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Considerations of Multicultural Science and Curriculum Reform: A Content Analysis of State-Adopted Biology Textbooks in Florida

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by

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Dedication

To my husband, Marcus Delgato, who gave me the love and support as well as the freedom and space necessary to finish this race.

To my mother, Marjean Davis Hughes, who no longer walks on this Earth but remains forever responsible for shaping my love of learning.

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ABSTRACT

The purpose of this investigation was to determine the extent to which multicultural science education, including indigenous knowledge representations, had been infused within the content of high school biology textbooks. The study evaluated the textbook as an instructional tool and framework for multicultural science education instruction by comparing the mainstream content to indigenous knowledge perspectives portrayed in the student and teacher editions of 34 textbooks adopted in Florida within the last four adoption cycles occurring from 1990 to 2006. The investigation involved a content analysis framed from a mixed methods approach. Emphasis was placed, in consideration of the research questions and practicality of interpreting text with the potential for multiple meanings, within qualitative methods. The investigation incorporated five strategies to assess the extent of multicultural content: 1) calculation of frequency of indigenous representations through the use of a tally; 2) assessment of content in the teacher editions by coding the degree of incorporation of multicultural content; 3) development of an archaeology of statements to determine the ways in which indigenous representations were incorporated into the content; 4) use of the Evaluation Coefficient Analysis (ECO) to determine extent of multicultural terminologies within content; and 5) analysis of visuals and illustrations to gauge percentages of depictions of

minority groups. Results indicated no solid trend in an increase of inclusion of multicultural content over the last four adoption cycles. Efforts at most reduced the inclusion of indigenous representations and other multicultural content to the level of the teacher edition distributed among the teacher-interleafed pages or as annotations in the margins. Degree of support of multicultural content to the specific goals and objectives remained limited across all four of the adoption cycles represented in the study. Emphasis on standardized testing appeared in the six textbooks representing the most recent adoption cycle. Recommendations included increased efforts to identify quality of content by including input from scholars in the field of multicultural education as well as indigenous peoples in the creation of textbook content. Recommendations also included further clarification of the definition of *science* within multicultural science education frameworks, *indigenous knowledge* as compared to *Western science* and *pseudoscience*, and *scientific literacy* as a central focus to a multicultural science education meant to address the needs of an increasingly diverse student population and prime-age workforce.

Chapter 1

Introduction

Background of the Study

Topics, strategies and practices of multicultural education and cultural diversity find themselves at the forefront of meaning and discussion concerning curricular reform within today's schools. Issues associated with multiculturalism include content debates that center on representation and identity and encompass larger aspects of inclusion and exclusion, that is, the considerations of dominant versus non-dominant cultural viewpoints and perspectives as well as their appropriate roles as major content drivers within K - 12 curricula and related instructional materials. More importantly, the curricular subjects considered among the multicultural debates remain primarily linked to the social sciences and humanities, demonstrated, as example, by the plethora of content analyses regarding the multicultural nature of history and literature textbooks. The natural sciences, thought of in terms of more traditional school subjects including biology, chemistry and physics and broadly considered within the scope of science education, warrant a significant place within the multiculturalism and cultural diversity debate (Eide and Heikkinen, 1998; Hines, 2003; Hodson, 1993; McCarthy, 1990; 1994).

In the later years of the 1960s, the content debates regarding multiculturalism, fueled by challenges to the "Eurocentric foundations of the American school curriculum" (McCarthy, 1990, p. 118), found roots not only among the marginalized groups that demanded education reform in the area of race relations but also among the educators that attempted to provide solutions to racial inequalities plaguing the school systems. Equality of educational opportunity partnered with aspects of cultural pluralism would form the basis of the soon to follow multicultural education movement. What has been termed *multicultural science education*, the educational reform movement with the goal of providing equitable opportunities in science education for culturally diverse student populations, has experienced considerable lag time behind the first conversations regarding multicultural education. Twenty-five years ago, any considerations of the cultural context of science education remained “little acknowledged” (Krugly-Smolska, 2007, p. 1) by scholars, and multicultural science education maintained a limited field of study with its frameworks and theories borrowed from either the general literature regarding multicultural education or from research in other disciplines. By the early 1990s, science education literature responded by moving to the forefront consideration of curriculum and instructional practices in the sciences that enabled schools and teachers to address issues related to cultural diversity. Krugly-Smolska (2007) noted that Canada’s Ministry of Education in 1989 responded to the call for cultural diversity by regulating that multiculturalism should “permeate the school’s curriculum, policies, teaching methods and materials, courses of study and assessment and testing procedures, as well as the attitudes of and expectations of its staff and all their interactions with students, parents, and the community” (p. 1). Science was certainly included in this call with ensuing school policies and procedures to allow curricular permeation of cultural diversity, yet appropriate instructional materials as well as direction and support for teachers, as remains the case today, fell short of the intended goal (Eide and Heikkinen, 1998; Krugly-Smolska, 2007; McCarthy, 1990; Ninnes, 2000).

