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ABSTRACT

According to the philosophy of John Dewey, the goal of education is to provide students with an increased capacity for having worthwhile experiences. This paper draws on Dewey's writings to develop a theory of worthwhile experience, termed "idea-based experience." A model is proposed of how individuals are apprenticed into having an idea-based experience, and this model is illustrated using the case study of the author's three-year-old daughter. The paper describes how the girl was apprenticed into having idea-based experiences with volcanoes. Also, the paper describes how she appropriated particular ways of caring about volcanoes and used volcanoes as a way of seeing objects and events in her everyday life. The paper illustrates the child's use of metaphors to construct an understanding of volcanoes and how these metaphors played an important role in transforming the nature of the apprenticeship. Contains 38 references. (Author/JPB)

Seeing the World Anew:
A Case Study of Ideas, Engagement, and Transfer in a 3 Year Old

There is such a thing as playing with ideas
- John Dewey

From a Deweyan perspective, the goal of education is to provide students with an increased capacity for having worthwhile experiences. I draw on Dewey's writings to develop a theory of worthwhile experience (what I call idea-based experience*) and propose a model of how individuals are apprenticed into having idea-based experiences. Then I describe how my three year old daughter was apprenticed into having idea-based experiences with volcanoes. Specifically, I describe how she appropriated particular ways of caring about volcanoes and using volcanoes as a way of seeing objects and events in her everyday life. I also describe how she used metaphors to construct an understanding of volcanoes and how these metaphors played an important role in transforming the nature of the apprenticeship.*

Jackson (1995) stated that Dewey would justify teaching the arts because ". . . they open the door to an expansion of meaning and to an enlarged capacity to experience the world" (p. 27). I believe Dewey would use this justification as the criteria to judge the worth of any educational endeavor. Good education is that which provides us with an expansion of meaning and an enlarged capacity to experience the world. Indeed, in Experience and Education, Dewey (1938) argues that the means and goal of education should be to provide students with worthwhile experiences. I believe that this goal may be achieved by apprenticing individuals into the having of worthwhile experiences. In this paper, I present a case study of my three year old daughter's learning of volcanoes and describe how she was apprenticed into a way of caring about volcanoes and seeing everyday objects and events through the lens of volcanoes. I describe how she came to construct her own personally meaningful experiences with volcanoes and how she also played an

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important role in transforming the nature of the apprenticeship.

The Apprenticeship

Before jumping into the case study, I would like to take some time to discuss the notion of an apprenticeship, Dewey's writings on experience, and how the apprenticeship model relates to having a worthwhile experience. I will start with a description of the apprenticeship which has emerged as a useful metaphor for examining learning and teaching.

The apprenticeship model has been used in a variety of ways. It has become a vital part of sociocultural learning theories (Rogoff, 1993; Lave & Wenger, 1991; Brown, Collins & Duguid, 1989), it has been related to scaffolding approaches to teaching such as reciprocal teaching (Palincsar & Brown, 1984), and it has been used as a means for comparing school learning to out-of-school learning (Resnick, 1987). In general, the metaphor of the apprenticeship has been used to describe the process by which people are socialized into some activity. Much of the writing on the apprenticeship is based on the work of Vygotsky (1986, 1978) who first provided a detailed theory of how learning and development proceeds from participation in sociocultural activities. He suggested that through participation in activities, we come to internalize (or appropriate) behaviors and cognitive artifacts (tools and signs). For example, Vygotsky proposed that children develop language by participating in linguistic activities. The first use of language appears as children engage in conversations with others. Over time, these conversations turn inward and the child begins to carry on conversations with him or herself. This process is demonstrated as egocentric speech--a phenomenon in which children talk to themselves. Eventually, this egocentric speech develops into inner speech, which is the silent conversations that older children and adults carry on with themselves. During the move from social to inner speech, children appropriate socially constructed signs (language) which come to mediate their thought.

It is important to recognize that the process of appropriation is a developmental process. Vygotsky (1978) states, "The transformation of an interpersonal process into an intrapersonal one

is the result of a long series of developmental events" (p. 57). These developmental events are connected to a move from peripheral participation in a sociocultural activity to more central participation (Lave & Wenger, 1991). For example, the child acquiring language progresses through various levels of participation in linguistic activities. Initially, the child simply reacts physically or emotional to a parent's attempts to communicate. Next the child may acquire the ability to respond with a limited set of words. Later the child will begin to communicate with two word sentences. Then the child will start to use simple sentences with others and so on. At each point, the child moves toward more central participation in the sociocultural activity of verbal communication. Initially, the parent plays the primary role in structuring communication, sustaining communication, interpreting needs, responding to the other, and so on. But with time, the child appropriates more sophisticated cognitive artifacts and takes more responsibility in the activity of communication.

