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Using the communities of practice framework to examine an after-school environmental education program for Hispanic youth

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Environmental education researchers have called for a greater analysis of 'learning' in environmental education in relation to contemporary theories and explanatory frameworks of learning. Situated learning, as a prominent example, is a sociocultural theory that contends that learning is a social process that occurs as individuals participate in 'communities of practice'. This study aims to enhance our understanding of the usefulness and applicability of the communities of practice framework to the analysis of learning in environmental education, focusing on the learning in after-school environmental education programs for Hispanic youth. Results suggest that the framework can be applied to identify some environmental education programs as communities of practice, characterized by the development of joint enterprise, mutual engagement, and shared repertoire. The framework was also found to be useful in identifying and describing learning as bringing about changes in identity formation as a result of participation in the programs. Finally, we suggest that such programs, due to their free-choice nature and multiple opportunities for participation, also offer suitable contexts for further research regarding the relevance of sociocultural theories of learning to environmental education practice.

Keywords: communities of practice; sociocultural theories; situated learning; learning theories; multicultural; after-school program

Introduction

In an attempt to reform and challenge traditional notions of science education, those concerned with science learning, and particularly multicultural science learning, are turning to the environment as a context for learning (Barab and Duffy 2000; Bouillion and Gomez 2001; Boyer and Roth 2006; Fusco 2001; Roth and Lee 2004). These studies find that programs centered on issues related to the environment offer various opportunities for participation and provide space for students to make connections between science and issues relevant to their lives. As part of a larger study examining the communities of practice framework in both science classrooms and an after-school environmental education program with Hispanic youth (Aguilar 2009), this paper specifically focuses on the use of the communities of practice framework as a heuristic for understanding social learning as a process and product in environmental education contexts. Where other studies have applied the communities of practice framework in top-down approaches or have assumed their existence,

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we argue for a careful examination of communities of practice dimensions before examining the social learning that occurs.

Rickinson's (2001) seminal review of research on learning and learners in environmental education calls attention to the need for critical examinations of both use and meaning of the term 'learning' and to learning as a 'process' rather than product. In response, Dillon (2003) argues for greater attention to the theoretical underpinnings of learning in environmental education. Dillon identifies a paradox in environmental education, in that it can provide out-of-classroom learning opportunities yet ignore any critical examination of how learning occurs in non-formal learning settings. While calls for addressing theory and epistemology have been made in the past (Hart and Nolan 1999; Robertson 1994), it is clear that the need for work to address these issues further remains.

Situated and more broadly sociocultural learning theories can provide an alternative to established views of cognition and learning which depict learning as an individual and isolated cognitive phenomenon (Kirshner and Whitson 1998). Instead, sociocultural theories, including situated learning (Lave and Wenger 1991), situated cognition (Brown, Collins, and Duguid 1989) and cultural–historical activity theories (Engeström 1987), all share the premise that the culture and history of contexts must be accounted for in an examination and explication of learning (Lattuca 2005). Additionally, situated learning more specifically contends that learning is a social process that occurs as individuals participate in communities of practice (Wenger 1998). Rather than looking at cognitive or conceptual changes in individuals, these theories examine individual identity formation and transformation through participation and membership in various contexts, or communities of practice, as key to the process of learning.

Dillon (2003) suggests that situated learning theories, because of their emphasis on the importance of context and participation, might be particularly appropriate for examining learning in non-formal environmental education settings. For environmental education, sociocultural learning theories provide an opportunity to go beyond assumptions about the outcomes of education situated in 'real-life' contexts, to examine the social and other processes through which learning occurs in these out-of-classroom settings integrating nature and interactions with other learners. Additionally, researchers examining sociocultural theories of learning have argued that situated learning theories might help to examine peripheral and marginal positions of students in the sciences (Brickhouse 2001; Lemke 2001). As Lemke states, 'Our goal is science for all, but what does this mean if our particular view of science is too aggressively masculine to sit well with many students' identities?' (2001, 300). Therefore, in an attempt to further understand how one group of learners, Hispanic youth in the southern USA, are participating and learning in an after-school environmental education program, we turned to sociocultural theories and more specifically to the communities of practice framework.