In July of 2000, the Board of Directors of the National Science Teachers Association (NSTA) adopted a set of declarations to update its position statement on multicultural science education. These declarations frame the democratic ideas behind the multicultural education movement of equality of educational opportunity as well as cultural pluralism within curriculum and instruction in science classrooms: 1) "schools are to provide science education programs that nurture all children academically, physically, and in development of a positive self-concept;" 2) "children from all cultures are to have equitable access to quality science education experiences that enhance success and provide the knowledge and opportunities required for them to become successful participants in our democratic society;" 3) "curricular content must incorporate the contributions of many cultures to our knowledge of science;" 4) "science teachers are knowledgeable about and use culturally-related ways of learning and instructional practices;" 5) "science teachers have the responsibility to involve culturally-diverse children in science, technology and engineering career opportunities;" and 6) "instructional strategies selected for use with all children must recognize and respect differences students bring based on their cultures" (NSTA, 2007). If science education curricula and the teachers who support instruction in science are to meet the requirements of equality of educational opportunity and cultural pluralism as exemplified by position statements endorsed by the NSTA, then instructional materials provided in the form of textbooks and auxiliary aides such as the teacher manuals and student workbooks must enhance the exposure to the contributions of "others" by containing material relevant to all who are represented in today's science classrooms. This curricular quandary involves content and instructional materials that support a Western view, which dominates and excludes other perspectives grounded in non-Western thought. Exclusion of other perspectives marginalizes the viewpoints of those who represent the minority voice in the culturally diverse student populations apparent in present-day classrooms. Traditional science textbooks, often perceived as the authority for scientific knowledge, may provide teacher and student limited support in the generation of as well as exposure to culturally relevant content (Lee, 2003; McCarthy, 1994; Pomeroy, 1994; Snively and Corsiglia, 2001).

The idea of multiculturalism as a component of science education prompts a controversy that stems from a variety of sources: *What constitutes multicultural science education?*; *What is its purpose?*; *Whom will the content serve?* According to Hodson (1999), multicultural science education has taken on three variations of meaning: 1) it represents a set of instructional strategies to help teachers address issues with diversity in the classroom; 2) it stands as curriculum that targets ethnic minorities in an effort to raise self-esteem and to reduce feelings of alienation or exclusion from opportunities in science; 3) it provides an approach for raising awareness of forms of discrimination within science and science education. The first two variations of multicultural science education express frameworks that align with assimilation and cultural pluralism, respectively. Although assimilation approaches perpetuate cultural norms of the dominant group with the expectation that the minority group conform, cultural pluralism promotes diversity by having members of the dominant group learn to value other cultural norms while the minority groups, in the effort to promote self-confidence, retain their own cultural identities. Hodson (1999) also suggests cultural pluralism “as the dominant interpretation of multiculturalism in Europe, North America, and Australia…[and] it is the official government policy in Canada" (p. 776).

The idea of multicultural science education as an approach to raise awareness of discrimination within science and science education promotes the notion of anti-racist science teaching. Although it is not appropriate to designate multicultural science education, in the general sense of the term, as the equivalent to anti-racist science education, Hodson's (1999) third definition moves to consideration an idea of anti-racist science, and education in the subject of biology, as example, holds a major role in establishing a context of inquiry that can serve to "challenge racist images and practices – not least because these may be based on ideas which appear to have scientific justification, and permeate biology texts" (Vance, 1987, p. 107). Biology content covers topics of genetics and race, human variation, and intelligence that represent areas linked to scientific justification and often appear unchallenged in terms of origins of scientific knowledge. A context of inquiry allows students to challenge racism evident in the content of textbooks and works to break the cycle of stereotype reproduction (Gill and Levidow, 1987; Krugly-Smolska, 2007; Pomeroy, 1994).

As the nation's classrooms have continued to evolve in terms of increased representations of cultural diversity, the last two decades have witnessed a growth in interest regarding the connection between science and culture. How should science curricula respond to the presence of those students who represent the "non-Western, Indigenous, and minority group learners" (Hines, 2003, p. 167)? Such a question creates additional potential problems for multicultural science education; those who argue the universalism of science challenge the curricular incorporation of unique ways of knowing the natural world indicative of worldviews outside of what is known as Western Modern Science (WMS). However, many researchers support the idea that scientific worldviews considered non-Western, such as those exemplified by indigenous or traditional ecological knowledge (TEK), hold value in the curricular content included in science education. For those who support multicultural science education, the disregard of worldviews of "others" remains a marginalization of certain voices and discounts their significance as components of the system of knowledge and experiences unique to those who do not hold membership in the dominant culture (Aikenhead, 1997; Gil and Levidow, 1987; Hines, 2003; Hodson, 1999; Snively and Corsilgia, 2003).

Statement of the Problem

Issues with multicultural science education frame, in one sense, an imbalance of what is valued within science as a discipline. In other words, an asymmetry exists (Svennbeck, 2000) within ways of knowing science: *Whose ways of knowing hold privileged positions in the science curriculum*? Western Modern Science (WMS), also referred to as white male science (Snively & Corsiglia, 2001), maintains this privileged position, and, therefore, evolves as the gatekeeper for science education content (Cobern & Loving, 1998). As such, WMS holds more value as the dominant way of thinking about science. However, other perspectives, often referred to as traditional, indigenous, ethnic or local science, provide diverse knowledge about science with particular relevance to the problems and social issues, couched within life sciences, that pertain to areas including natural resources, population growth, genetic engineering, and conservation (Siegel, 2002). What needs improvement within science education involves the creation of curricula and instructional materials that reflect a balanced consideration of other perspectives, which capitalize on the knowledge, skills and procedures, habits of mind, and organizing principles that Western Modern Science and indigenous knowledge, as example, share (Stephens, 2003). Without the presence of alternative viewpoints to ways of knowing, science education curricula essentially neglect an area that holds important implications for understanding modern science. The aim remains not to determine one form of science as significant over the other. Rather, considerations of differing world perspectives such as traditional or indigenous understandings support the study of science in the context of the real world for all students and encourage a significant goal for science education, that is, to provide instruction applicable to science-related problems in today's world (Barber & Tomera, 1985; Hodson, 1993; Snively & Corsiglia, 2001).

