Complementary expertise in a zoo educator professional development event contributes to the construction of understandings of affective transformation

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Abstract Cultural Historical Activity Theory served as the analytical framework for the study of a professional development event for a zoo's education department, specifically designed to build understandings of "Affective Transformation," an element pertinent to the organization's strategic plan. Three key products—an Affective Transformation model, scaffolding schematic, and definition, "providing emotional experiences for visitors which increase caring for animals and nature that may lead to zoo-related nature-protective behaviors"—emerged as a result of ongoing deliberation among professional development community members over two days. Participants, including both management- and non-management-level staff, as well as an expert facilitator, contributed complementary expertise to the process. The discussions, therefore, crossed both vertical and horizontal layers of authority. Moreover, leadership was distributed across these levels in the development of these products. Members used pre-existing resources, as well as tools created in the course of the professional development event. Interactions among participants and resources were instrumental in Affective Transformation product development. Examination of one zoo's construction of understanding of affective goals, therefore, may offer insights to other organizations with similar aspirations.

Keywords Affective Transformation · Cultural Historical Activity Theory (CHAT) · Educator · Informal education · Informal science institution · Professional development · Zoo

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The research study described in this article demonstrates the ways in which a common understanding of a key component of one U.S. zoo's strategic plan was constructed via a participant-driven professional development two-day event especially designed for its education department members. Henceforth, the institution is referred to as the Zoo. The names of the zoo and of the participants are not included in this article in order to maintain confidentiality.

The focus of the study was on how interactions among interrelated elements present within the professional development program contributed to a variety of understandings and outcomes. Data analyses indicate that the emergent objectives and associated outcomes within the professional development program, along with exchanges among participants that crossed both vertical and horizontal layers of authority, were central to construction of these understandings. As discussed below, the elements and interactions are viewed through an activity system (Engeström 1987) analytical lens. A description of the professional development target concept, Affective Transformation, is provided and examples of professional development program outcomes provide context for the discussion of the professional development activity system.

The context of the event provided an opportunity to research professional development that situated the participants as resources central to building understandings of a target concept.

Professional development program participants contributed to a common understanding of Affective Transformation by sharing their own expertise and perspectives. Such perspectives were based upon their personal experiences and the roles in which they operated, e.g., as zoo staff persons and, in the case of the professional development facilitator, as a researcher and expert in conservation psychology. This study reported here, therefore, provides a window into the sociocultural context of a science education professional development program that valued the expertise of the participating practitioners. This participant-centered focus is consistent with the learner-centered approach prevalent in informal science institutions such as zoos (National Research Council 2009). As demonstrated by the vignettes presented in this article, this professional development program was an exemplar of participant-driven activity, within which specific objectives and outcomes supporting the overarching goal were determined by the participants and the facilitator in real time, rather than being prescribed beforehand.

The context of the activity also provided an opportunity to research professional development focused on a concept relevant to the larger environmental education community. Affective Transformation, a term that was used by Zoo leadership since the early 2000s, and that has appeared in the Zoo's strategic plan since 2007, had not been formally defined or modeled in the environmental conservation education research literature. As the opportunity to provide professional development for the Zoo's education department arose, Affective Transformation was one of the target concepts addressed because it was of interest to the Zoo. Although Affective Transformation had not specifically been previously defined, affective outcomes are common goals for zoos, which have environmental conservation, animal care, and science research, as well as educational aims (Association of Zoos and Aquariums 2009). Patricia G. Patrick, Catherine E. Matthews, David Franklin Ayers, and Sue Dale Tunnicliffe (2007), in a study of 136 zoo mission statements, found that 88 out of 131 statements containing the theme of education included affective sub-themes such as inspiration, awareness, motivation, and appreciation. They also found affective terms in all 44 statements that related the themes of conservation and education. Examining how one zoo addressed the challenge of building understandings of their

affective goals, therefore, has the potential to offer insights to other zoos wishing to embark on similar endeavors.

Cultural Historical Activity Theory as a framework

Cultural Historical Activity Theory (CHAT) served as an analytical framework well-aligned with the social constructionist (Schwandt 2003) paradigm that characterized this research study. CHAT served as a theoretical construct for data analysis and interpretation, rather than as a construct for development of the professional development program. Following principles discussed by Yrjö Engeström (e.g., 1987) CHAT allows the professional development event to be conceptualized as a system with subjects, or individuals, that comprise a community with objects, or objectives. Within the system, divisions of labor among the community members are manifested by the roles they hold and enact as objectives are pursued. The pursuit of objectives is mediated by artifacts or tools within the system, i.e., those resources already available or newly created. Rules, or norms, present within the system also influence "artifact-mediated and object-oriented activity" (Engeström 2001, p. 136). These CHAT components, e.g., tools and roles, interact within the system, leading to outcomes. Importantly, "[a]ctivities are *social* [emphasis added] practices oriented at objects" (Engeström 1999b, p. 380) and the relationship between the individual and the collective leads to the distribution of cognition and expertise (Cole and Engeström 1993). The analytical discussion of the professional development event that appears in this paper is framed within this CHAT lens.