In general, the sociocultural perspective holds that as individuals come to participate in a particular community or social context, then they come to appropriate the knowledge, skills, behaviors, and values that are displayed within that context (Greeno, Collins & Resnick, 1996). However, the process of appropriation should not be understood as a social transmission model whereby knowledge, skills, behaviors, or values are directly transmitted from the context to the individual. Rather, appropriation is a constructive process whereby individuals transform the things they appropriate according to their prior knowledge and experience (John-Steiner, 1996; Rogoff, 1993). In addition, the individuals play an active role in transforming the social context. For instance, Lave and Wenger (1991) claim that newcomers to a sociocultural activity (such as tailoring) are caught in a double bind. They must appropriate the knowledge and skills held by the larger community or the "old timers," but they must also transform the community (see also Garrison, 1995). In the classroom, Newman, Griffin and Cole (1989) provided an example of how children help construct their learning environment. They showed that small groups of students each created a unique interaction with the teacher around a math lesson. Each small group essentially created their own learning environment which ultimately resulted in different learning

outcomes for the groups. From a different theoretical perspective, the prominent developmental psychologist Sandra Scarr (1992) has identified important ways that children contribute to the construction of the environments they experience. Children are not simply shaped by their environment, they also create it.

In addition to this theoretical work on the nature of the apprenticeship, empirical research has also addressed the issue. This empirical research has focused mainly on how people are apprenticed into particular ways of behaving, ways of thinking, or ways of using language. For instance, much of the research has described examples of how people come to participate in certain sociocultural activities, such as becoming a tailor, midwife, naval quartermaster, or butcher (Lave & Wenger, 1991). These studies essentially look at behavior and describe how behaviors are appropriated through participation in culturally constructed activities. Other studies, termed "cognitive apprenticeships" focus more on cognitive states (Brown, Collins & Duguid, 1989). These studies show how people appropriate certain cognitive artifacts through participation in activities. For example, Palincsar and Brown (1984) described how students were apprenticed into reciprocal teaching activities and how this participation led to appropriation of reading comprehension skills. Still other studies look more specifically at language and describe how students come to appropriate ways of using language (Heath, 1982).

The Apprenticeship from a Deweyan Perspective

Dewey's views on learning closely parallel the sociocultural theories of learning upon which the apprenticeship model is based. This similarity is no accident as Dewey is the direct ancestor for theorist promoting situative views of learning and the apprenticeship model (Phillips, in press). In addition, there are some intriguing intellectual connections between Dewey and Vygotsky. It appears that Vygotsky was initially surrounded by a group of Russian pragmatists and there is evidence to suggest that he and Dewey actually met (Prawat, in preparation). It is possible that many of the ideas we attribute to Vygotsky were originally formulated to some degree in the work Dewey. Whatever the connection may be, it is clear that both Dewey and Vygotsky

promoted the notion that learning is essentially a social process: we appropriate knowledge through participation in social activities (Garrison, 1995). As explained earlier, this is one of the key principles upon which the apprenticeship model of learning is based. The other key principle is that the apprenticeship is a constructive process: individuals transform the nature of the apprenticeship as they participate in it. Dewey (1938, 1916) expressed this principle in relation to his thoughts on democracy and the transactive nature of experience. Basically, he explains that in any experience, both the person and environment are transformed. More generally, he states that we are shaped by the communities we participate in, but we also play an active role in constructing these communities. We appropriate the rules, values, knowledge, behaviors, etc. of our communities, but we also influence the construction or transformation of these rules, values, knowledge, behaviors and so on.

Thus Dewey's views are compatible with the basic principles upon which the apprenticeship model is based. However, Dewey placed a particular emphasis on experience. He was concerned with how we come to appropriate worthwhile experiences through participation in social contexts --particularly school (Dewey, 1938). To my knowledge, no empirical research has used experience as a unit of analysis when looking at the apprenticeship. As I mentioned, most of the studies have focused on behavior, cognitive abilities, or language. Experience, as Dewey defined it, was a different construct than these. This difference needs to be elaborated on by describing Dewey's construct of experience.

Dewey's Construct of Experience

In Dewey's writing (1988/1929, 1958/1934, 1938, 1933) the construct of experience addresses behavioral, cognitive, and linguistic outcomes, but it also captures the affective and aesthetic aspects of an event. The affective and aesthetic qualities are especially salient in Dewey's writings on an experience. Dewey (1958/1934) wrote that in contrast to ordinary experience, which is forgettable and lacks a clear significance, an experience is meaningful and memorable: ". . . [an experience] is defined by those situations and episodes that we spontaneously refer to as

being 'real experiences'; those things of which we say in recalling them, 'that *was* an experience'" (p. 36). A critical element of an experience is anticipation. Anticipation is the emotional spark that defines, unifies, and drives forward the experience. Dewey comments, " . . . at each stage [of an experience] there is anticipation of what is to come. This anticipation is the connecting link between the next doing and its outcome for sense" (p. 50). Anticipation about how the experience will conclude, what it will reveal, what consequences it will yield, and what transformations it will bring about is what moves the individual to perform certain actions (doings) and pay attention to the outcomes of those actions. Anticipation motivates action and connects every action with a future consequence or possibility.