The problem necessitated, then, further investigation into the mounting recognition that dominant ways of knowing science, that is, what perspective aligns with the most valued, determine the content of curricula and instructional materials used in science classrooms across the United States (Aikenhead, 1997, 2001; Hodson, 1993; Ninnes, 2000). When one perspective supersedes another as the dominant voice, other voices loiter in the background with no real place or importance in the discussion. An ensuing battle of inclusion and exclusion of viewpoints plays out in front of teachers and students in a tangible form: the science textbook. Ninety percent of the science teachers in the United States use a textbook for 95% of the instructional time with novice teachers, including those assigned as out-of-field teachers, relying heavily on the textbook for instruction. Although the textbook ideally represents just one facet of a student's experience in school, researchers suggest the textbook not only serves but also will remain as a central instructional resource in the nation's classrooms (Chiappetta, Fillman, and Sethna, 1991a; Eide and Heikkinen, 1998; Ingersoll, 1999; King and Domin, 2007; Lloyd, 1990; Ninnes, 2000; Wang, 1998; Whitman, 2004).

If this remains the case, that is, the textbook and its continued role as the primary instructional resource, then an important caveat to the problem enters the equation with directives provided within *No Child Left Behind (NCLB)*, and two critical areas surface: 1) the demand for highly qualified and educated human capital and 2) the need for highly qualified teachers to prepare members of this future workforce to participate in the scientific enterprise (Johanningmeier and Richardson, 2008). As the current prime-age workforce not only declines in number but also increases in diversity, reduction of the achievement gap between white and minority students conveys an import signifying society's desire for a populace who can "do science." The question remains as to whether contemporary high school science, most commonly conceptualized by means of the textbook, can not only support preparation of a workforce facing an increase in minority membership but also hold interest so that students traditionally disenfranchised from science experiences do indeed learn to "do science."

Part of the *NCLB* solution to minding the gap remains placing highly qualified teachers in classrooms; however, counter to this fix looms the nationwide shortage of teachers, especially in critical need areas such as mathematics and science (NEA). To address the shortage, a district and its administration may place a teacher in an out-of-field content area, and Florida is no exception to this practice. In high school science for the 2006 – 07 and 2007 – 08 school years, 9.46% and 9.92% of the total science courses, respectively, were staffed by teachers classified as out-of-field (FLDOE). At the national level, Ingersoll (1999) found that in the American high school, about 20% of all science teachers did not possess “at least a minor in one of the sciences or science education” (p. 27). Formalizing the consequences of out-of-field assignments, such as impacts on student learning, may bring challenges to researchers, but the potential for a teacher’s over-reliance on the textbook remains a reality as the teacher and the textbook establish an affiliation that becomes critical to content delivery. The textbook and its auxiliary guides and resources emerge as the key navigational system for the teacher as he or she charts the unknown content waters of out-of-field teaching assignments (Ingersoll, 1999).

Yet the ability of science textbooks to be all things to all teachers – to not only enhance multicultural science education but also support instruction for all teachers including those serving with out-of-field certifications – remains questionable, especially in consideration of Western Modern Science as the valued way of knowing science. Add to the mix political and social influences as well as the need for profit, and textbook publishers find themselves forced to produce products that attempt to satisfy a host of stakeholders including textbook adoption committees, educators, parents and policymakers (Kirk, Matthews, & Kurtts, 2001). The process becomes the “quantity imperative” (Whitman, 2004, p. 33) with its associated economic rewards for those who meet the content mark. In the process of pleasing many constituents, publishers fall short of building quality instructional resources that include representation of not only the benefits and limitations of Western science but also the important differing knowledge bases illustrated by indigenous science (Cobern and Loving, 1998; Hodson, 1993; Pomeroy, 1994; Ninnes, 2000, 2001; Snively & Corsiglia, 2001).

Consequently, limited attempts exist within the investigation of science textbooks and their ability to support instruction that address these types of multicultural issues within science education. As the shift in emphasis moves toward a focus on real world issues and the promotion of science in a socio-cultural context, multicultural science education emerges as a framework for the education of diverse populations of students through culturally relevant learning as well as preparation for participation in a multicultural society, both locally and globally (Aikenhead, 1994: Hodson, 1993). Support of this framework, however, depends on continued research efforts that address the incorporation, including the strengths and limitations, of differing views of science housed within alternative worldviews and ways of knowing such as those held by members of non-Western cultures (Atwater and Riley, 1993; Aikenhead, 1997). Since science curricula and content often exclusively portray Western perspectives, examinations of educational resources such as textbooks and other instructional materials remain a significant component of research endeavors within multicultural science education.

The literature supported a limited number of content analyses that reflected investigations of textbooks as appropriate means for content delivery (Chiappetta, Fillman, and Sethna, 1991a). A gap existed in the critical examination of not only the existence of multicultural science content but also the inclusion of other perspectives indicative of indigenous knowledge. As the interest in multicultural science education has emerged since the early 1990s, a content analysis which investigated the inclusion of multicultural content supported research in an area of science education that remains under debate and consideration by scholars as well as practitioners, and the content analysis planned for this investigation represented a contribution to the literature regarding multicultural science instructional materials. The purpose of this investigation was to determine the extent to which multicultural science education, as determined in part by inclusion of indigenous representations including non-Western ways of knowing, had been infused within the content of high school biology textbooks. The study evaluated the textbook as instructional tools and frameworks for multicultural science education instruction by comparing mainstream content to indigenous knowledge perspectives portrayed in the text content.

Conceptual Framework

Multicultural Science Education

Modern day science education curriculum reforms conjure notions of ‘science for all’ (Kemp, 1999. p. 3) where every child can and ought to have the opportunity to participate in science. The idea of ‘science for all’ translates, in part, to a component of scientific literacy that places importance on basic science knowledge and its application to societal problems and issues (Chiappetta, Fillman, and Sethna, 1991a; Lloyd, 1990). Organizations devoted to improving teaching and learning in science education, including the National Research Council, continue the struggle to determine not only what constitutes ‘science for all’ but also how educators can assist all students in learning science (Hodson, 1993; Kemp, 1999). Over the last twenty-five years, the “how” piece of the puzzle has evolved into a variety of strategies, models, and practices including the placement of science education within the broader initiative of multicultural education. The idea of cultural approaches to science education, surfacing within the existing scope of multicultural science education, incorporates philosophical and sociological views of science (Hodson, 1993) including aspects of differing world perspectives as opposing ways of knowing science. The cultural approach to science education holds significant implication for the development of curricular content and the creation of instructional materials, including science textbooks, which support such approaches.

