Conceptualizations of nature from science students in Northeastern Colombia.

William Medina-Jerez, *University of Texas at El Paso*
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William Medina-Jerez
University of Wyoming

The purpose of this study was to explore rural and provincial students’ conceptualizations of nature in Colombia alongside the science education offered in their school communities. Students’ perceptions of nature were produced from interviews that revolved around a focusing event and two eliciting devices to document their views about home, school science, and nature. Eighteen students from two urban and one provincial school communities were invited to participate in an interview. An anthropological approach to education allowed for case descriptions in urban and provincial settings in a northeastern region of Colombia, South America. The findings specifically reflect how multiple worldviews correlate with the framework of school science.

Keywords: worldview; nature; conceptualization; school science; subculture of science

It is widely accepted that learners carry everyday ideas, conceptions, and understandings from their local communities into their schools. The disparity between school science and the worldviews of students has been attributed to a conflict between subcultures—the subculture of science and the particular life worldviews of students (Aikenhead, 1996; Baker & Taylor, 1995; Okebukola & Jegede, 1990). George (1999) asserts that “learning school science requires some students to cross boundaries between the cultural context of their homes, family, and community and the cultural context of Western science” (p. 3).

It is also a concern that the so-called subculture of school science in less developed countries (LDC) pursues educational programs that simulate overseas environments (social and geographical) and cultures that may be far dissimilar to the ones whose population is to be served (Gray, 1999; Kyle, 1999). With the emulation of those foreign policies, science education in these nations has also implanted a Westernized science teaching approach. In the words of Cobern (1998), “It [Western science] is too often scientistic and promotes a culture of school science that needlessly alienates many students” (p. 18). It also projects and accentuates economic, political, and scientific disparities among nations with lesser and most developed economies, which in turn cause the students and the public to see an implicit superiority of the Western scientific view and the concomitant inferiority of the student’s own worldviews.

Because nature is central in science education and the everyday situations of students, this study aimed to expose how students understand nature for different purposes (i.e., curative, personal interests, religious beliefs, family traditions). In concordance with repeated calls (Aikenhead, 1996; Atwater, 1996; Yager, 1988) for making science education meaningful and relevant to students, this study hopes to offer insights to science education that allows students to travel comfortably from their everyday life-worlds into the world of science and vice versa.

Theoretical Framework

“In an African study authors concluded that the rural people taking part in the research were irrational because they used traditional ideas to explain phenomena in nature” (Cobern, 1994, p.10). This study highlights how important it is to pay attention to and hear the voices of students if a clear understanding of their conceptualizations is to be reached (Cobern, 2000). The science education community is now aware of the disjunction between the scientific knowledge imparted within the classroom and the multiple events that students may encounter in their everyday experiences. For example, this discrepancy exists in transitions.
between students’ conceptions of the natural world and the scientific knowledge imparted within the classroom. For many students, there is a feeling they have internalized which dictates that what they do and experience every day in the school setting has nothing to do with their personal experiences outside the school environment. The way individuals understand their physical and cultural environments is termed conceptualization of nature (Cobern, 2000). Because this concept (nature) is a core element in science teaching and learning around the world, it is thus of paramount interest for science educators to investigate and understand the transitions that students make on a daily basis between their own worlds and that of school science, and more specifically the understandings students envision as nature. How students see, understand, and appreciate nature in their local culture is worth considering if education reforms hope for meaningful outcomes.

Frequent calls for reform in science teaching suggest letting students’ voices and views play a prominent role in the science curriculum. One issue that has captured the attention of researchers is the reasoning patterns (empirical or magical/superstitious) employed by students from rural or urban dwellings, a feature that unfortunately is used to discredit these ways of knowing (Okebukola & Jegede, 1990). These are ecologies of the classroom setting, although they may be less evident than other traditional features. Concomitantly, educational reforms throughout LDC continue to serve Western educational enterprises, despite their degree of inappropriateness.