As part of a larger study examining participation of Hispanic youth in both formal and non-formal science-learning contexts through the lens of situated learning, we originally assumed most learning contexts could be understood as communities of practice, albeit varying widely in what constituted the community and the practice. However, we soon learned that the educators, learners, and ourselves as observers, held views of the learning and participation occurring in these settings that at times were inconsistent with those in the communities of practice literature. Thus, rather than assume that the communities of practice framework applied universally to different environmental and science education settings, we stepped back to examine how the

educators, learners, and ourselves as observers, described their participation and learning processes. Specifically, using Wenger's (1998) communities of practice concepts, we posed three questions: (1) How do Wenger's three dimensions defining communities of practice (joint enterprise, mutual engagement, and shared repertoire) manifest themselves in an after-school environmental education program? (2) How do students participating in the environmental education program understand these dimensions? and (3) How can Wenger's dimensions provide a framework for describing learning as participation, membership, and identity formation in an after-school environmental education program? We hoped that answering these questions would build our understanding of the application of a communities of practice framework to environmental and science education contexts and of learning as a sociocultural process.

Theoretical framework

In response to the aforementioned calls for greater examination of theoretical underpinnings to learning in environmental education (Dillon 2003; Rickinson 2001), and clarification of associated epistemological assumptions and tensions (Meyers 2005), some researchers have begun to examine the significance of sociocultural factors to environmental education learning. For example, Brody's (2002) 'learning in nature' suggests that learning in environmental education is both a product and process of the interaction between the personal, social and physical realms, while Falk and Dierking's (2000) 'free-choice learning' draws attention to motivation in environmental education learning contexts. Whereas these theoretical frameworks describe the process of environmental education learning as a sociocultural activity, the focus tends to remain on the cognitive or affective product for an individual student (e.g., science content knowledge, understanding, and beliefs). In contrast, situated learning theories examine the sociocultural activity *and* the sociocultural outcomes of activity as learning. Learning here involves doing, being, knowing, and engaging (Lave 1993), concepts that are open-ended and thus difficult to define within neat parameters. Indeed, sociocultural frameworks allow us to examine aspects of environmental education learning often overlooked in other studies, such as how students learn to interact with each other and the teacher, and appropriate norms for the classroom and peer groups (Brickhouse and Potter 2001).

According to Wenger (1998), communities of practice is a place of learning where practice is developed and pursued, meaning and enterprise are negotiated among members, and membership roles are developed through various forms of engagement and participation. In other words, each communities of practice involves a unique system of: (1) *joint enterprise* through negotiated meaning, (2) *mutual engagement*, and (3) *shared repertoire* (Wenger 1998). The *joint enterprise* refers to how members negotiate their response to the conditions and goals of the communities of practice; *mutual engagement* involves the sustained interaction of people within a communities of practice and the roles and relationships that arise from this interaction; and *shared repertoire* consists of signs, symbols, tools, and language that are used as resources and have meaning specific to the community (Wenger 1998). All dimensions work together to determine the practice, and the practice, in turn, works to refine the dimensions.

For Wenger, the three dimensions contribute to a process of learning that involves participation, membership, and identity formation. Identity formation is a considerable and contested theoretical concept (Gee 2000–2001), so here, we restrict our discussion to Wenger's (1998) account of the processes of learners defining who they

are: (1) through negotiated experience in practices, (2) based on what they know and do not know, (3) through experienced pathways both within and between communities, (4) by reconciliation of belonging to various communities, and (5) by negotiating local membership to broader, outside communities. Identity formation then becomes a product of participation in communities of practice and simultaneously influences the practice. Because this notion of identity formation is dependent on engagement with others, it allows for various levels of participation (including non-participation) and multiple levels of membership including core, peripheral, and marginal. Therefore, understanding any evolution of Wenger's dimensions and the practices associated with them helps guide an understanding of how an individual might form identities within a context, including those where learners' identities might come into conflict with science and environmental learning goals.

The communities of practice framework has been used to analyze learning as participation and change in identity in a range of learning contexts, from the workplace to science classrooms (Case and Jawitz 2004; Kolikant, McKenna, and Yalvac 2006; Linehan and McCarthy 2001; Wenger 1998). In applying the framework to environmental education in non-formal contexts, we first collected empirical evidence to determine how the three dimensions are expressed in various settings, and then used the framework to examine learning as a sociocultural practice.

Study participants

All participants were from the environmental club (EC), an after-school environmental education program in schools along the Gulf Coast of Texas, USA. The program's goal is to bridge coastal communities from the USA and Latin America around a common concern for the Gulf of Mexico through the use of English and Spanish language, community involvement, and field trips. Thus, identity building, developing partnerships, and building community are important elements of the club. Clubs functioned under the guidance of the program director, a science teacher, and a Spanish teacher. They generally met once a week during the school year and club sizes ranged from 10 to 35 students, with sometimes sporadic attendance. All ECs were extracurricular opportunities, in which students were able to join of their own 'free-choice' (Falk and Dierking 2000). Because the ECs target Hispanic students, this study was able to examine learning among students who are often marginalized in the sciences (Bouillion and Gomez 2001; Fusco 2001).