Multiculturalism and its proper place within science education maintain a controversy within the science education literature (Siegel, 2002). Positioned at the root of the debate lay the differing views of world perspectives or acknowledgement of other ways of knowing that play out between two philosophies: multiculturalism and universalism (Cobern and Loving, 1998; Siegel, 2002; Snively and Corsiglia, 2001). Scholars who align with either of the two philosophies stand divided on a variety of issues within science education, but the central issue of the debate focuses on the nature of science (Irzik, 2001). Universalists allow that science, through the process of inquiry, strives to remain an objective means, characterized by predictive and testable theories, to produce knowledge (Siegel, 2002). As such, Western Modern Science (WMS) represents the paradigm of science, serving as the superior way of knowing when compared to indigenous forms of science. Multiculturalists find this aspect of superiority a measure that ignores, under the guise of exclusive politics, alternative ways of knowing (Irzik, 2001; Ninnes 2001), and reject Western science as the only science (Aikenhead, 2001; Hodson, 1993). While much of the dialogue focuses on the appropriate philosophy for science education, a consensus of a definition of science appears missing from the literature base, and the struggle continues for understanding the significance as well as the necessity of cultural approaches to science.

Science-Technology-Society (STS)

Although the research findings were consistent in terms of philosophies of science, that is, the debate between multiculturalists and universalists placed considerations of Western science at odds with traditional science, the literature pointed to other ancillary issues within multicultural science education that represented significant statements for the need for this study. As the multicultural science education debate opened consideration for the inclusion of culture, recognition of science as a subculture of Western culture and approaches to the learning of science as culture transmission and acquisition (Aikenhead, 1997) appeared within the literature. In essence, Western science becomes the subculture of science, and school science represents a mode of enculturation or assimilation to this subculture (Aikenhead, 1997; Hodson, 1993). Enculturation occurs if the subculture of science supports the student's own culture; assimilation occurs if the subculture of science disrupts the student's views and beliefs that exist within his own culture. A problem arises when students, who represent groups not of the mainstream culture, enter the science classroom with values and beliefs that do not align with the subculture of science (Aikenhead, 1997). Any attempt to assimilate Western science forces students of non-Western membership to remain at odds with their own ways of knowing as they attempt to move between their own culture and the subculture of science (Cobern 1996; Hodson, 1993).

Border Crossing

The movement between cultures and subcultures, known as border crossing in the literature, allows students to negotiate the need for academic achievement within the confines of formal education while retaining membership within their own cultural identity. The ability to cross borders requires development and implementation of science curricula that explicitly establish border crossings for students, facilitates these border crossings, validates students' cultural constructions of ways of knowing, and illustrates Western science in a social, political and economic context (Aikenhead, 1997). Science-technology-society (STS), a science curriculum known internationally, dedicates its initiatives within a student-centered and environmental problem-solving approach to science and has the ability to support border crossing within science classrooms (Krugly-Smolska, 1995). However, an imperative in this ability for teachers to facilitate any border crossing, particularly within the established context of science-technology-society, remains the development of science textbooks that illustrate the contributions and perspectives of ways of knowing in science exemplified by non-Western cultures (Ninnes, 2001).

Constructivism

Constructivist views constitute one of the most public theories of education, including those appropriate for science education, encountered today (Gross, 2000). Several forms of constructivism appeared in the literature base, and the term assumed related or distinct concepts (Ishii, 2003). Developmental-educational psychology and the sociology of science, two initial areas of constructivism, drive current thought within educational theory (Gross, 2000). Jean Piaget is known for his work within the developmental psychology aspect, and his premise of learning includes that "knowledge cannot be transmitted simply and directly by an active knower to a passive learner" (Gross, 2000, p. 13). The other aspect of constructivism included a more recent consideration of the sociology of science framed within the science-technology-society (STS) paradigm.

Here, previous knowledge of the student has already been socially determined. Considered within the scope of multicultural science education, multiculturalists assert no *one* knowledge but rather *knowledges* in the plural sense, and science ultimately represents just one way of knowing (Gross, 2000; Hodson, 1993).

If one considers constructivism within the claims made by Fox (2001), then learning as an active rather than passive process within a knowledge that is not only socially constructed but also personally and individually developed held much relevance as a component of the conceptual framework under which the larger scope of multicultural science education operates. Moreover, consideration of constructivism allowed the introduction of relativist views, as opposed to those held by the universalist camp mentioned previously, which solidified the idea that no universal truth exists in regard to science. As such, constructivist views, as exemplified by proponents of established curricula such as science-technology-society (STS), support the philosophical beliefs that drive multiculturalists in their quest for equity in the science classroom or, as previously noted, a 'science for all' that grants power to the other voices often left out of consideration in the ways of knowing science. A constructivist approach to science education appears promising as an agent for change, a means to permit the teacher to facilitate learning that remains sensitive to the worldviews of all cultures as opposed to endorsing just one view as the right and only view (Fox, 2001). However, as an important caveat, incorporating constructivist views in the rationale for multicultural science education comes with its own set of challenges. It is important to note that "science education informed constructivism does not necessarily problematize the cultural construction of scientific knowledge; rather it attempts to use knowledge of learners' personal constructs to generate more effective strategies for persuading students to adopt Western scientists' social constructions" (Ninnes, 2000, p. 604). What should accompany any attempt to promote cultural approaches to science education represents a thorough examination of the instructional materials, including the content of science textbooks, which will serve to support teachers in this quest.