Scholars in the anthropology and culture studies in science education (CSSE) fields have documented and addressed the interplay between the conventional (Western) scientific knowledge imparted in science classrooms and the students’ own worlds. This field of research emphasizes the relationship between culture, behavior, society, and science. The selected approach is supported by other studies conducted in the field, particularly in the research avenue established by Cobern (1991, 1993, 1994, 1998, 2000), who pioneered a series of studies to investigate variations in student conceptualizations about nature. For instance, Cobern (1993) incorporated Kearney’s (1984) worldview theory into his research endeavors in an attempt to explain the wide-ranging diversity of observed conceptualizations that students hold with regard to nature. The worldview theory accounts for a person’s mindset and her or his assumptions generated toward the surrounding world. It can be also defined as “the way people look at reality” (Kearney, 1984, p. 41). Particular to this approach is the adaptation of the so-called worldview universals. There are seven universals or macrothoughts in the worldview theory, the first four being the Self (the first point of reference for everyone is herself or himself), the non-Self (all which exists in the universe beyond the Self), classification (the abovementioned categories constitute a primary example of this universal, but other groupings are possible within the non-Self, that is, social, natural, and spiritual), and relationship (a resulting class comes from the natural interactions between the Self and the non-Self). It is difficult, if not impossible, to assume the existence of a given organism in isolation from the environment. Causality, fifth in the framework of the worldview theory, is understood as a cause-and-effect element that people use to make sense of the phenomena that have incidence in their worlds. In this stage, for instance, one can locate the assumptions and adherences (persisting behaviors) of finalism as a tool for understanding of phenomena in nature. Participation and magical causality are also attributed here as mechanisms in which explanations to physical phenomena are based, for instance, in the belief that celestial bodies have power to influence terrestrial events. In regard to magical causality, it is believed that a connection between a person’s thoughts, desires, and handling of objects provokes that the latter be infused with human features just because of the usage of material things. An example of this type of adherence (Piaget, 1971) is the popular belief known as evil eye in which people may cause other individual harm just by using feelings and thoughts. Finally, time and space are the last two categories that are generally taken for granted as implicit to the natural surroundings and therefore less tangible. These two dimensions are understood in different terms by different communities. It is known, for instance, that in some communities, time is perceived in linear terms, whereas in other ones the circularity of time is fundamental.

In regard to time and space, Kearney (1984) points out the case that many Latin Americans and people from Mediterranean societies view the present as the instance that plays a fundamental role in their day-to-day experiences; the future, at the other end, as intangible and unattainable. In Latin American communities, the prevalence of a present time–orientation connects with religious views. Happenings for tomorrow are not likely to take place unless they are granted by God, so it is commonly said that things will occur only if God gives permission: si Dios me da licencia. Linguistically speaking, it has been maintained (Kearney, 1984) that the semantics, that is, underlying meanings, of language are actually manifested in the way individuals understand phenomena in nature in thought and words. Colloquial expressions in some languages are said to promote and perpetuate odd interpretations of nature or...
cultural symbols established in connection with religion and local customs. Thijs and Van den Berg (1995) cite the following command that incorrectly describes the behavior of heat conduction: “Please shut the door to keep the cold out of the room” (p. 329). Nevertheless, some investigators are divided on the explanation of the language-thought relationship. Could the words of language (i.e., the message) possibly be sufficient to truly portray the experience of the sender?

Why, then, is it imperative to address students’ ways of knowing about nature in communities such as the one presented in this study? The answer might be found in the fact that education reforms in science education in LDC would greatly benefit from the various ways in which students interact with and interpret reality in their local environments. Provincial and rural communities in LDC are highly dependent on nature. Because the worldview presuppositions are dependent on culture and the organization of mind, getting to know how students understand their surrounding natural world might be informative of how they feel, think, and act in those worlds. Therefore, for science educators, this approach would allow them to know more about students’ attitudes and achievement within a local and culture-dependent context. For the purpose of this study, three universals of the worldview theory were taken into consideration: the Self (the student), the non-Self (nature), and causality (students’ conceptualizations of nature). This study was designed to respond to the following research question: How do students conceptualize nature in their familiar environments in relation to school science education?

Research Design

This study used an interpretative design (Erickson, 1986), including a hermeneutical approach in that the resulting interpretations are supported by what was already known (Eger, 1992); revision of related literature in the area (Aikenhead, 1996, 2000, 2004; Cobern, 1991, 1994, 1998, 2000; Okebukola & Jegede, 1990); personal experience in the field; and a constant analysis and interpretation of the information that was gathered. Interviews with students were the means by which information was gathered. For the purpose of conducting the interviews, this study included one focusing event and two elicitation devices.

