

Bringing the Biodiversity of Ecuador to Spanish Immersion Classrooms

(by Diane J. Tedick and Constance L. Walker, University of Minnesota, with teachers from Adams Spanish Immersion, St. Paul, Minnesota: Denise Anderson, 3rd Grade; Concha Fernández, 5th Grade; Dayna Laber, Kindergarten; Andrea Marcy, 2nd Grade; Melissa Richards, Kindergarten Highland Park Junior High Spanish Immersion Program, St. Paul, Minnesota: Andrew Burfeind, 7th and 8th Grade Science; Emerson Spanish Immersion Learning Center, Minneapolis, Minnesota: Janet Helmberger, 7th and 8th Grade; Robbinsdale Spanish Immersion, Robbinsdale, Minnesota: Amy Egenberger, 3rd Grade; Montserrat Recarte, 2nd Grade; Tanya Reynolds, 1st Grade.)

This project involved 10 teacher participants in the development of science content materials in Spanish for immersion programs at the elementary and middle school levels. With funding support from the U.S. Department of Education's Fulbright-Hays Group Projects Abroad Program, elementary and middle school immersion teachers were selected from metro-area Spanish immersion schools to travel to Ecuador to participate in a four-week study abroad curriculum development program directed by teacher education faculty in Second Languages and Cultures Education from the University of Minnesota. The program was developed in collaboration with Fundación CIMAS del Ecuador (Centro de Investigaciones en Medio Ambiente y Salud—Center for Research on Health and the Environment), an organization that offers programs focused on development and environmental issues in Ecuador, and which also coordinates the University of Minnesota's study abroad internship program in Ecuador through the Minnesota Studies in International Development (MSID). Dr. José Suárez and Dolores López, CIMAS Directors, work with an extensive network of researchers currently involved in biodiversity and environmental protection projects throughout the country.

The project objectives asked that teachers:

- Develop awareness of one of Latin America's most complex nations in terms of its variety of ecological environments
- Become familiar with biological systems in Ecuador and their adaptation to changing economic, social, and ecological systems through seminars with scientists in-country
- Develop Spanish-language vocabulary pertaining to science, utilizing terms that describe plant and animal systems and processes
- Understand an ecosystem that ranges from mountains to rainforest to tropical/coastal areas
- Participate in, through travel and site visits, the collection of information and resources appropriate for use in the development of curriculum
- Develop science curriculum appropriate for their own classroom settings at levels kindergarten through eighth grade, and
- Apply the fundamental concepts that define content-based instruction in the development of age and language appropriate materials for their particular teaching level

The Project:

Pre-Orientation Sessions

The program began in spring 1999 with pre-departure orientation sessions, which focused on the fundamentals of content-based language instruction, key concepts in science education, and background information on Ecuador. The challenge for immersion teachers, who practice content-based instruction daily, is to develop systematic ways to incorporate a focus on language

instruction in the context of content instruction. Researchers have established that “...subject matter teaching does not on its own provide adequate language teaching” (Lyster & Ranta, 1997). Language immersion teachers are increasingly more aware of the need to systematically attend to language form and structure, and both researchers and teachers agree that more effort can be made to the teaching of language structures in meaningful contexts. With this in mind, we asked that the teachers establish objectives for language instruction in the context of the science content lessons they would develop in Ecuador. In particular, we focused on a model offered by Snow, Met, and Genesee (1989), which suggests that teachers develop content-obligatory and content-compatible language objectives. According to Snow et al., content-obligatory language objectives, which are both structural and functional, “specify the language required for students to develop, master, and communicate about a given content material” (pp. 205-6). In contrast, content-compatible language structures “can be taught within the context of a given content but are not required for successful content mastery” (p. 206). Content-obligatory language objectives emerge directly from the linguistic needs for communicating the information in the content area, whereas content-compatible language objectives derive from the immersion language curriculum and ongoing assessment of learner needs and progress (Snow et al., 1989, p. 206). Examples of each appear in the sample lesson that follows.

The Study-Abroad Component

In July 1999, teacher-participants traveled to Ecuador for the study abroad component of the program, which began with a week-long intensive program on geography, anthropology, and biodiversity in the region, all of which was taught in Spanish. The teachers met with top experts in the country to learn about biodiversity in Ecuador, the environmental impact of development and contradictions of development in Ecuador, issues related to the Ecuadorian economy and external debt (and their impact on the environment), and the different cultures that co-exist in distinct regions of the country. A number of major environmental organizations also met with the group, including Fundación Natura, Acción Ecológica, EcoCiencias, Oikos, and Fundación de Defensa Ecológica (FUNDECOL). These organizations represent both governmental and grassroots efforts to conserve natural resources and work against the destruction of the environment.

