In instructional quality research, teacher enthusiasm is seen as the teacher's ability to transmit the importance and intrinsic value of learning content to the students (Patrick, Turner, Meyer, & Midgley, 2003). These actions are commonly defined as: rapid and excited speech, rapid eye movements, frequent and demonstrative body movements, changes in facial expression, highly descriptive word usage, acceptance of ideas and feelings, and high energy level (Collins, 1976; Rosenshine, 1970).

Enthusiasm as a Powerful Teacher Attribute

The positive climate that results from an enthusiastic teacher is critical for fostering students' motivation to learn (Meyer & Turner, 2006; Stipek et al., 1998). This type of resulting motivation is known as affiliative motivation that is defined as the motivation to be connected through positive relationships with others (Hill & Werner, 2006). Furthermore, individuals react to the emotional cues of the face and according to their perceived emotion of the other person (Turner, 2007). A person who is demonstrating enthusiasm is typically happy and thus they will translate that emotional energy to those around them. Ford (1992) stated that emotions such as enthusiasm are "an integrated part of motivational patterns" (p. 8). Enthusiasm is an aspect of building a positive learning environment that motivates students to be involved. This means that the energy level and enthusiasm that a teacher has will motivate students to stay on task (Bettencourt, Gillett, Gall, & Hull, 1983). Furthermore, findings suggest that teacher enthusiasm is just as important as students' initial interest in a subject (Kim & Schallert, 2014). Teacher enthusiasm can also be triggered by situational interest which can be "environmentally triggered, involving an affective reaction and focused attention" and leads to increased motivation on the part of the students (Hidi, 2006, p. 72). There is also evidence to suggest that natural enthusiasm is linked to higher student interest (Keller et al., 2014).

As it is intertwined with student motivation, teacher enthusiasm has been connected with higher student achievement (Bernstein-Yamashiro & Noam, 2013) and lower dropout rates (Pomeroy, 1999). All of this is, in part, linked to the finding that enthusiasm is a cyclical process where the students can initially feed off of the teacher's excitement and in turn the teacher is further energized by the student's enthusiasm (Frenzel, Goetz, Ludtke, Pekrun, & Sutton, 2009). Not surprisingly, classes that achieved higher mathematics scores and less disruptions were ones in which the teacher was most enthusiastic (Kunter et al., 2011). Students regularly identify teachers who show personal enthusiasm for a subject as a reason for being motivated to learn (Meyer & Turner, 2007). Obviously, enthusiasm is one of the teaching strategies needed in a teacher's repertoire (Mitchell, 2013). It should be noted, however, that teachers who attempt to continuously force enthusiasm are more likely to experience burn out (Keller et al., 2014; Metcalfe & Game, 2006).

Mathematics education has recently benefited from research on enthusiasm (Frenzel et al., 2009; Kunter et al., 2008, 2011, 2013). Frenzel et al. (2009) studied how mathematics teachers' enthusiasm was linked to student enjoyment. They found that student and teacher enjoyment were mediated by the teacher's enthusiasm. Kunter et al. (2008) distinguished the difference between enthusiasm for teaching and enthusiasm for mathematics. They found that teaching enthusiasm was a predictor of high quality teaching and that enthusiasm for mathematics was not. Teachers' also reported being more enthusiastic in classes that experienced less disruptions, higher student enjoyment, and higher mathematics achievement (Kunter et al., 2011). These findings connect with the findings that students who had teachers with better pedagogical content knowledge, constructivist beliefs, and enthusiasm for teaching showed higher achievement gains in their mathematics classes (Kunter et al., 2013). This suggests that teachers who observe best practices have students who are more enthusiastic which in turn creates more enthusiastic teachers. There is pertinent information in this research for science educators. Especially in the fact that students have consistently identified science as their least favorite subject (Obsorne, Simon, & Collins, 2003).

Research on enthusiasm from a science teacher educator's perspective is limited in science education. Turner et al. (2010) conducted a case study in which they found that students liked teachers who created a welcoming environment. Students identified science classes where their teachers used varied instruction and unusual learning strategies as being the most enjoyable. This type of creativity is an attribute of a teacher who is enthusiastic about teaching (Kunter et al., 2008). Student enjoyment is also a factor closely linked to teacher enthusiasm (Kunter et al., 2011). Kirikkaya (2011) looked at enthusiasm from the students' perspective. She found that students were most enthusiastic about science when they were doing hands on activities, group activities, and using technology. They were least enthusiastic when they were writing, reading, working alone, and performing mathematics operations. She also found that enthusiasm for science falls dramatically for students as they enter eighth grade as their perceptions of science being hard increased. This effect is only amplified when students have negative experiences with their instructor and/or the subject (Alsharif & Qi, 2014). This study seeks to continue the conversation on enthusiasm in science by addressing enthusiasm from the teacher's perspective and to address the gap in our understanding of enthusiasm in science education by exploring what enthusiasm is in a university science class designed for PSTs.