A preliminary year-long study (2005–2006) helped to determine which EC associated schools should be used as case studies. Using homogenous sampling (Patton 2002), the lead researcher (Aguilar) selected schools based on: (1) stability of EC, (2) science teacher presence in EC, (3) similarities on the states' school report card (Texas Education Agency 2006–2007), (4) presence of Hispanic students, and (5) proximity to each other. As one school experienced organizational and attendance problems in the middle of the study, we used opportunistic sampling to recruit another school. While homogenous sampling may limit the ability to extrapolate from the results, it allowed for a greater focus on students and contexts with similar demographics and backgrounds.

By focusing on multiple sites sharing several common factors, including the program director and goals, we were able to look more closely at contextual differences (represented in Table 1) rather than pedagogical differences. Beyond the slight differences in student body, the ECs at each school also differed in a number of ways, including use of Spanish language during club activities, student ethnicity, and nature of field trips.

Table 1. School and EC characteristics.

School/ environmental club	Surfside Middle School	Tidal Wave Middle School	White Sands Middle School
School location	Coastal Plains, TX	Coastal Bluff, TX	Coastal View, TX
District category	Non-metro stable	Non-metro stable	Non-metro stable
School size	>800 students	275 students	325
School academic performance	Academically acceptable	Academically acceptable	Academically acceptable
School demographics	56.5% Hispanic 36.7% Caucasian 2.6% African-American	47.1% Hispanic 44.9% Caucasian 5.8% African-American	39% Hispanic 54.5% Caucasian 3.4% African-American
Club attendees	15 regular 25 general	Five regular 15 general	Six regular 10 general
Club demographics	100% Hispanic	40% Hispanic	50% Hispanic
Club existence	Three years	Four years	First year
Club language	Spanish	English	English

Note: Data for school location, district category, school size, school academic performance, and school demographics from Texas Education Agency (2006–2007).

Club settings

Surfside EC, Coastal Plains, TX

During the 2006–2007 school year, 15–25 students regularly attended the EC. The group was split almost evenly between female and male participants. All students in the club were Hispanic and most identified as Mexican. Spanish was the predominant language used by the students and English was the predominant language used by the teacher co-leader during club meetings. When the program director attended, he often addressed the group in both Spanish and English. A student in the club typically served as a translator for students with limited English proficiency. Because the EC encouraged a bilingual dialog, it was a popular activity among ESL (English as a second language) students at this school. In fact, approximately 60% of the ESL students in this school participated in the EC (principal interview). The participating students were in Grades 7 and 8, but club alumni from the high school also frequently attended the meetings. The field trips included visits to a nuclear power plant, a local wildlife refuge, and bodies of water within the local watershed. EC members also sampled water quality along the watershed and kayaked in a local river.

Tidal Wave EC, Coastal Bluff, TX

During the 2006–2007 school year, approximately five students attended the EC regularly, but occasionally attendance reached up to 15 students, almost all of whom were female. The EC at Tidal Wave was ethnically diverse, consisting of both Hispanic and Caucasian seventh-grade participants. Spanish was sparsely used in the club, and there were no ESL members. Many of the members were involved in athletics and band, so attendance was often sporadic and inconsistent from member to member. Activities included participation in beach clean-ups, developing floats for a ‘no-littering’ parade, running activity booths at community fairs, and visiting a local wildlife refuge.

White Sands EC, Coastal View, TX

This club, which became part of the study midway through, was ethnically and racially diverse with only one male attending regularly. Spanish was rarely used, except for the few occasions when the Spanish teacher co-sponsor translated keywords from English to Spanish. There were no ESL members involved in the club. The club consisted of between five and 10 students, with six students attending regularly, all of whom were eighth graders. Activities included field trips similar to Tidal Wave's EC.

Individual students

The lead researcher used intensity sampling (Patton 2002) and the following criteria to choose three students to participate in in-depth individual interviews at points throughout the school year: (1) participation in EC, (2) researcher's ability to communicate with the student, (3) willingness to participate, and (4) parental consent. The number of students meeting all criteria was extremely limited, and thus the selection of students introduced bias into the study. Two eighth-grade students born in Mexico, *Susana*[1] and *Luis*, from Surfside Middle School, and one seventh-grade Mexican-American student, *Monica*, from Tidal Wave Middle School, were selected. Due to the limited time at White Sands, we were unable to gather sufficient data from an individual student.

Methodology and data collection

Our study focused on understanding a theoretical construct, learning as participation, through various perspectives using multiple methods. Thus, we used qualitative methods to develop case studies for each EC, a methodology consistent with the in-depth nature of the questions about student participation and lack of control over settings (Yin 2003).