Participatory, qualitative research methods

Other components of the professional development program, in addition to the Affective Transformation segment discussed in this article, included learning communities (Kelly 2011) and components that addressed personal assessment (Kelly 2009) and program evaluation; the latter focused upon evaluation in terms of the Affective Transformation goal. Twenty-three Zoo education department members participated in the overall professional development program and related research study. Various real-life circumstances, however, prevented 100 % attendance in each professional development segment.

The professional development program was designed and implemented with the guidance of a collaborative zoo-university Planning Team. At the time of this professional development two-day event, this team included a university faculty member, a science education doctoral student, and three members of the Zoo's education department. Two of these three Zoo-employed Planning Team members held management positions within the department. Although the third member did not hold a management position, she was in a leadership position in the professional development program as Project Manager. A non-management level Zoo education department staff member joined the Planning Team subsequent to this event. Research efforts surrounding the professional development event were led by the doctoral student as a participant researcher (the first author of this article), and were supported by other Planning Team members, each of whom also served as participant researchers, including the second author of this article, the Zoo-employed professional development Project Manager. Furthermore, the Zoo-employed Planning Team members were also participants in the professional development program. The Planning Team members referred to in this article include only the Zoo staff persons. The

doctoral student was also a professional development participant in the overall program, with differing levels of involvement in participant roles in each professional development segment.

The particular collaboration of the two authors of this article is reflective of the overall collaborative, participatory nature of the professional development program and research study. The second author of this article, for example, participated in early analyses of the professional development event and, in particular, of the products resulting from the event. The first author of this article introduced to the research team the usage of theoretical frameworks in research and CHAT, specifically. Although the first author, through participatory research methods, contributed both insider and outsider perspectives, the second author's contributions to interpretations and conclusions resulting from analyses reflect an insider perspective that would not have otherwise been possible.

Video and transcribed audio recordings of the 10.5 h professional development event that took place over two days (January 25–26, 2007) and artifacts produced during and resulting from the event (i.e., three Affective Transformation-related products) were the data sources drawn upon in exploration of the research question: In which ways did the following professional development program elements contribute to the development of a model, schematic, and definition of an important aspect of the Zoo's strategic plan, Affective Transformation?

- the Zoo staff members for whom the professional development was designed
- resources other than the staff members, (e.g., a professional development facilitator and extant research literature)
- interactions among staff members and other available resources

Qualitative analyses contributing to the discussion that follows categorized the happenings of the professional development event into CHAT components and explored how interactions within the system led to outcomes.

Interactions within the activity system

Although the Zoo education department was already taking steps to clarify Affective Transformation through the formation of a departmental committee tasked with reviewing relevant literature, such as that from the field of conservation psychology, the Planning Team hoped that the new professional development surrounding this target concept would support and expand the departmental efforts. During a professional development planning focus group with Zoo education department staff members, it was evident that there was some trepidation around the Affective Transformation term. When asked to describe Affective Transformation, participants attempted to recite from memory a working definition that the departmental committee had devised rather than discussing the term with personal ownership and ease. In an early professional development planning stage, education department leadership sought a knowledgeable professional who could address Affective Transformation via a keynote address, as well as facilitate additional interactive professional development with Zoo staff members over a two-day period. Since Affective Transformation was not a yet discipline unto itself, Planning Team members chose an expert in conservation psychology, which was determined to be the closest available analog to Affective Transformation. According to Carol Saunders (2003), "[c]onservation psychology is the scientific study of the reciprocal relationships between humans and the

rest of nature, with a particular focus on how to encourage conservation of the natural world" (p. 138).

The keynote address was the opening event for the professional development program for the management and non-management level staff, administrative office staff, instructors, and interpreters who attended. Individuals from other Zoo departments such as administration, marketing, human resources, and animal division had also been invited and subsequently attended the keynote; the invitations to others reflected the zoo-wide significance of Affective Transformation. An afternoon session was attended only by education staff members and a marketing staff person, who also attended the second day of the event. While nearly all members of the education department attended the first sessions, not all education department staff members were able to attend the session on the following day because they were required to attend to other departmental responsibilities as necessary to operate the zoo.