The Importance of Enthusiasm in Our Efforts in Pre-service Teacher Education

This study was aimed at improving our own teaching to, in part, provide an example and expectation that our own students will look to continually improve their own practice. This fits with LaBoskey's (2004) contention that we involve our students while challenging our own developing understandings of enthusiasm. It is necessary that we provide our elementary PSTs with learning experiences in a classroom that is structured around best practice. This could help to counteract the problem that first year teachers are influenced by practices within the school as opposed to the educational theories exposed in their pre-service program (Muller-Fohrbrodt, Cloetta, & Dann, 1978). Brouwer (1989) found that integrating our educational theories into our own teaching practices, we lessen the influence of school culture on a first year teacher's practice.

Korthagen and Kessels (1999) contend that in order for students to rely on theory in their practice that we must first help to provide useful experiences in which they can use the skills of best practice. Once we have done that then the interaction can be recorded and we can dissect and refine that experience with each student. It is important that we develop PST's practical experience that is based on theory which will lead them to rely on that experience as an in-service teacher (Korthagen & Kessels, 1999). Unfortunately, there is a dearth of research by science educators on their own practices of teaching PSTs (Bullock, 2012). This study is an attempt to address not only that need, but for our students to find emotional support, specifically enthusiasm, relevant to their preparation of becoming an educator. Trumball (2012a, 2012b) contends that being a teacher causes PSTs to create a new identity for themselves and we want to stress that enthusiasm is an important aspect of that new identity.

Loughran and Berry (2005) point out that many veteran and beginning teachers do not recognize a conflict between what they believe to be best practice and their actual teaching practice. Teachers may believe they demonstrate an enthusiasm for science, but their own students may actually view it as something different. This is something that we struggled with as our students questioned our own enthusiasm for the subject. This is important for our own understanding of teacher education which will help us to better communicate about teacher enthusiasm (Loughran & Berry, 2005).

Methodology

Self-Study

The complexities of teaching have renewed interest in faculty studying their own practices (Loughran, 2006). As a result, the field of self-study of teacher education practices has grown rapidly. For example, in preservice teacher education, Capobianco (2007) found that inviting pre-service teachers into reflective practice and modeling the development of professional practical knowledge allows them to better address the uncertainties in their own learning. Moscovici (2007) explored the power relationships in science methods courses. Nilsson and Loughran (2012) advanced their own understandings and practices by exploring their student teachers' self-assessments of developing pedagogical content knowledge. These scholars, and many others (e.g., Dias, Eick, & Brantley-Dias, 2011; Garbett, 2011; Trumbull, 2012a, 2012b), have showcased the challenges inherent in our teaching practice and ultimately advanced our understandings about the preparation of science teachers and teacher educators.

Self-study is a systematic and rigorous look into one's own understandings and/or practices, which leads to a deeper understanding of educational theory (Loughran, 2004). The purpose of self-study is to contribute to the improvement of the practice of teacher education, as well as validate professional expertise in a manner that contributes to an explicit pedagogy of teacher education (Vanassche & Kelchtermans, 2015). Vanassche and Kelchtermans (2015) proposed four general characteristics that constitute this approach. Self-study research (1) focuses on one's own teaching practice, (2) privileges qualitative research methods, (3) emphasizes collaborative interactions, and (4) bases validity on trustworthiness. Our study met these four criteria. It was designed to provide us with an understanding of how we model enthusiasm in our science course and its impact on our students. The focus was on our own understandings and practices involving enthusiasm. The process was a collaborative endeavor between two science teacher educators and 14 undergraduate students. We utilized a qualitative case study design that addressed construct and face validity. These characteristics are described in more detail below.

The self study research approach differs from reflection on practice in that the work is taken outside the individual and made public, thereby allowing for challenges, transformations, translations, and extensions by others (Loughran, 2004). Although the research focuses on the individuals and their practice, the discussion resides within the larger professional community of practice. This methodological approach is defined by the common focus of the studies, teacher educators' understandings and/or practices in regards to teaching. More specifically, it is about what is going on between the self (i.e., teacher educators) and their teaching practices (Bullough & Pinnegar, 2001). In this regard, our research is being offered through publications and presentations in an effort to continue the dialogue on enthusiasm in science teacher preparation.