Participants

This study involved the participation of 18 middle- and high-school students ranging from 13 to 17 years of age in a provincial school community of northeastern Colombia. All the participants were in either biology or chemistry classes or both. The selection of this number of students is based on previous research in this area (Cobern, 1993), in which the number of 15 students was considered sufficient to achieve code redundancy during the interpretation of the interview transcripts.

Interview Procedure

Prior to holding interviews with students, each question was practiced. The purpose was to gain enough experience and confidence in the use of each item, as well as to identify those questions that would require rewording, those that could be eliminated, and the ones that should be asked at a different time during the interview. The language elicitation device needed to stimulate a rich flow of responses from the informant, keeping in mind that none of the adolescent students was expected to perform linguistically as fully developed adults in terms of verbal communication skills (i.e., in narrative, discourse, and conversational contexts). However, the aim was to stimulate as much willingness, complexity, and variety of responses as might be possible. Also, the potential reluctance of the students was considered because this type of one-on-one interview with an adult is an unusual and plausibly stressful event for them. The intent of this exercise was to identify the concepts that have scope and force in the conceptualizations of nature of the abovementioned participants, as well as the place that other belief elements such as folk knowledge—which was an issue that emerged during interviews with students—had in those conceptualizations. This procedure also intends to demonstrate links within those conceptualizations and school science as the participant explains his or her views. Before proceeding with the interviews with volunteer students, demographic information and an overview of the science curriculum were collected from the cooperating teachers and schools where the participating students were enrolled. The conceptualizations of nature held by each of the participants were outlined in accordance to a three-task-based, semi-structured interview procedure adapted from Cobern (2000). Because the concept of nature is quite diverse and profound, efforts were made to ensure that the viewpoints of the participants departed from the same conceptual frame, which was the reason for including a focusing event and two elicitation devices in the interviews. As noted by Cobern (2000), “One cannot simply ask, what is nature, and expect to learn much” (p. 18). In regard to this standpoint, the participant’s views were, at all times, solely guided by an emerging procedure. It was only up to
the participant to mention those words (i.e., science, nature, scientists) and, when it happened, the investigator opportunistically followed with probe questions and requests for explanations and examples.

### Focusing Event

The interview with the student was initiated by presenting the participant with a focusing event that consisted of a series of six pictures of different landscapes depicting nature as both beneficial and dangerous, with and without human intervention, and portraying macro- and microscopic environments. These materials were prepared and tested in advance by the investigator to ensure the characteristics that they should have as mentioned by Cobern (2000). The intention here was to guarantee that the participants were aware of the topics to be covered and that they knew what the interview was essentially about. At this point, the participants were asked to observe the pictures and to decide if the terms were of nature or the natural world and whether the terms nature or the natural world conveyed the same meaning. Upon the selection of the terms (nature or the natural world), the opening question was asked: How do you define nature or the natural world? The question was asked to obtain an open statement about nature without prompting or suggesting scientific terms or standpoints from each informant. The investigator paid special attention not to introduce scientific terminology. Only the participant would bring such concepts into discussion. This task ended within 15 to 20 minutes and was administered during the first interview session.

### Elicitation Devices

The elicitation devices were used in two tasks. The first one consisted of 33 preselected words written on index cards as suggested by Cobern (2000; see Table 1). Because the interviews were conducted in Spanish, some emotional concepts such as excitation and confusion were translated as closely as possible to provide an accurate meaning. Concepts were carefully translated in bidirectional procedures and presented to minimize linguistic misinterpretations. It is important to mention the resemblance of the three tasks (one focusing event and two elicitation devices). The coherency ensured the validity of data in the sense that as the participant progressed through each task, there was sufficient overlap of topics so that the participant was continuously engaged in the discussion of relevant concepts about nature.

During the first task, the student was presented with a group of cards/terms and asked to regroup them under two labels: “Nature is . . .” or “Nature is not . . .” The student used the terms on the cards to complete the sentence. When the student felt unsure whether to classify a term as a “Nature is/Nature is not,” undecided card groups were allowed. The same procedure continued after presenting the student a second and third group of cards, each group containing about 11 cards or terms. When all the cards had been sorted, the interviewer showed the student the “Nature is . . .” cards and asked him or her to come up with groups of cards that were interrelated. Then, the student was asked to select, from this pile, one or more terms to comment on. The interviewer sometimes asked the student a question to get the conversation started (e.g., What would you like to talk about?). As the conversation progressed, the interviewer asked probing questions and requested examples (Can you tell me the reason for this selection? Why do you think nature is . . . ?). The interview continued until all groups of related cards were addressed.