The sections below discuss interactions among participants and resources (i.e., tools) that resulted in the production of three Affective Transformation-related products—a model, schematic, and definition, representing increased understandings of Affective Transformation among the community. The vignettes presented demonstrate how distributed expertise (Cole and Engeström 1993) contributed to the development of these products. In terms of CHAT, such distributed expertise was a *rule* that characterized the professional development event.

The process of developing an Affective Transformation model: The relevance of personal transformation narratives, conservation psychology literature, and the roles of the professional development facilitator and participants

As discussed in the vignette below, interactions between tools and the roles enacted by the facilitator and participants contributed to the development of an Affective Transformation Model. This vignette is informative because it (1) describes the development of this first of three Affective Transformation products; (2) demonstrates the social practice of activity; (3) illuminates how system elements—in particular tools, i.e., participants' personal transformation narratives and conservation psychology research literature, and individuals' roles—mediated specific outcome development; and (4) illustrates the participant-driven nature of this professional development program.

Personal narratives and the roles of the professional development facilitator and participants. The roles of the professional development facilitator and the participants were both pertinent to the development of an Affective Transformation Model. Notably, neither the professional development facilitator nor the Planning Team prescribed development of a "model" at the outset of the program. Instead, the facilitator proposed a model after holding a discussion with the participants. The professional development facilitator invited participants to share "experiences that [had] happened to [them] that are related to conservation." She said these could be "a-ha moments," examples of activities in which they had participated, or things and people that were part of turning points that made their "commitment to conservation real." The participants, in turn, shared stories that the facilitator used as a tool to ground the conservation psychology literature (another tool, described in the section below) discussed in her keynote address. The significant function of participants' personal narratives as a mediating tool is illuminated early within the professional development program.

During the session, the facilitator summarized participants' input using categorizing terms such as "collective impact and something that catalyzed that awareness," "the
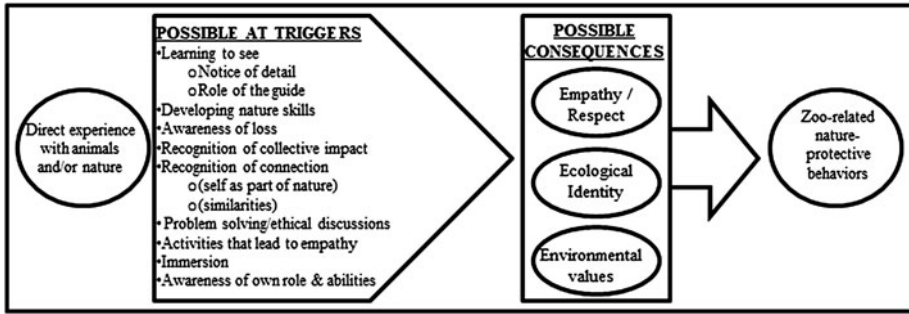
Fig. 1 Affective Transformation (AT) model developed during the professional development event. (Courtesy Zoo)

people component," "something that catalyzed a sense of loss of species," and "immersion." There is evidence that the participants' stories were used as a mediating tool by the facilitator to shape the Affective Transformation Model. It appears that these summarizing categories were closely tied to a list of "Affective Transformation Triggers," one component of the model proposed by the facilitator on the second day of the event (Fig. 1). Affective Transformation Triggers, e.g., recognition of collective impact and awareness of loss, may be described as experiences that influence environmental attitudes and behaviors. The role of the participants as active contributors was substantial to the progress made during the event. Likewise, the role of the facilitator in mediating these contributions was essential, as further discussed in the section below.

Conservation psychology literature and the role of the professional development facilitator. The section above described participants' narratives, which acted as a meditational tool in the development of an Affective Transformation Model. Additionally, conservation psychology literature was used as a tool in the development of the model. The facilitator's role as expert in this field interacted with this literature tool in order to further develop the model. The importance of attention to interactions within activity systems and towards objectives is highlighted in this activity. Following the participants' sharing of personal narratives, using a PowerPoint presentation based upon conservation psychology content, the facilitator discussed the terms "affective" and "transformation" separately. The facilitator introduced Louise Chawla's (1998) conservation psychology work concerning "significant life experiences" (p. 11) related to experiences outdoors and with an adult mentor. She also introduced a model of predictors of nature protective behaviors discussed by Elisabeth Kals, Daniel Schumacher, and Leo Montada (1999) and suggested that this model would be useful to the professional development participants due to its close alignment with their Affective Transformation objective.