Dewey also theorized that ideas can play an important role in initiating an experience. In Dewey's (1933) view, ideas are possibilities. As such, they have the capacity to generate anticipation about what may be discovered, understood, explained, seen, and experienced (Prawat, 1998; 1997). When we have an idea, we anticipate acting on that idea--trying it out, seeing if it works. When Darwin thought up his idea of natural selection he anticipated seeing and explaining certain things in nature. This led him to literally set out on a ship to see the world in a new way. The connection between idea and action is critical (Hook, 1995/1939). In fact, Dewey (1988/1929) states that, "Action is at the heart of ideas" (p. 134). Ideas generate a set of anticipations and these anticipation lead to action and the having of an experience. In return, if the experience generated by the idea is a personally worthwhile one, then greater interest in the idea results. I refer to this process as an idea-based experience (see figure 1). An idea-based experience is simply an experience where the anticipation which defines, unifies, and propels the experience forward is generated by an idea.

Thus the act of teaching individuals powerful ideas has the potential to provide them with worthwhile experiences. However, it is not enough to simply present the idea. After all, although the idea of natural selection awakened anticipation and action in Darwin, this same idea may put a class of middle school students to sleep. This is because the students may lack knowledge of why they should care about the idea, why others find it interesting, and how they can use the idea to

have meaningful experiences. Hence, the idea is incapable of generating any anticipation. For anticipation to develop, students need access to a community that values and uses the idea in a meaningful way. This is where the idea of the apprenticeship fits in.

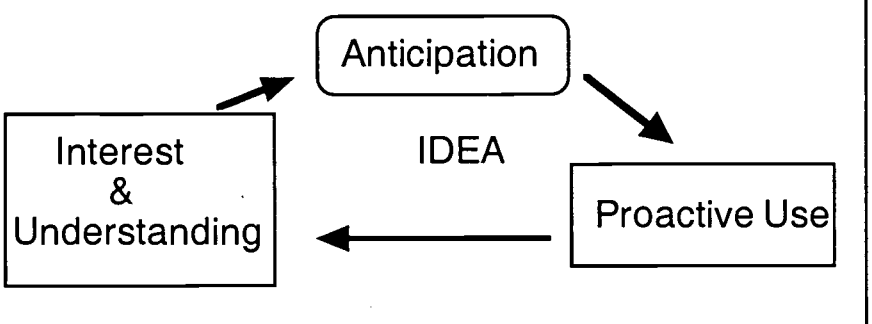

Figure 1

Apprenticeship of an Idea-based Experience.

By combining current understand of the apprenticeship with Dewey's construct of experience, we can develop a model how individuals may be apprenticed into idea-based experiences. As described earlier, the apprenticeship model has been used to describe how individuals appropriate the behaviors, skills, knowledge, and language of the social contexts that they come to participate in. It seems a small stretch to suggest that individuals could also come to appropriate certain experiences that are displayed within the social context. In other words, it seems feasible that if the social context involves having meaningful experiences with ideas, then individuals could be apprenticed into particular ways of caring about and using the ideas through modeling and scaffolding. For example, if a community displays interest in a particular idea and frequently uses the idea as a way of seeing, understanding, explaining, or contemplating objects and events in the world, then newcomers to the community will likely appropriate these ways of

valuing and using the idea as they come to participate in the community. Doing so will give them the capacity to have their own idea-based experiences.

Thus in an idea-based apprenticeship, a person is apprenticed into having meaningful experiences with an idea. This means that the person initially comes to participate peripherally in the activities of a community that values and uses a particular idea. As the person participates in these activities, he or she appropriates ways of caring about and using the idea. Initially, this interest in and use of the idea is strongly supported and initiated by modeling and scaffolding provided by the social context. But gradually, interest in the idea, anticipation about using the idea, and capacity to use the idea develop such that the person can not only use the idea independently, but actively seeks out opportunities to do so. When the person begins to actively apply an idea and has satisfaction from doing so, then an idea-based experience takes place. Finally, it is important to point out that through participating in an idea-based experiences, the individual constructs a personal understanding of the idea, personal ways of caring about the idea, and personal ways of using the idea. These constructive processes bring about transformations in the larger social context or community. Figure 2 provides a visual model of the apprenticeship from a Deweyan perspective.