During the second task, the student was shown a group of 18 statements (see Table 2) and then asked whether he or she agreed or disagreed with each case. The student then sorted the sentence cards under the “agree” or “disagree” labels, and was asked to review the two groups of cards (agree and disagree). Throughout this sorting procedure, the student was given the opportunity to enrich his or her comments on issues about nature that involved those qualities (i.e., ontology, epistemology). In the third task, the student let the interviewer know which ideas about nature were most relevant to himself or herself. This was essentially a ranking task. Here the student was presented with two cards/statements from the prior task and asked to reject both, keep both, or keep only one, depending on his or her feelings toward the message in each statement. Later, the interviewer showed a third card to be compared with the first set by the student. Once again, it was the decision of the student whether to keep or reject the new statement. At this point, the student was informed about the option of keeping all statements or discarding the ones with which he or she disagreed. This procedure was
repeated until all the sentences were considered by the student. It was essential for the student to keep the retained sentences in rank order. Before the end of the conversation, the student was asked once again to reconsider the rank of the sentences. This order was used to produce the narratives describing each student’s conceptualization of nature.

**Results**

Cobern (1993, 1994, 1998, 2000) used the same approach to explore students’ conceptualizations of nature and found that students use aesthetical, personal, and sometimes disconnected understandings to explain phenomena in nature. In this study, two observations surfaced as students reported on their perceptions about nature and their participation in the subculture of school science. First, students essentially used elements from their own worlds to conceptualize about nature; and second, the content of science education programs in the local schools was presented as a “relatively accurate description of Western science education” (Cobern, 2000, p. 19). The investigation of the student’s perspectives concerning his or her relationship with the natural world informs us that, for the most part, students are dealing with a disjointed vision of nature. For example, religion and local customs appear intertwined because of the home upbringings and religious education. Yet students from the military school show less spiritual-based explanations than students from religious urban and the provincial schools.

Freddy, a 14-year-old eighth-grade student in an urban-private military school, explained nature by scientific and religious principles: “I think that nature can be explained by science. Those explanations are more refined, and they can be scientifically confirmed, even though one cannot leave behind religion.”

On the other hand, Monica is 16 years old and in 10th grade at a public Catholic provincial school. Monica alluded continuously to the religious orientation that she received in school, which seems to be an essential part of her conceptualization of nature. She stated, “Nature comes from God. Behind the origin of the things, there must be someone who is omnipotent. He created everything with perfection and even by mysteries.”

The objectives from participating science teachers indicated the centrality of a pure scientist approach to nature. For instance, according to the instructional objectives statements, eighth- and ninth-grade biology students pursue the goal of improving their understanding in this area by using up-to-date research tools; they also were to value the importance of scientific knowledge in the preservation of the environment. Nevertheless, these meaningful goals seem unattainable in light of quality constraints, like the disadvantaged science laboratories in these schools. This situation was attested to by the science teacher:

If I need to stay extra time in the lab putting things together for my classes, well, I will do it. I think is part of my duties. If you come and visit the labs—which are completely obsolete, especially in biology—yes, there are the microscopes and stuff, and if they need maintenance . . . well, I guess that is my job. I mean, sometimes the teacher’s attitudes seems to slow things down.

There was also a case in which practical science experiences were not possible due to other methods adopted by the science teacher. Laura, a ninth-grade student, attested to the infrequent visits to the lab by saying, “We went to the lab about five times during the whole year; maybe on two of those occasions we did some stuff with the microscope, but the rest was just learning about the things that were in there.” As one of her classmates indicated, Laura also explained that the reason her teacher stopped doing lab activities with them was because one student cut his classmate when attempting to investigate blood types. “Then, our teacher penalized us with no more classes in the lab,” she added.

On one hand, students are inducted into professing the scientism-based school knowledge and, on the other hand, ascribing to a common sense interpretation of their everyday realities. Ana, an eighth-grade student, commented:

<table>
<thead>
<tr>
<th>Table 2. Sample of Sentences Used in Task Two</th>
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<tbody>
<tr>
<td>Epistemological description</td>
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<td></td>
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<tr>
<td>Ontological description</td>
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People should be careful with nature, because it is holy . . . because it is God’s gift, so we should not attempt to destroy it. It [nature] suffers when for instance we cut down a tree, sure it does . . . nature is alive.