On the second day of the professional development session, the facilitator proposed the Affective Transformation Model shown in Fig. 1. She suggested this model was influenced by the Kals et al. (1999) model, elements presented during the PowerPoint presentation, and "ingredients" from participants' stories. In particular, she noted that the literature *and* the stories were both reflected in the list of possible Affective Transformation Triggers. The evidence suggests that the facilitator mapped some of the participants' stories onto categories of experiences that influence environmental attitudes and behaviors already existing in the conservation psychology literature to compile a list of Affective Transformation Triggers. The left-most section of Fig. 2 includes the Affective Transformation
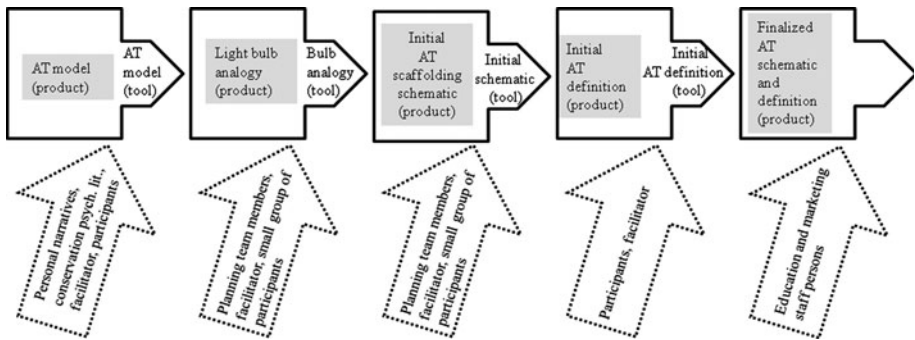
Fig. 2 Transitions within the professional development activity system that led to the construction of understandings of Affective Transformation (AT)

Model as a product and illustrates the activity system components contributing to the development of this product including personal narratives, literature, and the roles of the participants and the facilitator. This product, furthermore, then became a new component in the system. As described below, the product then began to serve a dual function, as both product and meditational tool while understandings of the target concept, Affective Transformation, were developed by the professional development participants. As Wolff-Michael Roth and Yew-Jin Lee (2007) state, parts of activity systems "can take different functions" (p. 199).

The Affective Transformation Model emerged first, but the 'official' AT *definition* was determined only after small groups proposed definitions, an analogy for Affective Transformation, and an Affective Transformation Scaffolding Schematic, discussed in the vignette below.

The process of developing an Affective Transformation Scaffolding Schematic: The relevance of the Affective Transformation Model and the roles of the professional development Planning Team, other participants, and the facilitator

The Scaffolding Schematic emerged during the pursuit of an Affective Transformation definition; there is evidence that the roles of the facilitator, the professional development Planning Team (a subset of the professional development participants), as well as other professional development participants were pertinent to the development of this schematic, as was the interaction of the roles enacted by the participants with the Affective Transformation Model, a tool previously developed during the professional development event. As was the case with developing the Affective Transformation Model, the development of an Affective Transformation Scaffolding Schematic was not an objective originally prescribed by either the professional development facilitator or Planning Team. This schematic is another example of an emergent outcome arising from social activity. The previous vignette demonstrated some of the nascent ways interactions among activity system elements, e.g., tools and roles, contributed to outcomes. As discussed below, as the professional development event progressed, additional layers of interaction emerged as the level of complexity within the activity system increased. This increased complexity was also exemplified by a "contradiction" within the activity system that surfaced during the occurrence described below. The function of this contradiction in the development of understandings of the target concept is also discussed.

Roles of the professional development facilitator, Planning Team members, and other participants. The path that led to the development of the final Affective Transformation definition was catalyzed by a Planning Team member's direction to participants on the second day of the professional development event when she said, "What we need to do now is really do some small group work on this definition." The facilitator agreed with the value of this objective, but favored identifying "components" of Affective Transformation rather than developing a "definition." This contradiction between the objective of determining "components" versus a "definition" continued to be present throughout the discussion. According to Engeström (2001), CHAT principles suggest that contradictions are "sources of change and development" (p. 137). The opposition present within the objective, as illustrated by the roles enacted by the facilitator and the Planning Team member, in this instance contributed to the emergence of multiple outcomes.

The Planning Team member told the facilitator that there had been a Zoo committee previously charged with this task of definition development. One member of this committee who was present provided two definitions. The first, "A change towards increased caring about animals and nature," she said was the working definition of Affective Transformation. The second, "A (lasting) increase in caring about animals and nature," she said was the definition within the Zoo context. She noted that "lasting" was in parentheses, because it was debated within the group. Another staff member questioned the necessity of coming up with a definition: "What difference does it make what we call it? Tell me why we need to figure out what it is?" Her role as an active participant in raising this question reiterated the contradiction between a definition and components.