The lead researcher acted as a participant-observer, aiding the program director and teachers and occasionally leading activities. She attended club meetings weekly at all three schools during the 2006–2007 school year, conducted formal and informal club observations on a weekly basis, alongside semi-structured focus group interviews with four to six students three times over the course of the year in each EC, and semi-structured individual interviews with three students three times during the spring semester. EC meetings were also occasionally audio-recorded, and extensive field notes and reflections during and after each EC meeting were taken. Individual students were asked to keep journals and to depict club members' locations within the EC practice through drawings, thus allowing them to articulate a difficult concept (i.e., communities of practice) and providing insight into the perceived situating of members (i.e., core, peripheral, or marginal) in the club.

Observations, drawings, and interviews focused on Wenger's (1998) communities of practice dimensions as depicted in Table 2. During focus group interviews, students were asked explicit questions about their interpretations of the notion of community, what communities they felt a part of, and what practices they undertook in these communities. Because the interviews were semi-structured, a strict script was not adhered to. Rather, the themes and questions from Table 2 were used to guide the focus group interviews and helped to translate complex terms like joint enterprise into questions or issues the students could understand. Individual interview questions focused on students' participation, membership, and identity with the EC and their

Table 2. Communities of practice dimensions guiding interviews and observations.

Communities of practice dimensions (Wenger 1998)	EC observation and interview
Joint enterprise Purpose of practice Evolution of practice	What is the purpose/goal/activity and common practice of the community? Who determines this? How is it determined? How is it expressed?
Mutual engagement Membership Engagement Participation Roles	How do people participate in the club activities/ discussion? In what types of roles are students engaged? In what types of roles are leaders engaged? What does full membership look like?
Shared repertoire Tools/language	What artifacts/symbols/words are used to give meaning to this community?

science classroom, in an attempt to examine the complexities of participation and identity formation that might be occurring in these contexts. The examination and comparison of both emic (student) and etic (researcher) perspectives (Pike 1967) strengthened claims about the communities of practice dimensions.

Data analysis

We employed a variety of methods in an attempt to develop rich, descriptive cases, and to strengthen claims of validity. We also employed data triangulation across methods within cases and across cases throughout the study (Patton 2002), recorded notes and researcher reflections after every data collection session and reviewed them before subsequent data collection visits (Creswell 2003), and used member-checks with respondents (Creswell 2003).

Additionally, we first developed a close familiarity with the theory to determine the dimensions to which the data could correspond. Thus, the lead researcher initially reviewed and highlighted interview transcripts, observations, and reflection notes for the three main dimensions from each case making notes about other themes and possible questions that might arise in the data. After multiple readings, themes related to identity, trajectory, community, and practice began to appear regularly, and were coded. Data were coded as segments rather than terms or single words (Linehan and McCarthy 2001), as the intention was not to reduce data to single identifiers but rather to develop a rich understanding of the communities of practice dimensions. Drawings were also matched with their respective interviews and the dimensions students were asked to represent in their drawings were examined. Once all data were coded, the analysis proceeded to where the findings converged in each case to determine which ones were most strongly supported by the data. Findings were compared first within each case to look at the strength of dimensions from each method of data collection, and then across cases using analytic induction (Patton 2002).

Findings

In all three ECs, the researchers were able to recognize and describe the three dimensions of Wenger's communities of practice framework, through interviews, observations, and student drawings. The students also seemed to recognize Wenger's

dimensions through their responses to the interview questions (see Table 2) and were able to articulate whether their EC was simply a community or a community of practice. Whereas each EC was unique in its joint enterprise and mutual engagement, shared repertoire was similar across all three ECs. Summaries of the findings are presented in Tables 3, 4, and 5, respectively.

Surfside EC

Joint enterprise, mutual engagement, and shared repertoire

At Surfside, we were able to discern aspects of the joint enterprise as students discussed reasons they joined and remained in the club (Table 3). They understood that there would be 'science' activities in the club, and also heard from friends that the club would be 'fun'. Over the year, both interviews and observations indicated that the Surfside EC evolved into a social network for many of the ESL students (Table 3), as depicted by aspects of mutual engagement and terms for membership. Interview responses and observations regarding mutual engagement illustrated that students, despite belonging to different peer groups, were able to work together and build camaraderie, ''cause we're close to some people (more) than to others but we all know each other'. The majority of students agreed that anyone consistently attending the EC was a member, despite differences in participation. One student responded, 'even though there are some people that are like not listening, they still do what we do with each other'.

In order to better understand how one might be a peripheral member, we asked about roles in the club. The students struggled with this question, but one student responded with, 'well it's just like, some of us might play a little bit of the same role or like maybe we have like more than one role'. Another student deliberated, 'Yeah, 'cause there's not really a leader in the club. We all do it together'. In fact, our observations indicated that everyone had a chance to lead, translate, play around, and contribute to the activities in their own way, indicating the EC provided space for students to participate in various manners meaningful for them (Table 3).