Nevertheless, it must be admitted that there are also some students who do not necessary fall exclusively into one or several of these descriptors. They showed a blending position and manifested their views about nature that can be demarcated in the causality and relationship worldview universals. Words and descriptors about a mechanistic world were expressed with an addition of intuitive, passionate, and subjective interpretation of the natural world. This is what Joaquin, an eighth-grade student at an urban public Catholic school, had to say:

Personally, I think that all the things that exist now come from the evolution of the planet, and all those phenomena that are occurring now (i.e., tsunami) are the costs we are being charged for because we have caused damages to nature. Nature is billing us. Anyhow, I will stick with both views [religion and science] a little more with the scientific one.

Students’ perceptions about reality were spoken with aesthetical, religious, environmental, and personal tones. Very little was mentioned in terms of a link between school science (i.e., principles, theories, definitions) and their beliefs and conjectures about the way reality appears to them. Kearney (1984), in his description of the worldview of Mexican campesinos, or farmhands, points to the intimate connection that exists between the first universal category (Self) and the type of speech style that is ordinarily used, not only by individuals in this community but also, to a great extent, in the rest of the Spanish-speaking world. The version of the external world that people construct can become highly dependent on the traits that characterize the belief systems typical in their communities.

About linguistic skill, students from the provincial school said less than the ones from the city. Controlling for and documenting language style, skill, and development remains a factor unaddressed in research on worldview theory. Findings with students from this study suggest that to tackle influences on narrative-based elicitation with secondary students, researchers should implement other tools that could ensure much more detailed data collection via multimodal communication and scaffolded questioning techniques. Furthermore, Kearney (1984) discusses the ways that Latin American populations are present-oriented in time, leaving God to solve problems by stating, “Si Dios Quiere.” In the students’ narratives, little elaboration was made from a science-related perspective. Equally interesting was the fact that, for most of these students, science and religion are similarly relevant in their conceptualizations. The issue of duality persists in their interactions with school science and their own perspectives, perhaps as feeling affiliated to folk practices in their community (i.e., homemade medicines, oral traditions that incorporate personal encounters with nature) and at the same time consulting with the doctor or specialist when otherwise appropriate.

### Students’ Conceptualizations and the Worldview Theory

The focal point in this investigation was the exploration of students’ images of reality. From the report made by students about their relationship with nature, the following major points were highly regarded.

First, as a member of the local community, the student (Self) is aware of the relationship that is to be maintained with nature. Attitudes toward nature (relationship, a worldview universal) that entail respect were perceived when students talked about their own and indigenous groups’ interactions with nature (non-Self). Examples reporting these respectful attitudes are:

- “Indigenous groups from the Amazon get permission from nature before cutting a tree” or “Getting from nature the resources that are solely necessary.” In their views, nature was described to sustain life, a reason they attributed nature as sacred. Students saw their interactions with nature as mutually dependent. In their views, nature deserves respect because it is sacred, and in return humans get the necessary resources for survival.
- Nature allows for homemade medicines, a tradition that is more frequently practiced in provincial settings in this country. It was interesting to note that official medicine is sought as a last resort, in the event of serious injury, or simply because, as eighth-grade student José reported, “Sometimes doctors do not find the cause of the problem.” In connection to this case, Joaquin related his personal experience:

I had an ankle fracture, so my mom took me to the doctor. He prescribed me some medicine and therapy, but we did not see much improvement. Then, we opted to go to the healer; he gave me four massages, and then I got well.

The same healer treated his 2-year-old sister when she was hospitalized due to a severe case of dehydration, and because the doctors did not solve the problem, his parents went to see a healer. “A week later she was
doing well,” he claimed. Joaquin also remembered having been treated with a slice of potato for bruises, and also pointed out that the use of volcanic mud can treat skin problems.