The facilitator replied that it was not a definition that was needed but, rather, components. The Planning Team member, however, noted that a definition was important: "We need a way to explain it and not be saying Affective Transformation because what does that mean to 98 % of our employees or volunteers or visitors?" Another member of the Planning Team, the professional development Project Manager, bringing the (other) participants' voices to the foreground (Planning Team members were also participants), reminded the group that participants had noted on a short, informal evaluation administered the day before a desire for "more concrete examples." She suggested that a list of Affective Transformation components would be helpful to those whose job responsibility is to create educational programs. In response, the facilitator said:

> It's different ways of coming up with an understanding of a concept. I don't think we should get hung up on the definition, but we're trying to say these are things that should be included in understanding of Affective Transformation, because that list will help the people who are the program people that need more specifics, and it will also help refine whatever definition we have.

In talking about components of Affective Transformation (i.e., "things that should be included") *and* a definition, she bridged the contradiction between components and a definition, which allowed the professional development event to proceed. The discussion among members of the professional development community underscored the significance of contributions from individuals with varying levels of authority. A Planning Team member who was also a member of Zoo management, asserted the importance of an Affective Transformation definition, while a professional development participant questioned this need. The facilitator, another authority figure, suggested the importance of discussing Affective Transformation components, rather than only a definition. Additionally, another Planning Team member, in a leadership position as Project Manager, offered a reminder based upon participant input that supported the position of delineating components.

The facilitator next asked everyone to break up into small groups for further discussion, and she allowed groups to discuss either a "definition" or "components." "If one group wants to work on more definitional kind of stuff, if one group wants to say, 'We don't really know what it is as a definition, but here's what it must include,' that also goes towards a definition," said the facilitator. Three groups worked together to further discuss Affective Transformation, then reported out to all of the participants. The roles played by the small groups contributed to the community's construction of understandings of Affective Transformation, and the outcomes of the small group discussions are summarized in Table 1.

The Affective Transformation Model as a tool and the roles of small groups and the professional development facilitator. Group One's discussion focused upon what Affective Transformation was, in light of the model the facilitator had proposed. A group member explained,

> We had a discussion about the triggers versus the whole picture, [referring to the Affective Transformation Model drawn on the whiteboard in the front of the room] you know, and I think that we keep moving back and forth between, like, is it Affective Transformation as one big thing, or is it a piece of the puzzle that gets you to the nature protective behaviors?

Group One's members discussed with the other participants and the facilitator a Christmas light analogy discussed by the group. It is noteworthy that this group's discussion built directly upon the Affective Transformation Model, indicating that this model became a mediating tool as the professional development event progressed, as illustrated in Fig. 2. In addition to evidence for usage of this tool, analysis of how this discussion transpired reveals how the division of labor present within the professional development setting, as evidenced by the roles the facilitator and participants enacted, contributed to the group's progress in building understandings of Affective Transformation. A group member said, "…then someone mentioned the light bulb, and it made me think of Christmas lights and, you know, that maybe Affective Transformation is maybe the flipping the switch, but you can't flip the switch unless there is all this pre-wiring." The facilitator affirmed this statement by saying, "Great. I like that." Small-group members continued to share their ideas about how "direct experience[s] with animals" at the Zoo potentially represent the wiring, which "leads to some subsequent Zoo visit where we get to flip the switch." A

Table 1 Products developed by small groups during professional development event

Small group	Product
Group one	A Christmas light analogy that emerged during a discussion of Affective Transformation components. This analogy became a mediating tool in further whole-group discussion.
Group two	A proposed Affective Transformation definition: "Affective Transformation (at the zoo) is a lasting increase in caring (connectedness) about animals and nature strengthened/nurtured/encouraged by scaffolding experiences characterized by at least some of the triggers (through direct experiences with the animals and nature via the zoo)."
Group three	A proposed Affective Transformation definition, "creating emotional experiences for visitors which create increased caring for animals and nature," and a drawing of Affective Transformation components. The drawing was later refined by members of education and marketing staff and became the Scaffolding Schematic as depicted in Fig. 3.

member also referred to one of the personal narratives of the day before stating, "if [she] had never caught butterflies as a child, she would not have been affected by knowing butterflies could go extinct."