Post-colonial Theory

The "colonial discourse" (Aikenhead and Ogawa, 2007, p. 540) found abundantly in the broader literature base within science education perpetuates a dichotomy that places indigenous knowledge on one end of the spectrum and science on the other. Such approach collapses knowledge systems into two broad groups, which serves to not only contradict the great diversity found within each but also mask the similarities that each shares with the other. Moreover, the implication of winners and losers in the knowledge systems game creates a cultural divide and remains key to privileging one way of knowing over the other (Aikenhead and Ogawa, 2007; Ninnes, 2003).

Post-colonial theory "involves a conceptual reorientation towards the perspectives of knowledges, as well as needs, developed outside the west" (Young, 2003, p. 6), and scholars such as Krugly-Smolska (2007) find its theoretical framework more appropriate to building on the existing realities of multicultural education, especially those that pertain to curriculum and policy development. Post-colonial theory, placed within the larger conceptual framework of a content analysis, framed considerations for this investigation in multicultural science content, as determined by inclusion of non-Western ways of knowing, as it functioned as a set of perspectives designed to foster inclusion of alternative knowledges into the broader context of power struggles. As a set of perspectives, postcolonial theory seeks not only to alter the way in which individuals think and behave about other individuals in this global society but also to ensure a sense of social justice and equity among citizens of all nations (Ninnes, 2000; Young, 2003). Thus, to use post-colonial thought moves points of concern away from winners and losers and reframes the perception so that indigenous ways of knowing, now coupled or bridged to Eurocentric knowledge, become part of the collective knowledge systems (Aikenhead and Ogawa, 2007; International Council for Science, 2002).

Pseudoscience

Although pseudoscience was not a formal part of the conceptual framework, a brief address of this concept serves to clarify some of the challenges with not only defining but also working with what has been deemed indigenous knowledge content. The notion of spirituality, a cornerstone of indigenous knowledge, initiates deliberation of a key issue in secondary science education: the "ongoing creation-evolution controversy" (Antolin and Herbers, 2001, p. 2379). While the scope of this investigation did not include knowledge or content with regard to evolution, the controversy prompted by efforts to position creation science or intelligent design in science curricula led to the following questions: *Where do concepts of spirituality from the Judeo-Christian perspective, more concretely played out as creation science or intelligent design, enter the discussion of indigenous knowledge? Is creation science an indigenous way of knowing nature?*

A report prepared by the *International Council for Science* (ICSU) and the *United Nations Educational, Scientific and Cultural Organization* (UNESCO) provides a good place to start for answers to these questions. In *Science, Traditional Knowledge and Sustainable Development* (2002), the delineation of pseudoscience from science unfolds between two approaches: one as sociological and the other as epistemological. From the sociological lens, a pseudoscience generally exists in competition with its science counterpart and is promoted by individuals not versed in science. As example, those who support creation science are typically not biologists or any other type of professional scientist. Epistemologically, the dynamics of science, characterized as “more systematic than everyday knowledge” (International Council for Science, 2002, p. 11) work to add to this systematic nature through such activities as repeated experimentation, statistical analyses, and development of comprehensive theories that contribute to a larger body of knowledge. Pseudoscience, on the contrary, is static and incorporates anecdotal evidence rather than statistical testing and other analyses to support its claims. Pseudoscience remains an “enterprise that is always in competition with science; it poses as science by mimicking it…and if moving forward at all, it is only enhancing its protective belt against criticism from the scientific tradition it tries to displace” (*International Council for Science*, 2002, p. 12).

The idea of competition plays an important role in demarcating pseudoscience from the concepts of science and indigenous knowledge used for this study. If indigenous knowledge exists as the various interpretations of how the world works from a particular cultural perspective (Snively and Corsiglia, 2001), then, as a body of knowledge, it originates from peoples with extended histories with the natural environment, and, most importantly, has developed “independently of Western culture” (International Council for Science, 2002, p. 12). As such, indigenous knowledge serves to inform rather than to exist in competition with science. If any competition between indigenous knowledge and science does occur, then the initiative generally originates from individuals who want science to replace or privilege itself in relation to alternative ways of knowing (International Council for Science, 2000). Pseudoscience, however, does not serve to inform science nor does it function independently of science, and the promotion of competition between the two only underscores pseudoscience's reliance on the very existence of science in order to establish itself as systematic approach to knowledge acquisition equal in nature to the scientific tradition (International Council for Science, 2002). Framing pseudoscience, then, from these perspectives removes it from consideration of the scope of this study as it exists neither as a science in the Eurocentric sense nor as an indigenous knowledge.

Research Questions

This study investigated the following research question: To what extent had multicultural science content, as determined by inclusion of indigenous representations including non-Western ways of knowing, been infused within the content of high school biology textbooks? More specifically, to address concerns of the ability of textbooks to support effective multicultural science education, the following questions were offered for consideration:

1. To what extent did the biology textbooks adopted in the 2005 – 2006 cycle include content coverage that supported perspectives of indigenous knowledge compared to biology textbooks adopted in Florida's last three adoption cycles occurring within 1990 – 1994, 1994 – 1998, and 1998 – 2004?

2. To what extent had multicultural perspectives and diversity been incorporated in the goals and objectives of the 2005 - 2006 adoption textbooks compared to the goals and objectives found in the textbooks of the earlier adoption cycles occurring within 1990 – 1994, 1994 – 1998, and 1998 – 2004?
3. To what extent did the nature of representations of indigenous knowledge included in high school biology textbooks adopted in 2005 - 2006 compare to the representations of indigenous knowledge in the textbooks adopted in the cycles occurring within 1990 – 1994, 1994 – 1998, and 1998 – 2004?
4. To what extent had representations of indigenous knowledge, including people, events and related vocabulary, been incorporated into the content of high school biology textbooks adopted in 2005 - 2006 compared to the earlier adoption cycles occurring within 1990 – 1994, 1994 – 1998, and 1998 – 2004?
5. To what extent did the illustrations, photographs and other graphics of examples of non-Western science relate in quantity and quality of visuals of Western science in the 2005- 2006 textbooks compared to the earlier adoption cycles of 1990 – 1994, 1994 – 1998, and 1998 – 2004?