The self-study approach, however, may differ in methodological design. Designs may include case study (e.g., Kroll, 2005), narrative (e.g., Kitchen, 2005) and heuristics (e.g., Oda, 1998). The methodological design used for this self-study was an exploratory case study design (Creswell, 2012). A case study is defined as an exploration of a "bounded system" over time through detailed, in-depth data collection involving multiple sources of information (Creswell, 1998). Case studies are particularly appropriate for understanding the details and complexity of a situation (Stake, 1995). Our case defined the duration of our self-study (one semester), the context (one course) and the student population (PSTs in one section). This was explored by a variety of data sources (described below).

Participants

Although the term self-study suggests one individual, this line of research is seldom an individual process. Self-study researchers often move beyond themselves to better examine their practical understandings of teaching and learning (Loughran, 2004). Our self-study group included 2 science teacher educators and 14 undergraduate students.

One of the educators, referred to as "I" throughout the findings section, was the course instructor during this study. He was a former high school science teacher and a new science teacher educator at the time of this study. He entered higher education as a self-described enthusiastic teacher who was prepared to foster such enthusiasm in future teachers. He was, however, challenged by his mentor on his notions and ideas of what that meant theoretically and practically. His practices in regard to enthusiasm and its impact on students became the focus of this study. As this inquiry was focused on understandings, the process was necessarily reflective and participatory. This process was assured by the inclusion of a critical friend (Schuck & Russell, 2005), the mentor. She also served as the course coordinator of this multi-section course and taught the course in the past. Her role was to advise in the methodological design, aid in the framing and reframing of classroom experiences, ask for clarifications in regards to intentions and rationales, generate more complex ideas of enthusiasm in science teaching; as well as challenge and be challenged on interpretations of the experience.

Going beyond the individual in self-studies on teaching also requires seeing the practice from the students' perspective (Loughran, 2004; Zeichner, 1999). Thus, this study was conducted with 14 undergraduate students. The students in this course were considered secondary participants. They included 13 females and 1 male in the class (up until the end of January there were 14 females and 1 male, but 1 female student dropped the class).

Context

This single case study was conducted in a semester long science content course designed specifically for elementary PSTs who were in their freshman or sophomore year. This was the students' first experience in an undergraduate science course. The class met 2 days a week for 1 h and 50 min each class. The students had minimal field experiences that equated to less than 40 h of observation. This class focused on giving the students an inquiry experience so when they take the science methods course they will be able to better incorporate inquiry into their lesson plans. The class consisted of three sections that split the semester into three equal parts. The first section of the class was focused on correcting student misconceptions about the nature of science and scientific inquiry. There were daily activities that were designed to introduce students to scientific inquiry and also get them comfortable with the inquiry process. The second section of the class was based around large guided inquiry-based environmental projects. Two of these investigations had the students outside and actually collecting data about the campus environment. The last section of the class involved independent inquiry-based projects. The instructor guided the students, but the students had control over their topics and investigative designs. Students would meet at the beginning of each class during this section and, after having questions answered and guidance given, they were free to leave the classroom and work wherever they felt would benefit them the most (though the instructor made himself available in the classroom during the entire class period).

Data Collection

The data collection tools included an instructor's daily journal designed to explore how the instructor felt about each day's lesson and to keep a record of any outside factors that may affect his energy and enthusiasm during that day. Journal entries included a pre- and post-class reflections focused on how the lesson went and how instructor's enthusiasm seemed to aide or distract from the lesson. Field notes were also made on student's responses during the class. Data collection also included student surveys. These Likert-scale surveys were designed to gauge how the students felt the lesson went and how animated and interactive they believed the instructor acted. This survey, a modified version of one developed by Mitchell (2013), was based on the definition of enthusiasm developed by Keller et al. (2014). The survey had two sections, the first section had ten prompts concentrating on the instructor. The survey was a Likert-scale consisting of the choices strongly agree, agree, disagree, and strongly disagree. The students would then circle the number (1-strongly disagree to 4-Strongly agree) that matched their view of the prompts on the survey. Some of the prompts included "Displayed excitement during class.", "Smiled frequently during class.", and "Praised student input." The second section of the survey had eight prompts that concentrated on the students. Those questions included “I enjoyed coming to class today.”, “I found the lesson to be interesting.”, and “I was excited during the class activity today.” These surveys were analyzed at five points during the semester so they could be compared with journal entries and changes could be made based on the feedback. The decision to not analyze the surveys after each class was made in order to allow for recognizable trends to be identified and prevent unexplored reactions to the previous class. Course evaluations also served as a form of data. These were analyzed for specific student references to enthusiasm. Additionally, approximately 60 h of classroom interactions were video recorded. The video camera, set up in the back of the classroom, focused on the entire room and the interactions within. The students were aware of the videotaping and had given permission for this to occur. Field notes from critical friend meetings were used as another source of data.