The provided snack, presence of the program director, and use of Spanish comprised the students' shared repertoire. In the last interview with club members, it appeared that the use of Spanish actually served as a type of boundary for club members. Inherently, this also determined who could really participate as a full member in the group. While the students said it did not matter to them if a member was Mexican or could speak Spanish, they did think 'it would be odd' to have somebody in the EC who did not identify as Mexican or did not speak Spanish. Thus, whereas it appeared all members were equally accepted, none of the predominately English-speaking members from the previous year stayed in the club. Thus, Spanish was both shared repertoire and a symbol of membership in this club (Table 3).

Learning as a social process

A brief entry from a student's journal indicated that students outside of the EC might have negative perceptions of club members. When asked to respond to the question, *How does belonging to these communities affect your role in other communities?* Luis wrote, 'Some will think that EC is gay "n" probably won't like you'. Still, when asked to discuss if he felt he belonged more to the science classroom or the EC, he wrote, 'the club because I have more friends and I give my opinions', indicating he was more comfortable in the EC than in the science class. The benefits of participation in the EC

Table 3. Surfside EC communities of practice dimensions.

Communities of practice dimensions	Surfside EC
Joint enterprise Purpose of practice Evolution of practice	Student goals are to learn about science, have fun, and make friends. This is negotiated by students, teacher, and director. The enterprise evolves over the year to one that presupposes a social network for students on the margins of the school community.
Mutual engagement Membership Engagement Participation Roles	Students engage as peer groups, but are also able to work together. They befriend each other throughout the year, but there are also instances of broken friendships and relationships. Roles include a leader and translator, but students voice that everyone has the same role or there could be multiple roles. Membership evolves to one that corresponds with the shared repertoire of language. Students that can speak Spanish and attend the meetings are considered equal members.
Shared repertoire Tools/language	Spanish language, snack, director's presence.
Learning as a social process	Understood as a connection from participation in the EC to other areas of life, 'science is not always boring, it can be fun'; 'science is part of my life because I like plants and animals'. Understood as identity with the community, 'the club, because I have more friends and I give my opinions'.

outweighed the negative consequences of being perceived as 'gay' by outsiders. This also illustrated that an identity was associated with the EC from members both inside and outside of the group.

Learning in the context of this EC could be viewed as membership and a developed identity with the club. Additionally students were able to connect participation in a broader community that involved speaking Spanish to competence in the local community of the EC. Students were even able to see connections between the broader community of science and the local community of the EC, as Susana noted in one of her interviews:

> It's like … you know when we went to the field trip over there … and we were looking for birds. That was fun, and like that was science I guess, but like that was fun, you know? … I thought it was gonna be like boring you know? I don't know, we're talking about all these numbers or whatever like, you know, science.

Such connections exemplify learning as connections of experience between communities and the negotiation of belonging to multiple communities as identity formation (Wenger 1998) (Table 3).

Tidal Wave EC

Joint enterprise, mutual engagement, and shared repertoire

Students in the Tidal Wave EC agreed that the practice of the EC community was to care for the environment: 'to achieve a better environment and community'; 'help

save the whales'; '(save) fish and keep our bays clean'. The students even expressed a desire to participate in more club activities, like beach and highway 'clean-ups', and were willing to do so through the summer, exemplifying the reach the practice had outside the EC context. Unlike Surfside EC, students were not necessarily joining the club to make friends. The enterprise was predominately negotiated to fulfill a sense of stewardship for the members (Table 4). The activities they participated in served as a means of engagement with the local community and as a link to connect science to their life outside of school.

Student drawings helped to illustrate mutual engagement and clarify the relationship between club attendance and membership. Students drew a circle representing the EC, where the center symbolized a member committed to the enterprise. Two students positioned most members in the center of the community. However, two different students drew a few members in the area between the center and outside, describing these members as 'participating but not as much as the others' and as 'people there just to get out of school for field trips'. For these students, core membership was defined by reasons for attending EC and by regular attendance at meetings and field trips (Table 4). Engagement among members here was inconsistent due to student involvement in other activities. Observations indicated students were only engaged when they worked on activities. Thus, similar to the joint enterprise, mutual engagement centered on concern for the environment rather than on relationships with other club members (Table 4). Shared repertoire included field trips, t-shirts from the field trips, snacks during club meetings, and the term 'tree-hugger' (Table 4), which seemed to resonate with the girls in this club and served as a type of identification for the participants.