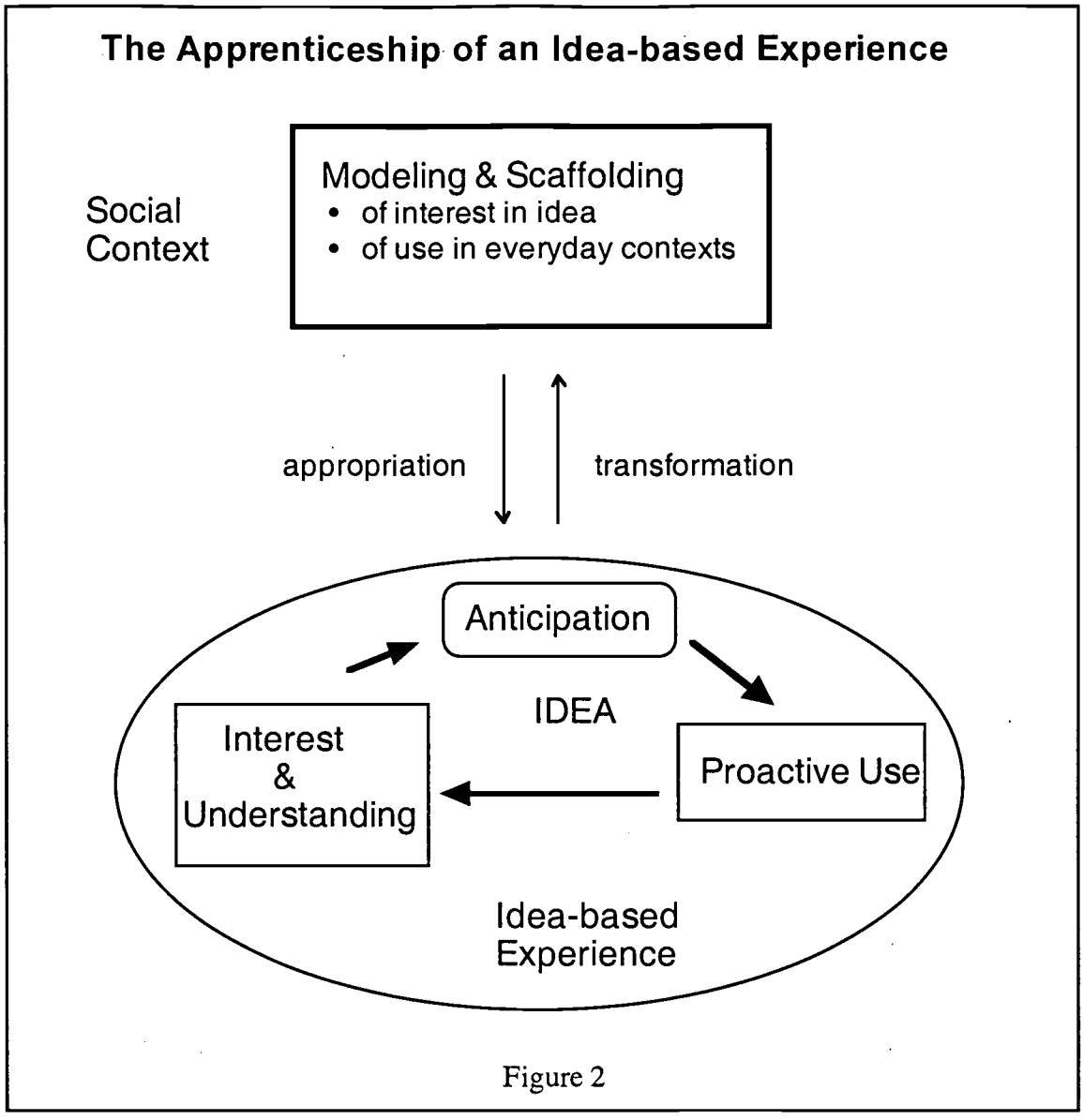

Figure 2

The Apprenticing of a Three Year Old

Now that some background on the apprenticeship and idea-based experience has been given, I will turn to a description of how my three old daughter McKinley was apprenticed into having worthwhile experiences with an idea. I chose my daughter as the subject of the study for a few reasons. For one, I thought it would be fun. In addition, this is an exploratory study and I realized it would be easier to create a particular social context within my home than in another

place, such as a classroom. In later studies I can address the more complex problem of apprenticing people into idea-based experiences in a classroom setting. But mainly I chose to study my own daughter because I would be around to observe whether indeed she did have meaningful experiences with the idea in her everyday life. A weakness of many studies involving application of learning in everyday settings is that researchers rely on self-report data or they set up contrived situations where subjects must demonstrate application of learning in a particular way, at a particular time, on a particular task.

According to the model I presented of how a person is apprenticed into an idea-based experience, there are two key conditions that must be created. First, there must be a social context where interest in and use of an idea is displayed. This may be accomplished by modeling interest through direct statements as well as general expressions of excitement and interest when talking about the idea. It is also accomplished by providing numerous examples of how the idea can be used and the satisfaction that results from using it. Second, the person must be scaffolded into caring about and using the idea. This is accomplished by allowing the person to initially participate peripherally in activities that involve caring about and using the idea and then allowing the person to move toward more central participation.

In this particular study, I decided to teach my daughter about volcanoes and see if my wife and I could apprentice her into having meaningful experiences with ideas about volcanoes. So we deliberately created a social context in our home where our interest in volcanoes was modeled and where we displayed meaningful ways of using ideas about volcanoes. In particular, we modeled how ideas about volcanoes and lava could be used as a lens for looking at ordinary objects and events in our everyday lives. We also engaged in direct teaching moments using a book about the earth (we would read the book to her or talk about the pictures in the book with her). These reading times often served as opportunities to model our own interest in volcanoes. Specific descriptions of our interactions will be given below.

During the time of this study, which lasted about a month, I recorded data using field notes and videotape. Every time my daughter and I engaged in an interaction involving volcanoes, I

wrote down what we said and did in a journal. I also videotaped some of these moments. In addition, my wife or I recorded all the episodes when McKinley used or talked about volcanoes. In the field notes, we recorded the context of the episode, what our daughter said and did, and ways that my wife or I were involved.

Dat an Exploding Volcano!