The fact that these issues (i.e., folk knowledge, homemade medicines) emerged during the interviews with students was particularly interesting. The tone of the conversations and the length of the responses increased as these topics were discussed. For instance, Freddy, a ninth-grader with high academic achievement, commented on the alternative medicine used by his family, a tradition that comes from his grandfather, who was a farmer and a healer. Those abilities seem to have been inherited by his father—an agricultural technician—who attended a spiritual center to become a healer, too. There, “He learned how to meditate and cure and now when he goes into the fields, people seek him out for help,” reported Freddy. Students’ folk knowledge is reinforced through family traditions practiced for generations. These practices carry into the local community in which neighbors and local residents share and care for their day-to-day needs. In some cases, students referred to their experiences with homemade medicines by giving examples of cures for different ailments. For instance, Elizabeth’s list of remedies starts with a mixture of onion and honey, a treatment that a friend of her mother recommended. “You leave the onion in contact with air for one night, and then on the next day, you collect the gooey substance that it produces, mix it with honey, and drink it . . . it is good to control coughing.” The healer in her neighborhood has already passed away, but she remembers the day she had sprained one of her hands. “I went to see him, he gave me a massage, and I got well. On the next day, I went to the hospital and got an X-ray.” For some students, commenting on these issues provoked attitudes such as denial. Wilson, for instance, initially rejected his familiarity with topics about the homemade medicines. However, he felt more comfortable when told about the cases narrated by his classmates. Later he admitted that his grandma uses infusions to treat the problems she has with her veins. “She prepared infusions of mint and cardosanto [an herb found in the surroundings], she would boil that mixture and drink it, and it seemed like she got some relief.”

Second, nature (non-Self) was highly regarded by the participating students. It was described, for the most part, in aesthetical, religious, and personal tones. Students projected a sense of wonder and admiration in regard to the natural world during the interviews. According to students, nature’s mystery and surprise make knowing and understanding the natural world a difficult task. José, an eighth grader, cited his fascination with nature by looking at animals and their life strategies. He also mentioned animal species living in harsh environments (i.e., algae in volcanoes) as a reason for his admiration. It is important to point out that the abovementioned qualities are informative of the students’ relationship with nature as well as their place and role in it. One example of this perception was revealed when students spoke of nature as a living thing and pure, which makes it a sacred entity. Paulo, a ninth-grade student, said that “all those phenomena [in reference to the occurrence of the tsunami in Asia] that are occurring now are the costs we are being charged for because we have caused damages to nature, nature is billing us.”

It is important to highlight the fact that students seemed to be aware of the connotations that terms such alive and sacred have in connection to everyday language. In the case of some students, they apparently borrowed this terminology to create or reinforce their perceptions of reality. Cristina’s comments attest to this situation: “Nature is alive, not as an organism, but I think it is alive; otherwise seeds would not germinate.” As for the conceptualization of nature as sacred, in Ruben’s case, “If nature was sacred, then we would not have the same privileges.”

Third, as a result of the relationship between the individual (Self) and the natural environment (non-Self), the resulting category (causality) was discussed in terms of the consequences of the human impact over the environment. The deterioration of natural resources was a salient point in the view of the students. Not only were humans cited as a threat to the environment, but nature itself as a threat to humankind. The view of nature was from a holistic perspective. Nature was described as a composite of living things interconnected and internally affected by disturbances on one of its parts. It seems that for students, there is not only a human-to-nature interaction (i.e., developed countries are dumping chemical wastes into the natural reserves) but also a nature-to-human interaction in the form of natural disasters (i.e., tsunamis).

In terms of the magical causality discussed in previous sections, José, an eighth grader, shared his personal experience:

My mom told me that when I was a one-year-old, I almost died because of the evil eye myth. I was taken to the doctors but they did not cure me. Then, my mom decided to take me to the healer. He diagnosed me and recommended some medicines which worked. Otherwise, I would have died.
José’s description contrasts with his conceptualization of nature. For him, like most of his classmates, nature was an aggregate of living things in which ecological networks maintain equilibrium. In his conceptualizations, José says that disturbances in a localized environment cause global repercussions such as climate change. Nevertheless, he could not elaborate on his reasoning. He simply maintained that climate change results because “animals, plants, organisms...everything is being destroyed.” Another interesting point about José is the duality of his interpretations. On one hand, he admitted the benefits of traditional practices such as homemade medicines, and on the other hand, he made it clear that nonscientific interpretations should be avoided. “Phenomena in nature are just that, and they should not be misunderstood as spiritual qualities.”