Operational Definition of Terms

For the purposes of this study, the following terms and definitions were used:

Multiculturalism. Educational theory that encourages interests in many cultures within a society rather than interest in only a mainstream culture.

Universalism. A philosophy that embraces knowledge that is characterized in the form of theories which are testable, predictive, revealing of underlying unobservable entities and the relations of causal mechanisms in which they are involved (Siegel, 2001).

Constructivism. A theory of learning where students "build their own understanding of the world, and in turn, their own knowledge" (Ishii, 2003, p. 1).

Multicultural education. "An idea, an educational reform movement, and a process whose major goal is the change of the structure of educational institutions so that male and females students, exceptional education students, and students who are members of diverse ethnic and cultural groups will have an equal chance to achieve academically in school" (Atwater and Riley, 1993, p. 663).

Multicultural science education. "A construct, a process, and an educational reform movement with the goal of providing equitable opportunities for culturally diverse student populations to learn quality science in schools, colleges, and universities" (Atwater and Riley, 1993, p. 664).

Culture. "An ordered system of meaning and symbols in terms of which social interactions take place" (Aikenhead, 1997, p. 219).

Science. "A rational perceiving of reality where perceiving means both the action of constructing reality and the construct of reality" (Snively and Corsiglia, 2001, p. 9)

Science-technology-society (STS). A movement in science education, originally inspired by environmentalism and the sociology of science, that emphasizes the teaching of scientific and technological developments in their cultural, economic, social and political contexts (Aikenhead, 2005).

Western Modern Science. Officially sanctioned knowledge which can be considered within the realm of inquiry and investigation that Western Europe and North America governments and courts are prepared to support, recognize and utilize (Snively and Corsiglia, 2001); generically referred to as Western science or Eurocentric science.

Indigenous/Traditional knowledge. "A cumulative body of knowledge, know-how, practices and representations maintained and developed by peoples with extended histories of interaction with the natural environment. These sophisticated sets of understandings are part and parcel of a cultural complex that encompasses language, naming and classification systems, resource use practices, ritual, spirituality and worldview" (International Council for Science, 2002, p. 9); also known as indigenous science; generically referred to as non-Western science. As these terms are often interchanged in the literature and *traditional* can also refer to the culturally accepted practices of a society, the researcher has selected the use of the term *indigenous* to maintain a sense of consistency in this investigation.

Traditional ecological knowledge (TEK). The science of long-resident oral peoples and a biological label for the expanding literature base which explores that knowledge (Snively and Corsiglia, 2001, p. 8).

Limitations

As the sample for this study included high school biology textbooks adopted by the state of Florida, generalizations of findings were limited to those texts included in the study and used by teachers in the state of Florida. However, as Florida holds a state-wide textbook adoption process and its adoption policies often influence the textbook activity of other states, the findings may hold true for any other state or local educational agency which chooses to adopt the selected texts for use in the respective high school biology curricula (Whitman, 2004).

Threats to reliability included the execution of inadequate communication of coding instructions as well as insufficient practice of coding to establish a desirable initial reliability. The possibility of coder fatigue did exist as the amount of text to be examined was quite large. Coding schedules took into consideration the length of units to be coded. Reliability was increased with the use of measures of interrater as well as intrarater agreement.

In terms of internal validity, recordings made and measured within the instrumentation, that is, the teacher edition coding form for degree of relation of multicultural content as well as the Evaluation Coefficient Analysis (ECO) worksheet where favorable and unfavorable meanings were indicated, were subject to experimenter effect where an unintentional bias or behavior influence resulted. Researcher bias was also considered to play a role in the threat to the legitimateness of the qualitative piece of the study as well as coder fatigue with regard to the large amounts of text included in the sample.

Chapter 2

Review of the Literature

Research Procedures

The initial literature review procedures began with a search of preliminary sources, including use of an electronic version of ERIC (Cambridge Scientific Abstracts), as recommended by library support personnel, using the following descriptors: *multicultural education*, *multicultural science education*, *content analysis*, *science textbooks*, *science-technology-society*, *secondary science*, *indigenous science*, *traditional ecological knowledge*, *constructivism*, *border crossing* and *universalism*. These searches led to the primary sources included in the literature review, which served to frame and support this study. Taken collectively, the literature for this review reflected articles and texts dated in 1987 and proceeded through 2001 with regard to the initial efforts of various content analyses of high school science textbooks, continued with consideration of the research in the early 1990s when multicultural science education initially appeared in the literature as an area of much controversy, and ended with current perspectives on indigenous knowledge representations, border crossing, science-technology-society (STS) and constructivism as aspects of learning within cultural approaches to science education.

Content Analysis of Textbooks

The literature within the realm of content analyses of science textbooks covered a wide range of texts appropriate for grade levels beginning with elementary and extending through college. For the purpose of this study, the literature review limited the scope of examination to investigations which included high school level textbooks with emphasis on those studies that utilized science texts in the sample. The exception to this criterion included two studies focused on elementary or middle school science texts (Eide and Heikkinen, 1997; Mulkey, 1987); these two studies provided important background on evaluation instruments used to examine multicultural content. In addition, the focus of this portion of the literature review centered on content analyses directly related to the study, that is, any research findings associated with scientific literacy, STS, cultural perspectives and the subject areas of biology or ecology. Content analyses, which examined text readability, vocabulary, gender bias and correctness of content, were excluded from the literature review.