Roles of the professional development facilitator, Planning Team, and other participants. Notably, during this discussion the facilitator did not act in the role of expert; rather, she allowed a participant to come into the spotlight by honoring and privileging her contribution. Analysis of a video recording of this event provides further evidence that this participant's contribution received attention from both the facilitator and the other participants, including Planning Team members. This analysis points to the importance of this participant's role as a central contributor in the development of Affective Transformation understandings. All participants turned their heads and bodies in order to focus upon the staff member, only occasionally turning back towards the board to glance at the Affective Transformation diagram when she referred to it. The facilitator also focused on this participant, and not once did the other participants turn their direction from the speaker to the facilitator to gauge her approval. In addition, other participants spontaneously joined in the conversation. For instance, after the small-group member referenced the butterfly story, a Planning Team member said,

> It seems like direct experience is what we are going to achieve but we are going to be forming our programs. We're going to be planning our programs, structuring them, which is actually kind of the wiring to achieve it. So, maybe the wiring also comes directly into how we as instructors and facilitators are designing to do that.

The significance of this comment is that it provides evidence that the others present were able to build upon the efforts of this small group and extend the notion of wiring to include intentionality in program planning, with the knowledge that Affective Transformation is the ultimate goal. The analogy was further developed when this participant who introduced the notion of program design added that the wiring could be could be series or parallel and that in series the experiences could build upon one another. Another Planning Team member built the analogy further: "If there's a switch, then they might light one bulb. They might light ten bulbs after that. They might light a whole display with Rudolph and Santa and the whole nine yards, you know." Throughout the conversation, the facilitator expressed her affinity for this analogy by making statements such as, "I like your switch thing, though, because those are the ones that are like little paradigm shifts. They can be little or big because maybe there can be like a big master switch or something."

After the participants had the opportunity to offer their comments about and additions to the light analogy, the facilitator offered her own reflection about the participants' conversation and asserted her role as someone who could serve to advance the discussion: "So, to push this even further, let's use a biology example now. What if these are lightning bugs?" She referenced species with synchronous flashing and suggested that when

> they're all flashing together it's like a really bigger change, or…you're laying in all this wiring, but when would the Zoo feel comfortable? Like I think we're going to try to turn on the lights, like when we have [a large] holiday [display] we have this big- okay, we're confident. We tested the little light bulbs. This one goes on. This one goes on. We've laid the groundwork. Now we're going to try something, pull our trump card out or whatever because we think all of 'em will go on and we go, "Yes, the person has pulled it all together, and they've been transformed."

As the discussion of the light analogy came to a close, a Planning Team member affirmed the analogy, and enacted a leadership role in guiding a transition to the next small group. The light bulb analogy, moreover, became another product of activity as well as a new element within the activity system. As shown in Fig. 2, the analogy served as both a product and a mediating tool in further whole-group Affective Transformation discussions. For example, when Group Two described their group's discussions about moving beyond the "singular experience" to a connection among many experiences building upon each other, the professional development facilitator said that their explanation was just like the Christmas lights.

Group Three's discussion was also cited by the facilitator as related to the light analogy, and ultimately resulted in the formation of an Affective Transformation Scaffolding Schematic. A marketing department staff person was a member of the group, otherwise comprised of education staff members. She served in a consultative and collaborative role in the professional development event and her participation framed the discussion that resulted in the development of the schematic, which was referred to by some Zoo staff members as "Affective Transformation through the marketing lens."

The schematic shown in Fig. 3 is a refinement of this small group's product as developed by Zoo education and marketing staff persons. During the professional development event, the small group initially created a drawing with "create nature protective behaviors" written in a center circle. Arms radiating from this circle were connected to zoo-related programs such as camp and exhibits, behaviors such as nature hike and recycle, and "we care about animals and their future," the Zoo's vision. As the group's spokesperson concluded her group's presentation she said, "Affective Transformation isn't the change so much as it's the emotional experience that created that change," to which facilitator replied, "I think that's a light bulb thing," indicating that the facilitator was linking the participants' ideas through the previously discussed "light bulb" analogy tool. This exchange among the members of the professional development community illustrates the ways in which a product introduced into the system became a meditational tool in pursuit of objectives. Figure 2 illustrates that the Affective Transformation Model (a previous product) and the function of the work of a small group, along with the roles of Planning Team members and the facilitator, all interacted to produce the Light Bulb Analogy and, in turn, this analogy also contributed to the development of an initial Affective Transformation schematic. This schematic represents another emergent outcome. While creation of a schematic was not previously stated as a professional development event goal, its emergent development proved valuable to the progress of this participant-driven event and of the development of understandings of the target concept, Affective Transformation.