Learning as a social process

Two excerpts help illustrate how participation and membership in the EC affected students' identities, illustrating learning as a social process (Table 4). First, in a discussion with Monica about her participation in both the science classroom and the EC, she claimed, 'I think in science I have more friends because I know more people there'. Yet, when asked which context she felt she belonged to more or was more a member of, she responded, 'The EC. Yeah, I think I am more involved in that than I am in science class'. Observations indicated Monica's behavior was quite similar in both contexts, but she was much more talkative in science class. Therefore, this last response is surprising in that observations of other ECs suggested that having friends in a group helped one to feel like they were a member of that community. It appears the EC gave Monica more opportunities to get involved in ways she found satisfying. Membership did not simply entail being present and working on activities, but involved a deeper personal connection to the purpose.

Another interview segment also illustrated how Monica and others identified with the EC community. While discussing that the girls were referred to as 'band geeks' because they were all in band, the lead researcher asked if there was a similar badge of identification associated with the EC. The girls responded that they were often called 'tree-huggers'. For them, this term was a form of solidarity that they seemed to take pride in. Like the EC at Surfside, others outside of the club influenced the identity associated with membership in the EC. Students in the club were willing, if not eager to take on this identity.

Table 4. Tidal Wave EC communities of practice dimensions.

Communities of practice dimensions	Tidal Wave EC
Joint enterprise Purpose of practice Evolution of practice	Students agree that enterprise involves helping the environment and the community through specific activities like beach clean-ups, 'to achieve a better environment and community'.
Mutual engagement Membership Engagement Participation Roles	Membership is determined by a commitment to the EC's enterprise of stewardship, and to those that attend regularly. It is also determined by consistent attendance to meetings. There are no clearly distinct roles in the club. Participation involves attending meetings and events.
Shared repertoire Tools/language	Impending field trips, t-shirts, snacks, 'tree-hugger'.
Learning as a social process	Understood as identity with and belonging to the EC community. Students find solidarity in 'tree-hugger' term.

White Sands EC

Joint enterprise, mutual engagement, and shared repertoire

Here students seemed to quickly grasp the concept of a community of practice and immediately identified their club as an example of one, where people were 'all working, reaching for the same thing'. That 'thing' for the students primarily concerned the environment and environmental stewardship. However, one student also felt that the goal was broader, 'Not only the environment, we, you know, down here we've also got a lot of Mexicans and Whites, no offense. But we get used to our community, the EC. We're also getting use to the other people around here'. This statement was telling of not only the context of White Sands, which was more ethnically diverse than the other ECs, but also about the impact that this EC might have had on the larger community relative to cultural and ethnic understanding, and suggests the practice involved a connection to their town and life outside of school. Another aspect of the enterprise was revealed when the students were asked why they joined the club. One answer summed it well, ''cause like I feel awful for the community and everything, and the jobs I wanna do work a lot with science. And also it looks really, really good on your record if you participate in things like this', illustrating how the students negotiated the ideal practice of the club (i.e., to help the environment) into one that supported their future endeavors (Table 5).

Disagreement arose when the students were asked about mutual engagement and participation in the EC. Students eventually agreed that those present during the interview were also the core group of students that worked hard and were devoted to the EC's goals. However, a few members believed there were also students in the club who were not interested in the EC's goals. Instead, they argued, 'They are in it to go to the trips or just to get credit'. Thus, when students were asked in the final focus group interview to identify characteristics of an EC member, they described being a 'team player' and going 'to every field trip' as important. Membership in this club seemed to be determined by attendance at club meetings and a work ethic deemed appropriate by club members. If students were perceived as committed to the cause

and were regular attendees, they appeared to hold equal footing in the club (Table 5). Most importantly, students were able to identify their own position within the club as well as that of other members.

The tools and symbols that signified meaning in this club were more difficult to identify. This was probably a result of my short time with the club and its status as a new club. Still, like the other clubs, snack was a significant symbol of the club and t-shirts also served as shared repertoire representing involvement with events and dedication to the club's enterprise (Table 5).

Learning as a social process

Because part of the focus of the EC involved science, the researcher and students also talked about the effect participation in the EC had on their feelings toward science. Here, issues of identity surfaced and we saw how participation in the EC evolved to affect students' participation outside of the EC, both examples of learning as a social process (Table 5). For instance, students noted that if the EC instructor also served as their science teacher, the teacher would often direct questions toward them about particular issues, making one student 'feel like a little bit smarter than the people that are in our class because we know about it more'. Another student, Theresa, poignantly expressed how her EC participation affected her in class:

> One day in science she asked a question, well she asked the class a question, and it got quiet and I answered it. And out of nowhere you hear like people who are saying, 'Theresa answered that? But she's an idiot.' No, she's extremely intelligent.