For students in this community, religion plays a major role inside and outside school scenarios; however, students do not seem distracted as they move from one setting to another. On the contrary, it is an important standpoint from which their perceptions of reality gain support through symbols of knowledge (Kearney, 1984). As for symbols of knowledge, odd interpretations can travel through authority figures. For example, many students view teachers as the repository of information. Wilson, a student from the urban Catholic school talking about the reasons for a natural disaster that had occurred recently (tsunamis), said that one of his teachers said these phenomena resulted from the earth collecting for human damages. This odd interpretation, for instance, was generated in school by an educator, and Wilson will probably continue to believe anthropomorphically that the nature seeks retribution. Descriptions that involved symbols of religion represented nature because of its role as a supplier of resources and its purity and beauty, because nature, for some students, is harmless and God’s creation. In regard to the latter point, students comfortably shared about the origin of life. In all cases, they referred to religion and school science teachings:

I think that nature is sacred because it was created by God. In religion class at school, we were taught about biblical explanations. In the science classes, we go over theories related to the universe, the Big-Bang theory...I do not remember. I also think that nature is pure because it has many beautiful things. (Teresa, Grade 10)

For instance, Elizabeth, although acknowledging the work that scientists do in trying to “explain the formation of the planet,” was clear in affirming her beliefs:

“In my case, I believe in God, I think that everyone should be allowed to have his or her own explanations.” Others such a Joaquin, a ninth grader, preferred to maintain a middle point: “I am very Catholic; we honor God as the only creator...I think that all the things that exist now come from the evolution of the planet. Anyhow, I will stick with both views.” Yet there were those students like Wilson, a ninth grader who manifested having his own explanation to the origin of the universe. “My own explanation is that a meteorite or rocks hit the earth and so they contained things like...I do not know, bacteria...then those organisms evolved because of climate changes in the atmosphere, and continued evolving.”

Conclusions

It has been observed that depending on the demands found in everyday life experiences, people employ either science-referenced explanations or folk knowledge-informed justifications to make sense of the encountered events (Thijs & Van den Berg, 1995). In connection to the compartmentalization of knowledge that has been documented in students from other nations (Costa, 1995; Jegede, 1995), the views expressed by the students in this study seemed to come from a commonsense standpoint. No school science knowledge had such scope in their conceptualizations as did their personal worlds. Scientific terms (i.e., pollution, oxygen) seemed to be used to describe phenomena in nature for credibility.

The following are salient points on how students from this provincial community envision nature.

The students’ images about their perception of the natural world are prominently based on their day-to-day experiences with the local environment. There is a blend of religious, popular knowledge, and personal elements shaping their views about nature. Their personalized elaborations included anthropomorphic tones when referring to nature as living thing. In their views, nature is alive because it feeds us, suffers, makes plants grow, and makes changes by itself.

Interpretations of nature as sacred were frequent. Knowing the significance of the term in a religious context, students seem to have borrowed it—probably because of its scope and force—to highlight nature’s qualities. In this Colombian community, nature was considered sacred because it is pure, beautiful, powerful, essential for life, unique, and harmless. Thus, nature is seen as an entity that deserves to be respected and feared.

In terms of variations between female and male students’ conceptualizations about nature, there was
only one distinction that surfaced in regard to the origin of nature. All female students asserted a creationist position in regard to the origin of nature. In the case of the male responses, their deliberations varied. Some male students took a creationist-evolutionist perspective. Others defended a solely creationist or evolutionist explanation. Yet other males admitted confusion as to the origin of nature and offered their own theories.

The geographical setting in which these students live allows them close contact with the temperate Andean ecosystem in which to exercise curiosity and inquisitiveness. Students have admiration for what they call the beauty of nature (i.e., greenish hues of landscapes) and easily see potential for conducting their own investigations. Teresa even stated, “I would like to become a naturalist and study nature to find the answers to a few questions I have, for instance, about the changing color mechanism of animals.”

These ways of looking at reality would bring relevance and appropriateness to science teaching in this community. Not even the reductionist view of nature, from science classrooms, had scope and force in these students’ conceptualizations of nature. It is observed that science education as offered to students in this community exposes them to foreign ways of knowing without consideration of the students’ views and the local cultural and geographical contexts.

References

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William Medina-Jerez is an assistant professor of secondary science education at The University of Wyoming in Laramie. His research interests include working with students from diverse backgrounds and exploring international science education. He hopes to improve access to meaningful science education and career opportunities for all students.