The process of developing an Affective Transformation definition: The relevance of the roles of the professional development facilitator and participants

Although the small groups' work described above suggested various Affective Transformation definitions, participants did not consider any to be the finalized version. Therefore, further discussions about an Affective Transformation definition occurred. As was evident in the exchange described in this vignette, it was acceptable and encouraged for the participants to enact roles in which they could alter definitions previously considered as well as to freely add and make changes to others' contributions. A brief conversation about parts of a definition followed Group Three's introduction of the first version of the Affective Transformation Scaffolding Schematic. During this conversation, a participant
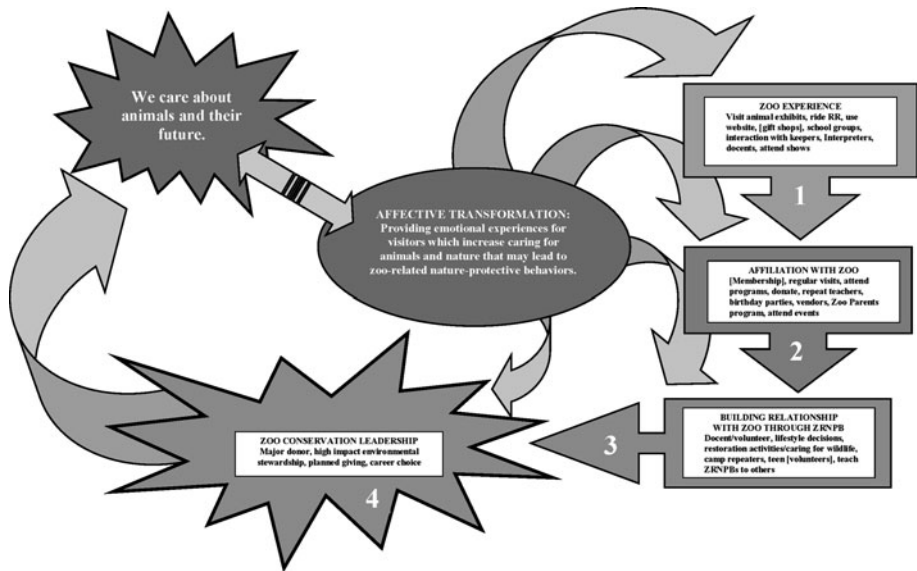
Fig. 3 Affective Transformation Scaffolding Schematic, as refined by education and marketing department staff members. *Bracketed words* indicate modifications made in order to maintain participant confidentiality. (Courtesy Zoo)

asked if she could "take a stab" at the definition. All participants turned towards her as she read aloud from her notebook, "An emotional change in how people feel about the natural world causing them to increase their nature protective behaviors." A Planning Team member, enacting a leadership role, invited this participant to erase two previous working definitions from the board and write hers up instead.

Other participants also contributed ideas. For example, one staff member said that "practicing of" assumes that people already practice nature protective behaviors, which is not necessarily the case. She went to the board and added the comma between "world" and "causing" and crossed out "practicing of" as seen in Fig. 4. The facilitator, in the role of expert, suggested adding, as a footnote, something about how people feel about their *role* in the natural world. Ultimately, therefore, this definition was written as: "An emotional change in how people feel about the natural world, causing them to increase their practicing of nature protective behaviors" with a footnote, "feel about their role in the natural world."

A Planning Team member, again in a leadership role, assessed if there was agreement on that definition, the Affective Transformation model as illustrated by the facilitator, and the schematic drawn by one of the small groups by asking, "Is everybody…at an ok place now?" "I hear yes," she said, and at the conclusion of this exchange everyone applauded. The definition as was later finalized by senior education and marketing department staff members, and as it appears in the finalized Scaffolding Schematic (Fig. 3) differs slightly from the definition above, but still retains the essence of what the participants developed and agreed upon. It is: "providing emotional experiences for visitors which increase caring for animals and nature that may lead to zoo-related nature-protective behaviors." Although this finalization occurred outside of the professional development event, it was essentially based upon the work that occurred during the implemented professional development—
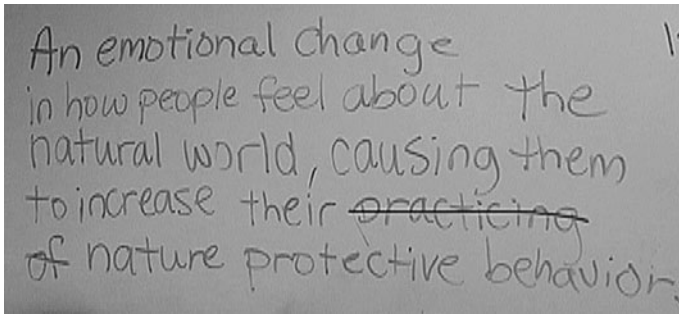
Fig. 4 Professional development participants' constructed definition of Affective Transformation

i.e., the interactions among the tools input into the system, tools created in the course of the event, and divisions of labor among members of the community enacting differing roles. These tools input into the system, e.g., research literature, personal narratives, and groups of participants; products of activity that became meditational tools, e.g., the Affective Transformation model; and roles enacted by participants are illustrated in Fig. 2. The transitions within the system and the contributing distribution of expertise among the participants are further discussed in the section below.