Data Analysis

The survey data was used as descriptive statistics in our qualitative analysis to further enhance our understandings of our practice. As such, the scores were not used to make generalizable findings; instead they were used to reveal trends and relationships that were then used as qualitative data.

The qualitative data was analyzed using an open-coding process. We segmented the various texts into meaningful units and assigned codes to label the segments (e.g., instructor’s tone, instructor’s rapid movements, student engagement). The final analysis involved comparing instructor data to student data, identifying classroom instruction occurring at certain points, and possible external influences (e.g., instructor’s lack of energy). We further analyzed the classroom video to ensure that the perceived practices matched the actual classroom practice.

Triangulation and Validation

The study was triangulated using multiple data collection tools and sources that included instructor’s journals, observations of students and instructor, field notes on class sessions, field notes from critical friends meetings involving the instructor and mentee, validated student surveys and student course evaluations. The study was also triangulated in regards to different theoretical schemes. These schemes were supported by the inclusion of the instructor, mentee, and students. In addition, the reflexive approach to data collection and analysis assured construct validity and the feedback from students and critical friend assured face validity (Lather, 1986; Loughran & Brandenburg, 2008). Finally, the reality-altering impact in terms of a gain in self-understanding and self-determination, catalyst validity, was realized in changes to previous understandings of the role enthusiasm holds in teaching and teacher education (Lather, 1986). This is further elaborated throughout the manuscript.

Findings

The guiding questions of the study were: (a) how am I demonstrating enthusiasm in my science classroom and (b) how are my students, elementary PSTs, responding to this attribute of my teaching practice. These questions are addressed simultaneously throughout this section. "I" is used throughout this section to reference the instructor's practices and understandings as they were collaboratively explored with the critical friend.

The Relationship Between Enthusiasm and Direct Instruction

As noted in context, the first section of the course timeline is aimed at addressing the PSTs' naïve and inaccurate conceptions about scientists and scientific inquiry. These topics are addressed in a series of short activities, mini-lectures, and guided discussions. I was enthusiastic about these lessons, noting in my journal that I was "looking forward to class today", "today is one of my more favorite classes", and "I was really energized today." Each time I noted a comment like that, every student agreed or strongly agreed that I was enthusiastic during the lesson. These ratings were directly aligned with the students' expressed interest in the lesson. This also supports the findings by Pickens and Eick (2009) that found that when a teacher enjoyed what they were teaching the students enjoyed the topic and the students were in turn more motivated in their work.

The second section of the course was concentrated on doing guided inquiry projects that required out-of-class research and follow-up lab reports. This was the point in the semester where I started to turn the direction of the learning process over to the students. There was a minimal amount of direct instruction. The analysis revealed both my level of excitement and the students' interest in the lessons now varied. Overall, once the activities became more student-led the direct relationship between my excitement and the students' level of interest did not hold up. For example, one inquiry project was focused on water quality. After some preliminary work, the students went to a creek to collect invertebrates. A few of the PSTs voiced displeasure for the activity before we went outside, however, everyone participated. This particular day happened to be quite cold and my journal entry after class illustrates how much even I struggled on this day.

> I really put on a brave face today because I was not looking forward to going out, but I knew that if I was not excited about it then they wouldn't be so I just pushed ahead with as much energy as I could in the hopes that it would rub off on them. I even realized how much I was forcing it (my energy) as we walked back inside and a colleague asked how it went. I put on a big smile and said science is great! Overall, I feel like my enthusiasm was helpful to them because otherwise it would have been more miserable than the cold made it. They were definitely cold coming back in, but I did not hear any complaints and there were even smiles as I was giving my science is great reply.

Table 6.1 Student exit surveys during water quality lab (outdoors)

Survey prompt	Strongly disagree	Disagree	Agree	Strongly agree
Instructor displayed excitement during class	0	0	3	9
[Student] enjoyed coming to class today	1	4	4	2
[Student] was excited during the class activity today	1	2	6	2

Note. This is an aggregate of all students present in class on this day

Table 6.2 Student exit surveys during soil quality lab (outdoors)

Survey prompt	Strongly disagree	Disagree	Agree	Strongly agree
Instructor displayed excitement during class	0	0	1	12
[Student] enjoyed coming to class today	0	2	6	4
[Student] was excited during the class activity today	0	3	5	4

Note. This is an aggregate of all students present in class on this day

Every student rated me as excited during the collection of observational data. However, they were not unanimous in regards to their interest in the activity. As seen in the example data provided in Tables 6.1 and 6.2 during the water quality investigation, five students reported not enjoying coming to class that day, while only two reported the same for the soil lab. The day we did the soil lab was considerably warmer and the temperature is likely the biggest reason for the discrepancy between the 2 days. However, I also noted some timid behavior, perhaps due to the students participating in some unfamiliar activities (i.e. digging and collecting earthworms) and I noted in my journal, "I felt myself kicking my energy up and being as enthusiastic as possible because I wanted them to stay positive through the experience." I also noted on this day that I wanted the students to be "excited about doing science" and this is why I put forth so much energy and enthusiasm both days that we were outdoors collecting data.