Peripheral Participation and First Signs of Interest

The first opportunity to model how volcanoes could be used as a way of seeing the world occurred when I entered McKinley's room on the first day of the study and noticed that it was a disaster. All the drawers were emptied out (thanks to our one and a half year old daughter), the books were laying in a big pile at the base of the book shelf, and toys (including a million little Tubers and Zots) were spread out across the floor. My immediate reaction was to say, "It looks like there was an eruption in here!" McKinley replied, "The lava came out of this thing [the Tubers and Zots bag]. Or maybe it was asteroids." Then after a pause she added, "Why are asteroids like lava?" In this episode, I initiated an activity that involved using volcanoes as a lens for looking at something and McKinley was able to participate somewhat in this way of "seeing." This event marks the beginning of McKinley's progress toward using volcanoes as a way of seeing the world.

McKinley began to display interest in volcanoes as I modeled my own interest and modeled how volcanoes could be used as a way of seeing the world. The episode above is one example of this. Another example involved muffins. I baked some muffins with jam inside and explained that as the jam gets hot, it gets bigger and bigger until it erupts out the top just like a volcano. Unfortunately, the jam never erupted, but it did sink to the bottom of the muffins. So we turned our muffins over and said they were upside down volcanoes. During this activity, I displayed my own interest in volcanoes by saying things like, "Here we go. We're making volcanoes!" or "Let's see if they erupt. Let's see if the jam gets bigger and bigger until it explodes out the top!"

At other times, such as when reading the earth book, I would make more direct statements about my interest in volcanoes. For example, I would say things like, "Let's go read the earth book and learn some more about volcanoes" or "Yep, the lava explodes because the bubbles just keep getting bigger and bigger. That's pretty neat, isn't it?" Through these different activities, McKinley was able to see me learn about volcanoes and express my interest in learning about or doing things with volcanoes.

Within the first week, McKinley began to reflect some of the things I modeled. She quickly started to display an interest in learning about volcanoes. For example, she was attentive and focused when reading the earth book, she asked lots of questions about volcanoes, and she started requesting the earth book for her bed time story every night. In addition, one evening after reading the earth book, McKinley commented, "I want you to tell me all about it. I want to learn all about volcanoes cuz I am just learning." This comment suggests that the first bit of anticipation was beginning to develop. McKinley had appropriated the notion that volcanoes are a valuable thing to learn about and she could imagine herself learning more.

Participation Becomes more Central and Anticipation Develops

After the first week of the study, McKinley continued to participate in activities that I initiated, but she also began to take a more central role in initiating experiences that involved seeing the world in terms of volcanoes. For example, one day I demonstrated an eruption by shaking up a bottle of kiwi-strawberry pop and opening the lid. McKinley of course loved this activity, but her mom didn't. Perhaps next time we will do it outside. Anyway, during the demonstration I explained how the exploding pop is just like erupting lava. I explained that when the lid is on, the bubbles in the pop are compressed by the pressure. But when the lid is opened, pressure is released and the bubbles get bigger and bigger until it explodes as fizz. In the same way, bubbles in the lava get bigger and bigger as the lava nears the surface of the earth and pressure is reduced. Finally the bubbles expand and the lava explodes. After finishing this activity, I asked McKinley what else is like volcanoes. She replied, "Sometimes my hair goes wild like lava. Sometimes it

goes flying up like lava." On most mornings, McKinley's curly hair does indeed go flying up like lava.

In this example, I again initiated an activity and displayed how volcanoes could be used as a way of looking at a bottle of pop--or how a bottle of pop could be used as a way of looking at volcanoes. McKinley was able to participate in this activity, but again I played the central role. However afterwards, she was able to come up with her own comparison of an object to a volcano. This indicates she was acquiring the ability to see the world in this way. Later, she began to engage in this way of seeing the world with less prompting and support. For example, one day my wife was helping McKinley draw a picture of a volcano. She then left to chop nuts in the blender. But whenever she turned the blender on, the nuts would go flying all over the place. After a few attempts, McKinley looked over and said, "Dat an exploding volcano." A few days later, McKinley began seeing *herself* in terms of volcanoes and lava. After I read the earth book with her, she started running around her room, pretending she was lava, saying things like, "I'm so big I just want to get out [of the earth]. I get out and burn down a house."

Subsequent with McKinley's increased initiative in using volcanoes as a way of seeing the world was an increased display of interest in volcanoes and anticipation in learning more about volcanoes and being able see the world in terms of volcanoes. Some of this increased interest and anticipation was displayed in specific comments. For example, one day she told her mom, "I want [dad] to tell me about [volcanoes]. Maybe when I grow up I will know all about volcanoes." Another day she said to me, "I wish I could read about and learn about lava all the time. I wish I could go to your school and learn about the earth." Finally, my favorite comment McKinley made that displayed her interest in learning was as follows: "I like the earth book better than your other books [she abhors Vygotsky] because it has things I say 'why' about." I found it interesting that McKinley thought I learned about the earth at school and that she thought the earth book was one of my school books. These comments suggest that part of her interest in volcanoes came from wanting to be like me: learn the things I know, do the things I do, and see and experience the world as I see it. She seemed to identify with a certain image of me and was imagining herself

growing into that image. This finding suggests that engagement which develops in an apprenticeship may partially result from identifying with the teacher or community. Such an interpretation is supported by the research on identity and possible selves (Brophy, 1998; Marcus & Nurius, 1986).