As part of the research investigation for this study examined multicultural content within ecology units, an important consideration was the degree to which ecological principles and concepts were addressed in textbooks. Barber and Tomera (1985) surveyed 156 science teachers, with a teaching experience range from one to 33 years, from a randomly selected sample of biology teachers in secondary settings in the state of Illinois. The teachers volunteered for the study. The survey included information on the selection of textbooks, degree of use of textbooks, teacher perception of the importance of ecology, ecological concepts and principles that were taught, and types of environmental problems that were discussed in class. No reliability measures were reported for the survey instrument. Two of the biology books used by the majority of teachers represented texts that devoted the greatest (32%) amount of coverage to the subject of ecology; however, most teachers found it necessary to supplement the textbook with additional resources that examined ecological principles. The Illinois teachers ranked ecology as one of the top five most critical components of biology content for high school science, yet many did not apply ecological principles to environmental-societal problems as illustrated by the use of science-technology-society (STS) methods.

McComas (2003) revisited the issue with ecology content in biology textbooks. The goal of his investigation included a determination of which elements of ecology should be incorporated into a traditional high school biology course. His sample included 13 high school level biology textbooks. McComas (2003) used a grounded strategy approach to create a list of ecology content from which evolved a general checklist used to review the textbooks. The grounded strategy approach proved of interest as a possible technique for incorporation in the proposed study. The study concluded that the biology texts devoted an average of 9.7% of the total pages to topics of ecology. No interrater agreement was reported for the content checklists. A paucity of ecological content, considered one of the best possible areas for presenting issues of environmental concerns directly linked with curricular support such as STS, in the texts presented a challenge for teachers striving to increase capacity for scientific literacy in their students.

Although Mulkey (1987) investigated elementary and middle school science texts, her study introduced a new perspective in content analysis with the development of an instrument to assess social influences in science. Her study (1987) addressed social aspects of science, and her work represented consideration of content as socially and culturally influenced, an important consideration in the development and support of the conceptual framework for the proposed study. She also demonstrated the assignment of independent and dependent variables to a content analysis, which presented an additional design consideration for the proposed study. Mulkey's (1987) sample included 187 science textbooks used in seven school districts in the public schools in New York. The selected textbooks included grades 2, 4, and 8, and neither the sample of textbooks nor the school districts were randomly selected. Independent variables included social class with four levels and grade with two levels. Textbook content was divided into six dependent measures. A two-way analysis of variance was used to examine the relationship between social class and textbook content. Social class proved significant with regard to the prior exposure that students received concerning scientific content.

Lloyd (1990) investigated science textbooks for elaboration of ideas linked to scientific literacy as a means to impact reading comprehension. Her sample included three biology textbooks appropriate for non-college-bound students, average ability students, and students at all academic levels. Photosynthesis was selected as the science topic for investigation. A concept analysis permitted the identification of the ideas associated with photosynthesis; the most general ideas served as points of reference for elaborations of concepts. Her study showed that the textbook created for the lowest level learner had the fewest amount of elaborations, which represented an important consideration in determining appropriate content for texts. One of the strengths of the study recognized incorrect information in texts as an important variable. Since part of the proposed study included ecology content in biology textbooks, some aspect of correct and incorrect findings and information must be considered.

Chiappetta, Fillman, and Sethna (1991a; 1991b), Eltinge and Roberts (1993), and Lumpe and Beck (1996) investigated the extent of curricular emphasis in science textbooks. Although these groups of researchers offered a synthesis of textbook content in terms of scientific literacy, the most significant contribution to the proposed study came from the investigations by Chiappetta, Fillman, and Sethna (1991a; 1991b). In their first investigation (1991a), the researchers created a method and developed an instrument to analyze textbooks; in the second investigation (1991b), they applied the method and instrument to seven high school chemistry textbooks. As textbooks often served as the primary instructional resource in science classrooms, these instructional tools impacted not only how teachers presented content but also how students interpreted scientific meanings. Chiappetta (1991a) and his colleagues developed an instrument to quantitatively evaluate content emphasis in an effort to determine how much of the information in the texts related to vocabulary and terminology, often regarded as the primary content that students learn in science classes. Four areas of scientific literacy were identified (*knowledge of science*; *nature of science*; *science as a way of thinking*; *science-technology-society*) and used to create a coding scheme applied these to the textbooks. Science-technology-science (STS) as a component of Chiappetta's instrument solidified for the researcher the descriptors commonly used to identify STS and related content. In addition, STS remains an important curricular link to incorporating cultural diversity into the classroom. Interrater agreements among the researchers ranged from 0.80 to 0.97; *kappas* ranged from 0.71 to 0.79. The challenge with this study included the use of themes rather than science terminologies, and reliability was improved by clearly defining and differentiating the themes with definitions of descriptors for the four areas of scientific literacy. For application of the method to the chemistry textbooks (1991b), interrater agreements ranged from 0.82 to 0.92; *kappas* ranged from 0.73 to 0.89. *Knowledge of science* was found in both studies to represent the primary textbook theme.

Eltinge and Roberts (1993) specifically investigated aspects of science inquiry as part of scientific literacy and analyzed science biology textbooks for linguistic content to classify phrases as representative of science inquiry or not. *Kappas* for the study ranged from 0.69 to 1.00. Lumpe and Beck (1996) applied Chiappetta's (1991a) method to a selection of seven popular biology textbooks. Interrater agreements ranged from 0.81 to 0.93; *kappas* ranged from 0.74 to 0.91. These investigators also determined *knowledge of science* as the primary textbook theme.

Chiang-Soong and Yager (1993) introduced the idea of a content analysis that investigated science-technology-society (STS), which represented yet another important link to the study in support of cultural approaches to science education. These researchers examined 11 popular science textbooks in the United States to determine existence of science-technology-society (STS) content. Interrater agreement was 0.98. Biology textbooks in the study had the most number of pages devoted to STS topics compared to chemistry and physics books with the exception of one physical science book used in junior high grade levels; STS content appeared to lessen as the textbooks progressed for use in the higher grade levels. An important limitation of the study remained an issue of quantity versus quality. Chiang-Soong and Yager (1993) did not assess the quality of the STS content including relevance or appropriateness of the material as well as any instructions or strategies provided to the teachers. Not every possible scenario for a societal issue can be covered by any one science textbook, and this represented an important limitation with regard to the nature of the textbook. Such limitation held importance for this study in that indigenous knowledge representations and any direct application within an STS scenario may appear limited or be left out entirely of the textbook content for the same reasons identified by Chiang-Soong and Yager (1993).