The final portion of the class was structured to facilitate independent student research. On the first day of the final inquiry project in the class I noted in my journal, "I find it absolutely fascinating what the students choose for their individual projects because it gives a window into them and their interests. It energizes me to watch them do something that they are really passionate about and their work really shows it." However, that enthusiasm did not last. On the fourth to last day I wrote in my journal "I've gotten comfortable with this class so I think my enthusiasm to see them and interact with them has really carried me through some of the days where my energy was less." In my journal I noted, "I'm passionate for their own projects, however, because I don't necessarily interact with all of them I am not sure if they pick up on that or not." The video confirmed that my time was being dominated by

Table 6.3 Exit survey questions during individual research projects reactions

	Class 18				Class 27			
Survey prompt	1	2	3	4	1	2	3	4
Instructor displayed excitement during class	0	0	6	6	1	2	5	6
[Student] enjoyed coming to class today	0	0	6	6	0	3	7	2
[Student] found the lesson to be interesting	1	0	6	4	1	0	7	3

Note. 1 = strongly disagree 2 = disagree 3 = agree 4 = strongly agree

a few of the students and I was not getting around to all of them. A question on the exit survey asked students if I "moved around the room to interact with students/groups on an individual basis" also identified that the students were aware that I was not doing a good job moving around the room and giving attention to everyone. The students also gave me lower ratings on my enthusiasm for that day on the exit surveys. These results could be due to the fact that I was not interacting with everyone and not all students had the opportunity to experience my enthusiasm for their project.

By the end of the semester, I was consistently remarking about how drained I felt before class writing in my journal, "We are wrapping it [final project] up so I don't find it terribly interesting, but we'll see."; "I'm a little tired today."; and "My enthusiasm wasn't there and I didn't even have time to think about faking it." The video also backs up this feeling as I was interacting with students in a more business-like fashion. The lively laid-back atmosphere that had been seen on video leading up to the inquiry-based projects had been replaced with a more stay-on-task atmosphere. The fact that I noted in my journal that I "did not feel like I was actively teaching science" did not leave me as excited for class at the end of the semester as it did at the beginning. This was further evidenced by the fact that my daily ratings of my own energy before class was consistently lower than at any other time during the semester. This is attributable to end of the semester deadlines and work outside of class that was demanding my attention and energy.

As noted, the students did not find me to be as enthusiastic once I gave them more control of the learning process. The enthusiasm scores I received were lower. It was at this point that an indirect relationship between my enthusiasm and their level of interest emerged. As can be seen from Table 6.3 from the beginning of the individual research project to towards the end (30 classes total) they viewed my enthusiasm as waning, even though they enjoyed coming to class and found it interesting. There were, however, consistently two people each class period that did not find class interesting or enjoy coming to class. There is, however, no way to know if it was the same two people each time. The students chose their projects and they were more interested in what was happening during class. I felt that my role had become more of a supportive role to help the students organize their research and help properly format it to the expected final product. The exit surveys showed that once I was no longer the focal point, my excitement ratings by the students were consistently lower.

Overall, the students had a positive view of my teaching style. On the end of the course assessment a student wrote "The instructor was always kind and seemed to enjoy teaching/helping the students." A different student noted that my "teaching style was perfect for this class." Both students are expressing characteristics that we consider to be enthusiasm which are behaviors or expressiveness that denote a teacher's passion and enjoyment (Keller et al., 2014). The exit surveys never came out with more students disagreeing that I showed enthusiasm than showed it. Even though I struggled with my enthusiasm once direct instruction started to turn into student directed work there was always a majority of students who felt that I was being enthusiastic during class.

Attempts to Control Students by Stressing My Own Enthusiasm

Post journal entries also highlight my enthusiasm for teaching through disappointment. One particular instance came on a day when students were to explore and test ice balls (which they know nothing about and are not even told what they are made of). I introduced the activity as "quite possibly my favorite activity of the semester." After class, I noted, "They enjoyed seeing how they [ice balls] were all different, but lost some of that fervor when it came time to actually collect observational data on them. I was a little disappointed by that and felt the need to inject as much energy into it as I could." However, the students reported that they were nearly as excited as I. A review of the video did reveal my misconception on student excitement for that day. My idea of the students' excitement is similar to what I defined as enthusiasm-which would be smiling frequently and making lots of rapid motions. These were actions that they displayed initially. After that initial show of excitement, they focused on the task. All students were observed to be on-task and focused on their investigations. Meanwhile I maintained my smiling, demonstrative gestures and moving around to the individual groups to inquire how each was conducting their investigations. Everyone agreed that I was excited during the lesson on the exit surveys, and just one student disagreed that they were also excited even though they displayed it differently than me.