Transitions within the activity system and distributed expertise

Interactions among tools and roles enacted by community members

Yrjö Engeström (1999a) discusses "unexpected innovations" (p. 32) resulting from activity. Likewise, the creation of the Affective Transformation model, schematic, and definition were emergent outcomes. While it was intended that the professional development program lead to outcomes with potential to expand Affective Transformation understandings, the three specific objectives—to create a model, schematic, and definition—were not defined as pre-set goals prior to the event. These objectives and their related products represent new knowledge produced within the community that was developed via the interactions among participants and tools within the professional development program activity system.

Analysis of transitions within the activity system and the processes by which the products related to the target concept were constructed demonstrated the manner in which tools and roles of the professional development community members were interwoven in the pursuit of the objective at hand, an enhanced understanding of Affective Transformation, as illustrated in Fig. 2. For instance, the Affective Transformation model was a product resulting from interactions among the roles enacted by the professional development facilitator and participants and the tools of the personal transformation narratives and conservation psychology literature. This product became a tool that interacted with the roles of the professional development community in the development of the light bulb analogy. This analogy, in turn became a tool and lens through which the initial Affective Transformation scaffolding schematic was viewed. Furthermore, this initial schematic emerged as a product via interactions within the system, as did the initial Affective Transformation definition. These products later served as tools in the final refinement of the

Affective Transformation definition and scaffolding schematic. A limitation of the research study presented here is that it was not designed to capture data regarding zoo staff members' long-term usage of resources gained via professional development. We assert, however, that the model, schematic, and definition, representing constructed understandings of Affective Transformation, have the potential to serve as tools within the Zoo's system as the educators carry out this strategic plan goal.

Complementary and distributed expertise

Evident in the vignettes discussed in this article was a pattern of shared expertise and valuing of participant input that crossed both vertical and horizontal layers of authority. For example, participants who did not occupy senior leadership ranks within the Zoo or professional development program infrastructures took central roles in proposing and refining the light bulb analogy and developing the Affective Transformation definition. This is especially significant because these were individuals who would be most directly involved in incorporating Affective Transformation principles into their education programs. Other participants who held higher positions of authority due to the job roles they held within the department as managers and/or the roles implicit within the context of the professional development program as Planning Team members also contributed to the process of constructing the Affective Transformation products. Their participation was significant for several reasons. First, they are individuals who would be held responsible for meeting strategic plan goals and direction of other staff members in pursuit of Affective Transformation objectives. Second, they provided necessary guidance during the professional development event such as prompting next steps and assessing levels of agreement from the group at large. Third, they likely had more experience considering Affective Transformation and its implications than did other participants due their participation in professional development planning efforts, which we posit may have influenced the input they provided during the professional development event. Furthermore, the role of the facilitator as an expert in a closely related field and authority figure during the professional development event provided an additional layer of expertise that allowed participants, for example, to move beyond the Affective Transformation definition that the in-house committee was tasked with developing.

Although all participants had different levels of authority, the analyses presented demonstrate that both expertise and leadership were distributed as the contributions of all individuals were honored in the development of the Affective Transformation model, schematic, and definition. We suggest that the evidence indicates that the roles played by all members of the professional development community were necessary to create these products. In addition, the tools present within the professional development system were also necessary for product development and, thus, contributed to the mutually developed understandings of the target concept of Affective Transformation—a component of the Zoo's strategic plan. These tools include both those that existed prior to the professional development event such as conservation psychology research literature and those that were created by the community during the event.

Implications for informal education organizations

This study demonstrates one way in which professional development can be used to form better understandings of an informal education organization's strategic plan. We suggest

that this manner of involving the staff members, along with their personal experiences and perspectives related to the strategic plan, as well as an appropriate facilitator, and other resources may also potentially strengthen understanding of other guiding principles, such as the mission or vision. While the topic addressed in this professional development program was not previously defined in the literature, we further suggest that it may be a useful enterprise to engage staff members in professional development in order to build models of their organization's mission or strategic plan, even in instances when the components are already well-developed or 'officially' defined. As demonstrated by this study, staff member experiences have the potential to interact with existing tools to build greater understandings.

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