Use Becomes Proactive

As explained earlier, an idea-based experience fully develops as anticipation related to an idea propels the individual toward action. One form of action is proactive use of the idea as a lens for looking at objects and events in the world. By proactive, I mean that the individual actively seeks out opportunities to use the idea instead using the idea out of necessity or in response to being prompted. For example, I often ride my bike to school, because I don't have much of a choice. This use is not proactive. In contrast, I recently bought a new mountain bike and I seek out opportunities to use this bike for rides on the trail. This type of use is proactive and it is connected with anticipation. I often anticipate where I'm going to ride and what the experience is going to be like. When I get a chance to ride this bike, it is truly an experience (although not an idea-based experience).

Towards the latter part of the study, McKinley began to display this type of proactive use, which combined with her displays of interest and anticipation related to volcanoes, suggests that she was participating in idea-based experiences. For example, as McKinley's expressions of anticipation increased, she also began to see more and more objects or events through the lens of volcanoes. In addition, she did so without prompting from my wife or me. In fact, this seemed to be such a satisfying way of seeing the world, that she began to see volcanoes and lava everywhere. For example, one evening I was performing magic tricks for McKinley and her sister. I am no great magician, but I once picked up a fake thumb, a red handkerchief, and some sponge balls so that I can now perform a few magic tricks sufficiently to mystify a three year old. My best trick is to stuff the red handkerchief into my closed fist and make it disappear. Then, after saying a few magic words, I close my fist again and slowly pull the handkerchief out. As I was doing this trick

for about the tenth time, McKinley started comparing the handkerchief to lava. She said the lava gets bigger and bigger so it has to find a way out of my hand. When I shoved the handkerchief back into my fist, she said the lava was going back into the earth.

McKinley began to compare a lot of things to lava, particularly liquids. One evening she was helping her mom make zucchini bread. When they poured oil into the mixture, she said it was like lava because it's runny. When they next added honey, they compared it to lava as well. The next morning we had pancakes for breakfast and McKinley started talking about how she was pouring lava on her pancakes. A few days later she said her feet were hot like lava.

Finally, toward the end of the study, McKinley dropped a cup of milk on the floor. Now, McKinley is not a child that handles mishaps well. She is either blessed or cursed (I haven't figured out which) with high intensity emotions. For her, there are no little mishaps, just tragedies and this was one them. She ran around the kitchen for a little while screaming, "Mommy! I need a cup of milk! Mommy!" But miraculously, just as suddenly as she exploded, she calmed right down. A transformation came over her face as she stopped yelling and looked down at the cup lying on the ground. Then she looked over at me and asked, "Did the bubbles get bigger and bigger until it exploded?" I immediately recognized that she was thinking back to the pop bottle activity. McKinley was now using this idea of bubbles getting bigger to see the event of spilled milk in a new way. It was not a scientifically correct way of explaining the event, but it provided a meaningful way for her to look at it. The spilled milk was no longer a tragedy, but an interesting event.

Summary

In this first part of this study, I described how McKinley came to participate in a social context that displayed interest in and use of an idea. I also described how she appropriated interest in volcanoes and ways of using volcanoes as a lens for looking at objects and events in the world. This appropriation allowed her to create her own worthwhile experiences with volcanoes--even to construct a meaningful experience out of a tragedy. By the end of the study, McKinley appeared to

be seeking out opportunities to see the world in terms of volcanoes as indicated by the fact that she frequently saw objects and events in relation to volcanoes. Her sheer abundance of applications leads me make an important point about transfer.

The general body of research on application and transfer of knowledge paints a pessimistic picture. Although there are some notable exceptions (Anderson, Reder & Simon, 1997) typically studies find that subjects demonstrate limited transfer or application of learning in everyday setting (Detterman, 1993; Prawat, 1989; Singley & Anderson, 1989). This study found a very different result. The difference can be partially attributed to methodological issues. In most transfer studies, the research methods dictate what people must transfer, where they must transfer it to, and how (Campione, Shapiro & Brown, 1995). Such methods limit people's ability to demonstrate application and use of knowledge. In contrast, since I am McKinley's father, I was able to observed instances of application and use that occurred naturally in her life. In fact, that was a major reason why I chose to make her the subject of my research. In addition, since McKinley was taught in a home setting, she didn't have to do the extra work of transferring knowledge from a school context to an everyday or work context. Nonetheless, there is reason to believe that there is still more to the story. After all, McKinley rarely makes such frequent application of the things I try to teach her. The rest of the story involves an understanding of the relationship between interest in ideas and application or use of those idea within an idea-base experience. The construct of an idea-based experience suggests that interest in an idea can lead to anticipation, anticipation can generate proactive use, and use can result in greater interest (see figure 1). McKinley's frequent use of volcanoes as a lens for seeing the world was likely a result of this process. However, other experimental studies need to be conducted before anything definite can be said about the relationship between interest and use. Surprisingly, little research has been conducted in this area. We know a lot about factors influencing the capacity to transfer, processes involved in transfer, and limitations of transfer; but not a lot about why people are motivated to transfer or why they seek out opportunities for transfer. In fact, since most of the research has involved transfer of content that is not personally significant, we know little about the transfer of content that students

really care about. The construct of an idea-based experience should prove useful in this area. With that said, I will turn to the second part of the study which focuses on the constructive aspects of the apprenticeship.