Both examples illustrated that students were able to traject their participation in EC to the science class and to express competence in science.

When asked to draw the EC and describe the characteristics of a club member at the beginning and end of the year, students depicted themselves in the club with the center of the club representing a student with all the characteristics of a club member. Some students had changed their positions, explaining that they were closer to the center because they felt they had learned more, liked the EC more, and felt more important. When asked during a focus group interview whether the changes had to do with making friends or just learning more, students responded with the following sequence of comments: 'Learning more', 'Learning more and making friends even though we pretty much knew everybody', 'But we weren't all friends'. One member then stated that she was not sure if she had really made friends in the club. Finally, at the end of the final interview with this group, a student offered, 'Because talking about it. It just made it feel like I'm a part of the full community of the EC', and another student added, 'like a full part of it'.

At the end of the study, most of the White Sands students interviewed identified themselves as full members of the club. They felt 'important now'. Students' trajectories followed a recognized commitment to the EC and an ability to connect their experiences in the club to other areas of their life. Through their ability to connect these experiences as an EC member, they appeared to develop a sense of competence and ultimately a sense of importance. As the students discussed how they had both made friends and learned, they recognized their own growth in the club.

Table 5. White Sands EC communities of practice dimensions.

Communities of practice dimensions	White Sands EC
Joint enterprise Purpose of practice Evolution of practice	Enterprise includes both environmental stewardship and learning how to get along as a group and with others in the community. It is also negotiated to address students' needs of future preparation for college and careers.
Mutual engagement Membership Engagement Participation Roles	Students are engaged with each other during interviews and events. Student roles are based on different tasks but are equal. Engagement is dependent on students' ability to work with each other and 'get along'. Membership is determined by students' abilities to work together and their attendance at club meetings and field trips.
Shared repertoire Tools/language	T-shirts, snacks.
Learning as a social process	Understood as a trajectory of competence and identity with the community, 'One day in science she asked a question … and it got quiet and I answered it, and out of nowhere you hear like people who are saying, "Theresa answered that? But she's an idiot." No, she's extremely intelligent.' Students feel 'important now'.

Discussion

This study represents the first attempt we are aware of to determine whether an after-school environmental education program includes the elements that define a community of practice, as proposed by Wenger (1998). Other studies (Barab and Duffy 2000; Hogan 2002) have applied the communities of practice framework more generally to suggest ways to design environmental education learning environments or to describe out-of-school environmental education, but have not examined in detail the dimensions that define a community of practice. For instance, Hogan (2002) examines a program that suggests students participating in a real-world environmental organization will gain greater competency as environmental practitioners. Instead, she finds that students were limited in their ability to learn the practices of environmental practitioners. Therefore, in an attempt to examine the utility of the communities of practice framework to understand learning as a social process, this study has had to carefully examine how Wenger's dimensions manifested themselves in the ECs and then examine how these dimensions create a framework for understanding learning as participation, membership, and identity formation. This is important because assumptions about the existence of communities of practice, and their enterprise, could lead to misunderstandings about both the learning process and the product.

Findings from the study suggest the communities of practice was an appropriate framework with which to examine the three ECs as settings for learning as a social process and product. All three ECs showed evidence of joint enterprise, mutual engagement, and shared repertoire. Despite being part of the same EC network, each club's joint enterprise was unique, suggesting the importance of student and educator agency in determining and negotiating the enterprise. The mutual engagement or membership was often characterized by the students as commitment and dedication to the joint enterprise, suggesting the interdependence of communities of practice dimensions

(Wenger 1998). Although shared repertoire was not often discussed by the students in interviews, through observations we were able to ascertain the objects, symbols, and issues that held particular significance for each club.

An examination of the ECs also helped to illustrate the phenomenon of learning as participation, membership, and identity formation, where these three concepts helped to shape each other and what the students deemed important for their personal growth (Brickhouse, Lowery, and Schultz 2000; Lemke 2001). Both participation and membership around the EC practice played a significant role in shaping students' identities in all three ECs, where participation and membership affected how students saw themselves (e.g., Theresa) and how others saw them (e.g., 'Tree Huggers', cf., Brickhouse, Lowery, and Schultz 2000; Reveles, Cordova, and Kelly 2004). In turn these forms of identification affected how students further participated in the EC, as indicated by their trajectories of participation, and how they used the EC to meet their individual needs (cf., Roth and Lee 2002; Wenger 1998).