Another interesting notion is that of Frenzel et al. (2009) that noted that enthusiasm was a cyclical process in which the students would become enthusiastic because the teacher was and vice versa. There were some days when this did not prove to be the case. The students noted that the instructor was excited during the class, but the students themselves noted that they were not excited about class that day. In each of the cases, the students reported that they had come to class in good moods. This dichotomy was strongest during a day in which the students were working on writing lab reports after having done an investigation of soil quality. All students surveyed, but one, noted that I was excited during class, giving positive feedback, and moving around the room and being interactive with groups and individual students (see Table 6.4). However, nearly half the class disagreed that they were excited during

Table 6.4 Soil lab report write-up class (indoors) reaction

Survey prompt	Strongly disagree	Disagree	Agree	Strongly agree
Instructor displayed excitement during class	0	2	6	4
[Student] was having a bad day before class	7	3	1	1
[Student] was excited during the class activity today	1	4	3	4

Note. This is an aggregate of all students present in class on this day

class that day. This was also the case in reverse when students were working on their independent research projects in the last section of the class they gave me lower excitement scores, but reported being excited themselves (see Table 6.3).

The Relationship Between Enthusiasm and Level of Content Expertise

This course is an interdisciplinary science course. As such, the instructors must address topics that include aspects of life, physical, and earth science. Many instructors at the college level, myself included, have content expertise in one area of science with a variety of possible other areas addressed at different levels (and some not at all). My background is in the physical sciences of physics, chemistry, and earth science. One lesson in particular dealt with content that was out of my expertise (more detail on this lesson is provided below). This lesson dealt with succession and the natural cycle of plants which my knowledge was limited to my own K-12 education. I taught myself as much about the information as I could, but this caused me to concentrate more on remembering and giving correct facts. The video showed that my demeanor had become more "business-like" in the way I taught the class and my physical stance became stiffer than other classes. I showed less outward signs of enthusiasm. There were no demonstrative motions, my facial expression did not change from a neutral position, and I had only two instances where I showed excitement. I also seemingly became glued to the front of the room where my notes were and did not move around the classroom casually and comfortably as I had in previous classes.

A subject I do know well is the nature of science and scientists. I am extremely passionate about science, I have worked in research labs and I like sharing my experiences as a scientist. During the class sessions on these topics, my enthusiasm was very high. I noted in my journal, "…I am looking forward to teaching today…", and "I really enjoyed watching what the students drew last semester (students drew what their idea of a scientist was) so today is one of my more favorite classes." There are many other instances similar to these where I start out before class noting how much I am looking forward to getting into the classroom with the students. Even in my post class journal my excitement carried through noting that "…I really felt like my energy ticked up once class started." and "I was really energetic today."

It was not hard to be enthusiastic about topics that I am passionate about. What I came to realize is that my enthusiasm for the content was not transferred to the students during the individual inquiry-based projects. In my journal I stated, "I've come to realize that what I thought was enthusiasm for the entire class was really just enthusiasm for the subject." This was a realization that I had during a meeting with my critical friend when she pointed out that when I discussed my enthusiasm for each class that it was centered on the content and not on the students or the class. This does not mean that I did not care about the students, but merely that I was excited about the content so much that my enthusiasm would have been high no matter the group of students. Regardless, I did enjoy this particular group of students as I wrote in my journal towards the end of the semester that "…my enthusiasm to see them [the students] and interact with them has really carried me through some of the days where my energy was less." After the first few weeks of class there is not a class period where I am not on video interacting with the students in a casual and friendly manner. What was lost in translation is the enthusiasm I felt and wrote about in my journal and the actual outward show to the students and their perception of while working on their independent inquiry projects. This suggests that my enthusiasm for the students was lost in my content enthusiasm during the first two sections of the course. I had also given up my control over the content to my students and their chosen topics for projects were not ones that I was as excited about as I was the content I had put together throughout the semester.