Hands and Yolk

As I mentioned earlier, theorists and researchers have emphasized that the apprenticeship and the appropriation that takes place in an apprenticeship are constructive processes. Individuals play an active role in constructing their own understanding and transforming the social context. Below I present some particularly intriguing examples of how McKinley created metaphors to help her construct an understanding of volcanoes and how these metaphors transformed her interactions with my wife and me.

When I first sat down with McKinley, I tried to explain what I thought was the big idea about volcanoes: when lava gets hot it tries to expand and if it has no where to go, it eventually explodes out or finds some crack to flow through. During this explanation, McKinley mostly asked why, why, why, why? [She's at the stage were every fifth world is why. In fact if I say "why," she objects, "Hey, dat my word. 'Why' my favorite word." Then she asks, "Why I like to say 'why'?"] In addition to asking "why?" McKinley also asked questions about the pictures. She got particularly interested in a picture of a vein of lava rising up through the crust of the earth and splitting into three branches as it neared the surface. She first remarked that the branches were like lots of thumbs coming up. "Dis one, dis one have lots of thumbs," she commented while grabbing her own thumb. "The thumbs come up to grab the cloud." This she said while reaching her hand up into the air and then pointing at the ash cloud in the picture. "Yeah, it's sort of like a hand that comes up," I replied. Then McKinley noticed another picture of a volcano that had just one vein of lava and commented, "Some [veins of lava] push their hand, and some just stick their head up like this [pointing to the single vein of lava]." Then McKinley began telling a story about the lava that went something like this:

> The lava is on its way. It just on its way. Yeah, it on its way and it comes up and it burned up a house. It burned it right up. Why it burn up the house? Well there dis train, but the lava didn't burn it up. The lava covered it, but it didn't burn up because it had more heat. It had this thing that made it rain on the lava. Dat make it cool down and then the water went away.

McKinley regularly personified lava in this way. She continued to talk about lava as a hand and tell personified stories about it for the whole month that I observed her learning. With time, her stories and comparisons of lava to a hand became more sophisticated.

Many learning theories and theorists suggest that we make sense of new information by relating it to things we already know (see as examples Smith, diSessa & Roschelle, 1993; von Glasersfeld, 1991; Vygotsky, 1986; Anderson, 1984; Smith, 1975; Piaget, 1972/1964; Dewey, 1933). Quite often, we use familiar things as metaphors to understand something new (Prawat & Peterson, in press). This seems to be what was going on with McKinley. I'm afraid that my explanation of lava getting hot, trying to expand, and finally exploding its way out of the earth made very little sense to McKinley. She couldn't understand what I was talking about so she made up her own way of explaining volcanoes. A hand was something she was familiar with and understood how it could move and reach through the dirt. Hence it made sense to simply talk about lava as a hand reaching up through the earth.

This metaphor not only helped McKinley construct an understanding of volcanoes, but it also transformed the nature of the apprenticeship. Without realizing it, my wife and I both began to talk about lava in terms of a hand. When trying to explain some aspect of a volcano we would naturally start calling veins of lava hands or fingers. "Hands" and "fingers" became an important part of the discourse about volcanoes. In a sense, McKinley apprenticed <u>us</u> into her way of talking about volcanoes. It was not until I began writing this paper that I realized how McKinley had transformed the way we talked about volcanoes.

McKinley also came up with other metaphors to understand lava. The most bizarre of these was when she started comparing lava to *yolk* of all things. In the earth book, there is a picture of a lava flow at night. Most of the flow is a black mass of lava interspersed with lines of glowing red

lava. In one area, a yellow bubble of lava is rising up. I explained that the black parts are where the lava is cooling down and turning into rock, the red parts are where it is still hot and runny, and the yellow part is where it is hottest and runniest. As I was explaining this, McKinley started calling the yellow part the yolk. I figured she just thought the bubble looked like an egg yolk and the comparison was not going to help her understand lava.

To my surprise, McKinley again talked about yolk in relation to lava about five days later. One morning at breakfast, after she compared her syrup to lava, she started telling a story: "He [the lava] is made out of rocks and yolk and he came up and up and up and grew a hand on his head. The hand grabbed the earth and threw it and it exploded. Then he ran down the mountain and burned up a house." I thought it was interesting that she referred to yolk again, but I didn't see how it was helpful in understanding volcanoes. Then, a few days later, McKinley again told a story about lava using the yolk metaphor. This time, she explained that the lava is made out of yolk and rocks and added, " . . . the yolk makes it runny and the rocks make it explode."

When she explained this, I suddenly had an insight into why she was sticking with this yolk metaphor. I think it was helping her to understand how lava can be in different phases. It can be hot and runny or it can cool off and become solid rock. By saying the lava was made out of yolk and rocks she was able to grasp this idea that part of a lava flow can be runny while another part can be solid. For McKinley, the fact that lava could be solid *and* runny was a new and likely perplexing idea. She solved this perplexity by saying that lava is made out of rock and yolk. With time it became clear that she wasn't taking this idea literally, but was simply using yolk to represent a state of "runniness."