Whereas all three ECs demonstrated Wenger's three dimensions, albeit with differences among all ECs, a related study (Aguilar 2009) showed mixed results related to the communities of practice dimensions in science classrooms. In contrast to the results of this study, the examination of communities of practice in science classrooms illustrated that students and teachers alike did not always agree on how they would define the joint enterprise, what mutual engagement consisted of, what the qualifications for membership were, or the meaning of shared repertoire (Aguilar 2009). Taken together, these studies suggest that a careful examination of learning environments is necessary before assuming the existence of communities of practice and their related dimensions. Possible explanations for the successful identification of Wenger's (1998) dimensions in all three ECs include the free-choice nature of student engagement in the EC, opportunity to define the joint enterprise, multiple opportunities for participation, and connections of activities and learning in the EC to other aspects of the students' lives.

Falk and Dierking (2000) have made the case that learning outside of formal classrooms often occurs as a result of personal need or curiosity. Students who chose to participate in the EC appeared to do so for reasons they found valuable in their lives and critical to their identity. For instance, at Surfside, the club provided a social network and sense of support that students seemed to lack in other areas at school. Research on Mexican-American student achievement has found that extra-curricular programs provide a source of social capital, via peer relationships, which can affect how these students participate and engage in schools (Gibson et al. 2004). Further, extra-curricular programs have provided students with a sense of membership and belonging (Gibson et al. 2004). These 'free-choice' programs have offered students and teachers a space freed from institutional constraints that dictate both what is important to know and the social structures that affect access to social capital (Gibson, Gándara, and Koyoma 2004).

Consistent with the notion of the relative absence of constraints imposed by formal classroom settings, students in the ECs were able to negotiate the joint enterprise for their particular club. Viewed from the perspective of an ecological theory of knowing, where, according to Barab and Roth (2006), the physical environment gives rise to affordances (opportunities that allow for action) dependent on effectivities (skills needed to act), the EC participants' effectivity sets and affordance networks converged on similar paths within any one club, allowing for a better understanding of the purpose or practice and enabling students to better negotiate the enterprise to

pursue their own goals. The differences in joint enterprise reflected the differences in effectivity sets of participants and affordance networks offered by each setting.

Further, similar to other environmental education settings, the EC provided multiple opportunities for participation and engagement (Boyer and Roth 2006; Roth and Lee 2004). Boyer and Roth (2006) found volunteers in an environmental program who appeared to be 'off-task' were actually contributing to the learning goals of the program, suggesting that modes of participation do not need to be singular. A related finding was the equality of membership for students in the clubs. Most students were considered equal participants if they were perceived to be engaged with the joint enterprise, which was likely a result of the multiple opportunities the EC provided for participation.

Finally, the types of activities and the modes for participation in the EC may have allowed for greater access to participation and thus identity with the communities of practice. Similar to Roth and Lee's findings (2004), participation in the community science activities led to learning that crossed 'community' boundaries, so that students took lessons from participation in the club to other areas of their lives. In addition to science, building a social network of students with similar backgrounds, contributing to their local and global communities, and preparing for their futures constituted aspects of the joint enterprise that transferred to the students' daily lives.

Conclusion

If environmental education researchers intend to move beyond the constructions and interpretations of learning that have dominated past research, we might well begin to adopt more sociocultural learning theories, such as the communities of practice framework, to examine how environmental education programs contribute to a social process of learning. Being able to define how Wenger's three dimensions of joint enterprise, mutual engagement, and shared repertoire develop within environmental education settings may also help move research beyond more simplistic notions of experiential learning and assumptions about how situating learning in outdoor activity automatically leading to conceptual or behavioral changes. As practitioners and researchers, we need to think more critically about our development of activities and programs focused on environmental and science concepts, especially when we assume that these concepts are the core of our practice.

In fact, our study illustrates that joint enterprise will not necessarily be that prescribed by the teacher or director, but rather, emerge from negotiations through the interaction among members to meet their needs. Research then must also engage why students are joining environmental education programs and what they expect to gain from these programs. This is especially important for environmental educators who work with marginalized or under-represented student populations. Using these questions may help to prepare us for the unique shape each program takes on, due to individual agency and goals, but may also help ensure the practice is able to attend to both individual and collective goals.

Still, a number of studies have identified problems with the communities of practice framework in various fields of research. In *Beyond Communities of Practice* (Barton and Tusting 2005), researchers identify weaknesses within the framework as it relates to discourse, linguistics, literacy, and positions of power. In our related study on science classrooms (Aguilar 2009), we find these weaknesses to be much more prominent than in this study. However, our understanding of how joint enterprise,

mutual engagement, and shared repertoire contribute to the social processes of learning in the EC does require an examination of other sociocultural learning theories. Thus, while this study provides a first step in exploring more in-depth situated learning theory, additional work comparing multiple theoretical frameworks and their applications to understanding and designing learning environments is warranted.

Note

1. All student, club and school names used are pseudonyms to protect participants' identities.

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