The Impact of False Enthusiasm

There was one lesson during the semester that I was not at all enthusiastic about teaching. I had taught it the semester before and did not enjoy the experience and felt that my students did not either. The lesson was focused on historical explanations in science. It was teacher-directed and involved a lot of reading material and history. The lesson was originally structured to be an introduction on how scientists go about proposing explanations. I wrote in my journal before class that day that "…this was the one day where my enthusiasm was rock bottom (last semester) … I can fight through that lack of enthusiasm to experience what it is like to have to force it." The idea was to challenge myself to be artificially enthusiastic about the lesson. I believed this was important to experience because there are times when these PSTs will have to teach lessons that they are not enthusiastic about. This might be due to numerous factors, but in a lot of cases teachers at all levels do not always have control over their own curriculum. I noted in my journal that "…I think my dislike stems from my lack of really understanding why I am doing this and not being totally comfortable with the whole thing because it is a lot of reading." Which is an emotion that I typically feel when I have no control over what I am teaching in the classroom.

Table 6.5 Historical explanations lesson reaction

Survey prompt	Strongly disagree	Disagree	Agree	Strongly agree
Instructor displayed excitement during class	0	1	3	8
[Student] enjoyed coming to class today	0	0	7	4
[Student] found the lesson to be interesting	0	3	5	3
[Student] was excited during the class activity today	1	3	4	3
[Student] liked class discussion	1	2	4	4

Note. This is an aggregate of all students present in class on this day

During the class I had to force my enthusiasm and afterwards I was surprised by the outcome. I wrote, "I was really surprised by how I did today. I did not feel as though I had to force myself to be excited throughout class. I think I was business-like during the historical explanations part, but I was not as actively down as I was last semester and I do not feel that I hate it as much as I did after doing it last semester." This was backed up by the exit surveys from the students. All but one student agreed that I was excited during the lesson. All the students reported enjoying coming to class that day. Three students, however, reported that they did not enjoy the lesson or like the classroom discussion and four students reported that they were not excited about the lesson (see Table 6.5). The fact that all of the students enjoyed coming to class could be implied that I had done a good job of building a pleasant and inviting atmosphere, but that once there the content and class activities dictate whether class is enjoyable. The video revealed that even though I was successfully forcing the outward attributes associated with enthusiasm, the lesson was still very business-like and did not allow for any student exploration other than some critical thinking. Student exploration in this case meant a hands on activity where they are actively engaged whereas this lesson was a simple cognitive exercise designed for them to think only. There was also very little interaction between students as they spent a large amount of the class reading passages silently to themselves. Given this evidence, I came to realize that although I was able to successfully fake my own enthusiasm, it did not impact the students' level of enthusiasm as I intended.

Discussion and Implications

With this study, we explored the theoretical and practical understandings of enthusiasm in teaching preservice elementary teachers. Our reflective journey has authentically complicated our understanding of this attribute of effective science teachers. First, we have come to realize that our initial theoretical notions, including the necessary characteristics, of enthusiasm were all concentrated on outward displays of emotion. We now understand that enthusiasm does not require that a teacher simply show an outwardly display of enthusiasm, but it does require passion, creativity, and excitement about teaching the lesson from the instructor before students even walk into the classroom. This attribute begins with the teachers' relationship with the topic, including how it relates to the students, and the students. We believe this now challenges our practical understandings. Our students, elementary PSTs, do not always enjoy teaching science. This may be because they do not have the necessary content knowledge (Abell & Smith, 1994) or don't find it particularly interesting (Pelletier, Séguin-Lévesque, & Legault, 2002). Interest being important here because of the relationship between interest and motivation, and subsequently enthusiasm (Long & Hoy, 2006; Kunter et al., 2011; Pelletier et al., 2002). Furthermore, emotions, such as enthusiasm, energize students which provides them with the motivation to participate in certain tasks (Turner, 2007). Our experience, however, seems to point towards intrinsic motivation being a more important factor in student motivation than a teacher's display of enthusiasm. In addition, setting up classroom norms that achieve a positive environment cultivate an environment where students are motivated to learn (Ritchie, Tobin, Hudson, Roth, & Mergard, 2011). Enthusiasm from the teacher is merely the outwardly display of the positive environment, but we have come to understand that a positive environment must be purposefully constructed through every aspect of planning classroom activities and interactions.