As with the hand metaphor, both my wife and I picked up on this way of talking about lava. For example, we started referring to the runny part of the lava as the "yolky" part. Also, my wife began to compare the whole earth to an egg with a rigid outer shell, a runnier outer layer, and yellow core. Again, McKinley not only transformed the knowledge we were teaching as she tried to make sense of it (individual constructivism) but she also transformed our interactions with her (interpersonal constructivism).

McKinley transformed our interactions with her in other ways as well. For example, she was the one who first began comparing many liquids to lava, which led us to do the same. This started when she was helping her mom make a cake. When they poured the oil into the bowl, McKinley said it was like lava. This led her mom to compare the other liquids used for the mix to lava. Such comparisons eventually led to a discussion about viscosity and how some lava is more viscous than others. They examined viscosity by pouring different liquids and seeing how fast they spread out. This whole interaction was initiated by McKinley. Her influence even extended out to a broader social context involving her grandparents. She often told them about volcanoes and with time, they began to ask her about volcanoes, tell her about the volcano they saw in Hawaii, and they even bought her a volcano kit for Christmas.

The key point is that my wife and I initially created a social context where volcanoes were valued and used as a way of seeing the world, but McKinley also played a key role in constructing this social context. She had a particular influence on the nature of the discourse about volcanoes. Also, her developing interest in volcanoes and use of volcanoes as a way of seeing the world further contributed to the establishment and broadening of a social context that cared about volcanoes.

Conclusion

From a Deweyan perspective, the primary goal of education is to enlarge students' capacity to have worthwhile experiences. One type of worthwhile experience which has particular relevance to education is an idea-based experience. An idea-based experience unfolds when anticipation relevant to an idea leads the individual to activity seek out ways to use the idea--such as using it to see, understand, or contemplate objects and events in the world from a new perspective. An idea-based experience literally involves a striving to see the world anew.

In this study, I presented a model of how individuals can be apprenticed into idea-based experiences. Then I described how my daughter McKinley was apprenticed into idea-based

experiences that involved caring about volcanoes and proactively using volcanoes as a way of seeing objects and events in her world (such as a dropped cup of milk) from a new perspective. She gradually came to develop this interest in and use of volcanoes in a way that reflected the modeling and scaffolding provided by my wife and I. However, the apprenticeship was also a dynamic constructive process. In particular, McKinley invented some metaphors in order to help her construct an understanding of volcanoes and these metaphors transformed the interactions that she had with her mom and myself.

There are some obvious limitations of this study that should be discussed. First of all, the purpose of this study was to provide a description of an individual being apprenticed into an idea-based experience as well as to contribute to a theory of what it means to have an idea-based experience, how a person comes to participate in an idea-based experience, and what processes are involved in an idea-based experience. Although it does contribute to theory development, it cannot say anything definite about causal factors. As mentioned, other studies need to more precisely address the issue of the relationship between interest and use that takes place within an idea-based experience. Similarly, other studies need to look more precisely at the relationship between the modeling and scaffolding of interest and use in a social context and the appropriation of particular ways of caring about and using an idea.

Another limitation is that there may be something inherently interesting about volcanoes. Part of the interest McKinley developed in volcanoes is likely attributable to the fact that kids like things that explode. However, the particular type of interest and use that she displayed suggest that some appropriation was taking place. For example, she expressed interest in actually learning about volcanoes and coming to know the things I know. Also, she used volcanoes to see objects and events in the world in a way that closely paralleled the modeling provided by my wife and I. Nevertheless, it stands to reason that some ideas or topics may be more conducive to idea-based experiences than others. Volcanoes probably fall on the conducive side. Identifying the factors that make some ideas more conducive to idea-based experiences than others is another area of needed research.

A final limitation is that my own daughter was the subject of research. One should be cautious in drawing generalizations. The type of apprenticeship that worked in my home will not necessarily work in other settings, even other family settings. But again, I emphasize that the purpose of this study was the development of theory--in particular, a model of how individuals may be apprenticed into idea-based experiences. It remains to be seen if the theory developed in this paper can help us design apprenticeships that would be effective in providing classroom students with idea-based experience. There are many factors that complicate the picture in a classroom. For instance, students come with already developed attitudes: "I'm not a science person," "School is not my thing," "Only nerds really like this stuff," and so. There is less one-on-one interaction. Students may see themselves as opposed to the classroom community instead of a part of it. Students have varying abilities and family support. And the list could go on. The point I wish to make is that the same type of apprenticeship that worked in my home will likely not work in a school setting. However, the general idea that students can be apprenticed into idea-based experiences through some forms of modeling and scaffolding may still be valid. In fact, that is the problem I am currently working on. My colleagues and I are trying to figure out how to apprentice students into meaningful experiences with science ideas by teaching and working with teachers in elementary and middle schools. Hopefully we will be able to use ideas to increase students' capacity to experience the world just as ideas about volcanoes increased McKinley's experiencing of the world.

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