What We Learned—A Brief Overview of Ecuador’s Biodiversity and the Challenges It Faces

Ecuador is one of the richest 16 countries of the world in terms of biodiversity. In fact, it is considered the richest country of the world in its biodiversity. There are 10 “hotspots” in the world where there is a heavy concentration of biodiversity. Ecuador contains three of those “hotspots,” known as the highlands of the western Amazon, the Colombian Chocó, and Western Ecuador. We learned that Ecuador has a huge number of endemic species (species that exist only in one place) of both flora and fauna. It has eleven areas where endemic birds are found and six areas where endemic plants are found. Ecuador has more amphibian species than any other country in the world (402 species, 138 of which are endemic).

There are four main regions in the country: the coastal lowlands, the volcanic central highlands, where Quito—the capital—is located, the Galápagos Islands, and the Amazon rainforests of the east, referred to as “El Oriente.” The coastal areas contribute 85% of the country’s lumber, and the ecosystems in this zone are being destroyed due to export industries (lumber, bananas), including the destruction of mangrove forests, which are being torn down to create pools for cultivating shrimp, another major export. The central highlands, where a stretch of the Andes splits into two ranges, leaving a deep central valley, is the most populous and the most exploited; forests are being destroyed for firewood and to create farmlands. Some of the land in this region is also being contaminated by the toxic pesticides used in the flower industry (Ecuador is an exporter of some of the world’s most beautiful roses), and the people who work in that industry are also becoming sick because of the toxins in their working environment. The Oriente, which covers approximately 50% of the country’s land, has the fewest inhabitants, but is experiencing severe environmental problems due primarily to the oil industry. While there isn’t much biodiversity in the Galápagos Islands, there are many endemic species in that region, due to the isolation of the islands from the larger continent. The Galapagos Islands, of course, represent perhaps the major protected area of the country’s 24 protected zones.

Ecuador's natural resources are in danger not only because of human intervention but also because of the natural disasters that have plagued the region. El Niño (1997-98) caused nearly 3 billion dollars of destruction; recent volcanic eruptions (most recently those of Pichincha and Tunguragua) have also brought tremendous challenges.

The problems in Ecuador are complex and the result of a combination of many factors. Some problems are common to those Latin American nations developing both economic and political relationships with the United States and a wider world. Others are common to nations that struggle with the legacy of colonial rule and seek to get beyond crippling problems of unemployment, disease, and economic chaos. Add to these the fragile nature of the environment when the pressing needs of human survival are at stake, and you have a recipe for a struggle to balance these needs against one another. Environmental depletion and economic problems in Ecuador are largely the result of the massive external debt held by the country. As of January 31, 1999, Ecuador held \$13 billion in external debt. The vast majority of the country's operating budget (42%) goes toward paying the external debt, yet the payments are hardly making a dent. Approximately 70% of the population is either unemployed or underemployed; as the economy grows, so does the inequity in terms of the distribution of wealth. A good 70% of the country's population lives in poverty, and approximately half of those are indigenous. Like many countries of Latin America, an excessive concentration of wealth resides with very few people.

In learning about biodiversity in Ecuador, we found that the interrelationships between humans and the environment are at the crux of every issue we examined. We gained insight into the beauty and the complexity of this fragile ecosystem, and gained great respect for the strength of the Ecuadorian people in their attempt to find balance between development and preservation.

The Site Visits

Prepared with the background provided in the first week through the content presentations, the teachers were then ready to visit a number of regions in the country. With the guidance and support of CIMAS, teacher-participants traveled in small groups during weeks two and three to various locations within Ecuador to explore further content issues and to gather authentic resources and materials to integrate into the curriculum. As groups visited various sites around the country, they gathered information to share with the whole group in relationship to the following questions:

- What is the nature of a particular region of the country in terms of geography, climate, agriculture, population density, culture and livelihood?
- What are the particular flora and fauna of a geographic area, and how have changes been evident over time? What are the unique characteristics of adaptation in the region?
- How have people responded to changes in the ecosystem?
- What is the relationship between land forms and land use, and how does this affect crop choices, growth, movement to market, etc.?
- How are particular aspects of culture reflected by region?
- What aspects of life in particular regions might provide for interesting comparisons between Ecuador and Minnesota?

The four regions of the country were explored with small teams visiting several sites within the central highlands: Reserva Ecológica Maquipucuna and Mindo; Papallacta (Agua Termales); Tinalandia; Otavalo; and the volcán y región Cotopaxil, a research reserve in the rainforest (Reserva Yasuni), the coastal areas where FUNDECOL is working to conserve mangrove forests (Muisne), and the Galápagos Islands. The teachers returned to Quito to share their experiences with the rest of the group. Much of what they learned has been incorporated into the curriculum.