Second, we came to realize that Frenzel's et al. (2009) notion of enthusiasm being cyclical between teacher and students does not always hold up. We realize that, even if we succeed at getting our PSTs to be enthusiastic about all of the science topics in their curriculum, it will not be sufficient. Their own enthusiasm may increase the likelihood of their students being motivated, but not necessarily. Over the course of this self-study, we saw that although the students believed the instructor was very enthusiastic about the science topic, they did not come to share that feeling. Even though Bettencourt et al. (1983) identified an increase in on-task behavior, our students self-reported their on-task behavior as being consistent throughout the semester regardless of the instructor's enthusiasm. Our students being post-secondary and Bettencourt's et al. (1983) study being with four to six graders could make a difference because maturity and intrinsic motivations are likely to be different. This is complicated further by the fact that the reasons for a person's motivation is likely to change as they age (Pintrich, 2003). Another interesting outcome is that even though students might not have been excited during the lesson that did not necessarily keep them from participating. Many studies did cite an increase in motivation with enthusiastic teachers (Bettencourt et al., 1983; Kunter et al., 2011; Meyer & Turner, 2007; Stipek et al., 1998) and there was some cursory evidence that the instructor's enthusiasm had an impact on motivation as a student wrote in the end of course evaluation that "When I did not get a grade I wanted I tried hard the next assignment to get a higher grade and I noticed this with several other students. He makes the class feel comfortable and relaxed so that learning is promoted." However, this was not always the case. For instance, during the soil lab a student rated them self as fully participating in the activity, but rated them self as not being excited during the activity and this student even wrote "worms…" unsolicited next to that question. This suggests that although enthusiasm may be an important teacher attribute, there are other attributes that may be more important. One theory could be related to the setup of the class. Little is known about how the construction of a classroom climate (e.g., traditional vs. constructivist-inquiry) impacts motivation, but it is possible that our approach positively impacted student motivation (Pintrich, 2003). Pelletier et al. (2002) has suggested that environments such as ours, where students have more control, produces more intrinsic and self-determined motivation (Pelletier et al., 2002).

Third, we also realize that although enthusiasm is a critical attribute in science education, it may be more necessary in cases where the pedagogical approach is not particularly exciting for the students. In contrast, when the students find the learning process interesting (e.g., inquiry-based instruction), it may not be as critical to the learning process. In this study, there were certainly days where both the instructor and the students were enthusiastic about what was going on in the classroom. For instance during an activity where students designed spinning tops with different levels of instruction (to demonstrate inquiry) all of the students strongly agreed that they and the instructor were excited during the class. However, on days where the students gained more control over the learning process, they were motivated to learn despite the fact that they did not perceive the instructor as being particularly enthusiastic. This occurred during the final portion of the class when students were working on their own projects (described previously). The instructor consistently received lower marks during this time for enthusiasm while the students identified being enthusiastic themselves. Practically, we realize that as we prepare our teachers to relinquish some of the classroom control during open-inquiry projects, the class periods provided students with more choice and freedom. They were not stuck listening to a lecture or glued to one spot conducting an experiment. They had freedom to move and work with others and make decisions about what they were experiencing. Most importantly, they had control over the topic in which they had personal interest. This interest creates a positive emotion within the PSTs and provides them the motivation to tackle their own project (Turner, 2007).

Teacher enthusiasm appears to be more important during teacher-centered instruction, as was the case with the initial weeks of this study. Students need to see that the teacher is energetic when they are the main focus of the instructional process. Which helps to establish a positive classroom environment that motivates students to do their best (Marzano, 2013). When that process becomes more student-centered, allowing for more choice and interaction, the motivation stems from other aspects of the learning process. Even though it is important for a teacher to be positive in the classroom (Stipek et al., 1998), perhaps they do not have to force enthusiasm, as the instructor tried, if they have planned a lesson that students find interesting, can take ownership of, and be enthusiastic themselves. Lessons that allow students to collaborate and be creative seem to promote this quality. This was especially apparent during the tops activity, draw a scientist, and the final inquiry projects.

Some limitations in this study should be addressed. The first being that students took an exit survey at the end of every class. The instructor (first author) was always careful to leave the room so students would not feel coerced in filling out the surveys.

The second issue is the possibility that some students quickly filled out the survey at the end of each class without much thought. Though it does appear that the students put thoughtful consideration into the surveys at the end of each class, we cannot know this for sure. The last concern is the fact that students chose to leave questions blank on some days. There was no pattern to this activity and it is unclear why this was done though a student did informally mention to the instructor that if she did not feel she observed the question she left it blank. However, there were multiple students that left questions blank on the same day so we cannot know for sure if this was the reason for all of the students.

In regards to implications to future research, the results of this study do raise some interesting questions. The relationship between content knowledge and a teacher's enthusiasm is an important area that needs further analysis. This study suggested there is a positive relationship, but more research is needed. The next area is the idea that enthusiasm is cyclical. We found evidence to suggest that this in fact does happen, but not all the time. Perhaps there are other factors that excite students besides teacher enthusiasm. Further studies should investigate whether the relationship between student control and teacher enthusiasm are linked. Specifically how the relationship works on days where the instructor has control verse the days where students are in control. Finally, a look at how lessons themselves foster enthusiasm should be investigated. Our evidence suggests that a good lesson plan and adequate content knowledge play a role in both the instructor's and student's enthusiasm.

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