Curriculum Development

In the final week of the project, with the facilitation in Spanish by project directors, the participants wrote their science curriculum units in Spanish and worked together to coordinate these units across grade levels. The final product is a fully articulated, Spanish-language science curriculum across grades K-8, which will be disseminated at participating schools and nationally. While the teachers kept busy during that final week writing their series of lessons, the project directors were collecting curricular and instructional materials in Spanish throughout Quito to support the curriculum. A large box containing a set of the materials was created for each of the participating school districts.

Overview of the Curriculum

For the curriculum development portion of the program, the teachers formed four teams and worked in Ecuador to develop lessons in grade level clusters. The resulting K-8 thematic series of lessons is interdisciplinary, combining subject matters areas such as natural sciences, social studies, language arts, art, math, and technology. The lessons, which are written in Spanish, have been aligned with the National Science Education Standards (National Academy of Sciences, 1996) and include attention to the following standards:

Science as Inquiry Standards

- Levels K-4—Abilities necessary to do scientific inquiry:
 - Ask a question about objects, organisms, and events in the environment
 - Plan and conduct a simple investigation
 - Employ simple equipment and tools to gather data and extend the senses
 - Use data to construct a reasonable explanation
 - Communicate investigations and explanations
- Levels 5-8—Abilities necessary to do scientific inquiry:
 - Identify questions that can be answered through scientific investigations
 - Design and conduct a scientific investigation
 - Use appropriate tools and techniques to gather, analyze, and interpret data
 - Develop descriptions, explanations, predictions, and models using evidence
 - Think critically and logically to make the relationships between evidence and explanations

Life Science Standards

Level K-4 • Characteristics of organisms; Organisms and environments

Level 5-8 • Populations and ecosystems; Diversity and adaptations of organisms

Science in Personal and Social Perspectives

Level K-4 • Characteristics and changes in populations; Types of resources; Changes in environments

Level 5-8 • Populations, resources, and environments

The Kindergarten/Grade 1 series of lessons build on children's prior knowledge to develop new vocabulary and concepts in Spanish. In four lessons, children learn to compare and contrast basic plants, trees, and animals in Ecuador and Minnesota, and learn on a very preliminary level that geographic and climatic differences, as well as location on the globe, determine which plant and animal species live in distinct regions of the world. They learn the differences between herbivores and carnivores and begin to understand that the plant and animal worlds depend upon one another. They are introduced on a very basic level to concepts related to consequences that result when the environment is destroyed.

In the series of lessons developed for Grade 2, children develop a deeper understanding of climatic issues and how they differ in the northern and southern hemispheres. Again, Minnesota and Ecuador are the contexts for the study of these issues. Students are introduced to the four main regions of Ecuador: the Amazon, the mountain range, the flatlands and coastal areas, and the islands. Students engage in hands-on science experiments to learn concepts such as cloud formation. They return to knowledge gained previously (e.g., plants in Minnesota and Ecuador) as they begin to learn about vegetation and food sources that are affected by climatic and

geographic differences. They expand on what they've learned about animal life and learn various classes of animals—mammals, amphibians, reptiles, etc.—with attention to those species that are endemic in Ecuador, and learn how different animals protect themselves to survive in the wild. These lessons are followed by an introduction to how plant, animal, climatic, and geographic differences further influence the human cultures that emerge in distinct regions. Students learn about different cultures in Ecuador and the shelters they build for themselves. Finally, students are briefly introduced to issues related to the destruction of natural resources, whether caused by human intervention or natural disasters.

The series of lessons written for grades 3 and 4 begin to develop scientific inquiry skills in students. Students are guided through the process of inquiry by exploring with the teacher certain regions of Ecuador (focus on cloud forests in the central highlands and the Galápagos Islands). The teacher shows multiple examples (pictures, books, videos, etc.) of things found in the region as the students identify what they observe in terms of vegetation, animals, landscapes, and people/culture. They explore why those plants/animals/etc. are found there by studying the climate, the topography of the region, and the natural resources available. They then explore the interrelationship between the organisms found in a particular region and the environmental aspects of that region. Throughout the process students are taught and practice language functions for describing, suggesting, and expressing opinions; and language structures to describe cause and effect and to use basic verbs in the subjunctive mood to express possibility. A game is used to help students understand the concept of how environmental destruction and human intervention relate to one another. Students learn how humans' actions can lead to either environmental destruction or conservation of natural resources. The series of lessons culminates with a final project developed by groups of students following the same inquiry process outlined in previous lessons. The students are asked to explore a problem or issue related to the ecosystem of Minnesota's forests. Students' work is presented to other classes and is assessed by both the teacher and students with a rubric similar to those being used to assess students' performance on high standards in the state of Minnesota.

The inquiry process begun in the 3rd-4th grade lessons continues in the lessons planned for grades 5-8. In this series of lessons, students begin learning about their place in the world of environmental conservation by discussing the need for balance between humans' rights and desires to enjoy and experience the nature that surrounds us and our responsibility to respect and take care of our natural surroundings. They learn about the national parks and nature reserves and centers in Minnesota and begin exploring the national parks and protected areas of Ecuador through websites and materials purchased in Ecuador (CD-ROMs, slides, videos, books, etc.). Students are then assigned to do small group explorations about a selected national park or reserve in Ecuador. They need to prepare a written and illustrated report that describes the ecosystem of the designated area with the intention of using the report to inform individuals who wish to visit the areas as ecotourists. They then compare what they learned about the ecosystems in Ecuador with ecosystems in the U.S. and create posters to show the similarities and differences. The series of lessons culminates with an opportunity for students to become involved in social action initiatives. Students write letters to politicians, business leaders, or agencies about the environment and their opinions regarding actions that should occur to protect certain ecosystems. Finally, students engage in a class debate about the advantages and disadvantages of ecotourism.

Sample Lesson Plan

This lesson is a translation and adaption of a lesson prepared by Andrea Marcy and Montserrat Recarte, two of the project's teacher participants.

LAS REGIONES DEL ECUADOR

Level

- 2nd grade

Time Frame

- 40-50 minutes

Materials needed

- Large map of the world or globe
- Map of Ecuador showing the location of the equator and the Galápagos Islands
- Large cards with the names of the four regions (La sierra; La costa; El Oriente; Las Islas Galápagos)
- Copies of pictures (from books, CD-ROMs, or web) or postcards representing animals, plants, foods, and/or landscapes that characterize the four main regions of the country—approximately 2 or 3 photos for each region, 8 to 12 photos per small group
- Velcro or other material to attach pictures to a poster-board without ruining the pictures
- A poster-board for each group, divided into four equal parts

Objectives:**Content**

Students will:

- Identify the geographic location of Ecuador and make predictions about its climate given its location.
- Identify the location of the four main regions in Ecuador.
- Categorize pictures of selected plants, animals, and landscapes according to the four main regions.
- Develop an initial understanding that the distinct regions of the country and their climatic conditions influence culture in different ways.

Language (vocabulary; functions; structures):**Content-Obligatory**

Students will:

- Use the following terms (and others depending upon pictures selected):

la sierra	la llama	el volcán
las montañas	la tortuga	la rana
las Islas Galápagos	la iguana	el cangrejo
la costa	el manglar seco(a)	El Oriente (La Amazonía)
la playa húmedo(a)	la jungla/selva	el cactus
el país	las regiones	la altura
el continente	el nivel del mar	
- Use phrases to describe weather and climate, such as “hace calor” and “hace frío”
- Use “estar” to describe location (está en...) and condition (está seco)
- Use language (e.g., the impersonal “hay”) to talk about things in the environment

Content-Compatible

Students will:

- Use the following verbs and phrases:

pensar	estoy de acuerdo
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tener (no tener) razón opinar
de acuerdo creer lo mismo

- Use phrases to indicate agreement/disagreement, and to share opinions
- Use 2nd person singular informal verb forms in the present tense to form simple questions to elicit others' opinions (e.g., ¿qué piensas?)
- Use the first person singular and plural present indicative of verbs (e.g., yo creo que, no pienso que, opinamos que...)

Description of the Task

Context

The initial activities serve as a review of information previously introduced. Students know where Ecuador is located, that there are four regions in Ecuador and where they are located. The lesson occurs in Spanish. It is possible that some of these structures will need to be taught to students prior to the lesson, e.g., phrases for expressing opinions, asking others for their opinions, agreeing, and disagreeing, etc.

Pre-task

The teacher asks for a volunteer to locate Ecuador on the world map or globe. Another volunteer is asked to write "Ecuador" on the board. They review why Ecuador is called Ecuador and locate where the equator runs through the country. The teacher asks if anyone knows the name of the continent where Ecuador is located. Another volunteer writes "Sudamérica" on the board. Students are asked to predict what kind of climate they believe Ecuador has and why. The teacher reviews (or introduces) the basic structures for describing weather temperatures and conditions—hace frío, hace calor, está húmedo, está seco.

The teacher shows the large map of Ecuador and asks the students if they can recall the names and locations of the four main regions of the country [La sierra, La costa, El Oriente, and Las Islas Galápagos]. As students recall the regions, the teacher shows the name for each (written on a large card, like a flashcard). Each card can be attached to the map (velcro or some other material is placed on the card so that it can be attached to the map and removed easily). Student volunteers are asked to identify the regions of the country with their corresponding names. At the end of the activity, the four regions are labeled on the large map so that all students can see.

Task set-up

The teacher divides the class into small cooperative groups with 4 students each. Each group is given a poster-board that has been divided into four equal sections and they are told that once they begin, they have 15 minutes to complete the task. Each group is also given a set of copies of pictures or postcards that can be attached to the poster-board. The pictures represent plants, animals, foods, and/or landscapes from the distinct regions. For example:

- El Oriente: the jungle (rainforests), rivers, tropical fruits, colorful poisonous frogs
- La Sierra: snow-capped mountains/volcanos, llamas, cloud forests, potatoes
- La Costa: mangrove forests, beaches, crabs, shrimp
- Las Islas Galápagos: cactus, giant tortoise, iguanas, rocky shores

Students are told that they are to work together as a group to place the pictures under the corresponding region. She may need to model this for the class by showing a picture and having the whole class offer ideas and opinions about which region such an animal/plant/place would likely be found.

Each group member is assigned a role, but all students are to participate in the group activity.

- Recorder: Student writes the name of the each region in one of the four sections on the poster board.

- **Facilitator:** Student keeps the group on task and makes sure that everyone gets a chance to share his/her opinions. In addition to expressing his/her own opinion, this student will need to practice basic questions, e.g., “¿Qué piensas?” or “¿Qué crees?” or “¿Qué opinas?”
- **Timekeeper:** Student keeps track of time so that the group completes the task in the allotted time
- **Reporter:** Student reports back to the whole class and explains his/her group’s poster. This student will need to practice the 1st person plural e.g., Creemos que... or Pensamos que... and phrases with “because” e.g., porque hace calor.

During-task

The recorder writes the name of each region in a section of the poster while the other student’s work together to think about possible categories for the pictures. The group works together to complete the task and the teacher circulates among the groups to check on their progress.

Post-task

The presenter for each group briefly explains why the group arranged the pictures in the way that they did. After the groups present, they compare the posters and look for similarities and differences. The teacher points out on the map particular geographic aspects of the various regions and helps students make the connections. The class discusses the groups’ work, asks questions, and makes suggestions for changing the location of the various pictures until they come to agreement. Throughout the discussion, the teacher encourages use of the new vocabulary and structures they have been practicing. The teacher asks questions that help students begin to understand the relationship between climatic and geographic conditions and how they influence what’s available to particular cultures. For example, in the sierra it gets very cold so it makes sense that there will be llamas instead of iguanas and that people will cultivate potatoes instead of growing tropical fruit.

Assessment

Informal assessment occurs throughout the activities. The teacher may also decide to assess students’ participation, understanding of content, and use of language more formally by creating a checklist and checking off students’ names as she observes their participation. For example,

Needs improvement	--
Satisfactory work	•
Excellent/outstanding work	+

References:

1. Lyster, R. (1997, July). *Attention to language in immersion classrooms. Presentation at Meeting the Challenges of Immersion Education: Summer Institute for Immersion Teachers. Minneapolis, MN: University of Minnesota.*
2. Lyster, R. & Ranta, L. (1997). *Corrective feedback and learner uptake: Negotiation of form in communicative classrooms. Studies in Second Language Acquisition, 19, 37-66. National Academy of Sciences. (1996). National Science Education Standards. Washington, DC: National Academy Press.*
3. Snow, M.A., Met, M., & Genesee, F. (1989). *A conceptual framework for the integration of language and content in second/foreign language instruction. TESOL Quarterly, 23(2), 201-217.*

Resources

To learn more about Ecuador, check out these websites.

<http://www.interknowledge.com/ecuador/index.html>
(basic information about Ecuador and its regions)

<http://www.stanford.edu/group/LAEH/html/amazon.html>
(an extensive bibliography on the environmental history of Latin America)

<http://www.elcomercio.com>
(the website for El Comercio, one of the major daily newspapers of Ecuador)

<http://www.hoy.com.ec/>
(the website for Hoy, one of the major daily newspapers of Ecuador)

<http://www.samexplo.org>
(the South American Explorer's Club, which has club sites in Ecuador, Peru, and the United States—the website has extensive links to others in Ecuador)

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