Eide and Heikkinen (1996) examined the teacher editions for middle school science courses to determine the extent of the multicultural content and its degree of relationship to the science content. The researchers created a list of descriptors used to locate what they termed *multicultural items* in the text and then coded, using a Likert-type scale, the relationship of the identified item to the science content. The techniques used by Eide and Heikkinen (1996) served as the model for the teacher editions segment of the content analysis used in this study. Interrater and intrarater reliabilities were between 0.79 and 0.99 with an established *alpha* of 0.80. Eide and Heikkinen (1996) found that in most of the textbooks, the multicultural content occurred in limited amounts and the purpose for the multicultural content was rarely expressed or explained to the teacher.

Two other studies that examined visual content in textbooks served as the basis for the analysis of the visuals and illustrations segment used in this study. King and Domin (2007) examined the photographs found in 11 general chemistry books to determine the extent of representation of minorities. A minority was defined as anyone who could not pass for having "predominantly European ancestry…and included persons of African or Asian ancestry, non-white Hispanics, and Native Americans" (King and Domin, 2007. p. 343). The researchers identified instructional bias as invisibility, stereotyping, fragmentation, and cosmetic. Fragmentation was defined as minority-only photographs or photographs boxed in a section separated from the main text. Cosmetic bias occurred if the photograph was on the cover of the text or on a full-page but the total representation of minorities for the textbook was below 36% (King and Domin, 2007).

Powell and Garcia (1987) examined the quantity and quality of the depictions of females and minorities in elementary textbooks, and their methods served as the basis for the visuals and illustrations component in this study. Photographs and visuals were evaluated with regard to gender, race, child or adult, and active or passive. Although most groups were depicted in active roles, female children and youth were represented more often than other children and youth and female and minority adults were represented less often than white males. Powell and Garcia (1987) also suggested that the depictions in the textbook limit career opportunities for minorities in science by limiting the number of photographs that depict minorities “doing science.”

Two recent studies have come out of the original work of Chiappetta, Sethna, and Fillman (1991a) and hold much interest for the proposed study. Lee (2007) used the original framework with modifications to examine the presentation of the nature of science in the introductory chapters of high school biology textbooks. Since the literature base and related understandings regarding the nature of science has expanded to support more topics including multicultural aspects, there existed a need to revise the original four themes of the framework by adding more descriptions of the nature of science that reflect, as example, directives in national-level documents and other important research. Lee (2007) modified the original framework and added three noteworthy criteria with regard to the themes of *science as a way of thinking* and *science-technology-society* (STS): 1) “various ways of understanding the natural world;” 2) “contribution of diversity;” 3) “societal or cultural influences” (Lee, 2007, 169). Lee (2007) found that most of the biology books, with regard to balance of the four themes, presented a limited amount of STS content.

Brooks (2008) also undertook a content analysis that incorporated the original work of Chiappetta (1991a). She investigated the curricular balance in physics textbooks in the areas of the nature of science and ethnicity, and part of her study included the development of a method for coding photographs and other visuals to support the diversity component of her research. Brooks (2008) found *science as* a *body of knowledge* and *science as a way of knowing* to represent the most common themes in the sample. In addition, she found an imbalance in the diversity depicted in the visuals with ratios of ethnicity not in line with the United States census.

Additional content analyses representative of dissertation work by two graduate students at the University of South Florida held particular interest to the researcher and played an important role in the proposed design for this study: *A Content Analysis of Cultural Diversity in Florida State Adopted World History Textbooks* (Wartenberg, 1997) and *Multiculturalism, Public Policy, and the High School United States and American Literature Canon: A Content Analysis of Textbooks Adopted in the State of Florida in 1991 and 2003* (Hansen, 2005). Although both of these investigations analyzed textbooks in content areas other than the sciences, the proposed problems related closely to the issues at hand in the multicultural science education debates, and the question regarding the influence of debates, policy changes, and research in the broader context of multiculturalism resonated with an investigation established to determine the extent of inclusion of multicultural content in high school science textbooks. Although both studies indicated efforts by the textbook authors to include multicultural content in the textbooks, both studies also showed no clear trend in the increase of inclusion of multicultural content with implications that curriculum materials, most notable the textbook, remained largely unaffected by changes in policies regarding multicultural education (Hansen, 2005; Wartenberg, 1997).

The proposed investigation grew out of the work of Ninnes (2000; 2001a; 2001b), who analyzed the occurrence of non-Western perspectives in high school science textbooks in Australia and Canada. Ninnes (2000) looked for various approaches to including indigenous knowledge and discovered that each of the texts in the sample, which included two serial textbooks, portrayed high frequencies of indigenous knowledge. The portrayal of indigenous knowledge, however, did not necessarily indicate meaningful examples of contributions of indigenous groups. If these examples remained token representations without sincere discussion of the contributions of indigenous members of a culture, then the efforts of inclusion served to produce racist stereotypes, that is, messages that those who endorse Western science appeared as superior to any other individual with differing perspectives.

In additional content analyses of junior high science textbooks, Ninnes (2001a) considered science content from the perspective of the messages regarding ways of knowing, also referred to as the nature of knowledge, as well as the presence or absence of alternative interpretations or explanations of natural phenomena. In most cases, the texts presented alternative ways of knowing as trivial, inferior, and outdated and left the reader with the impression that "we" as the correct and authoritative members of the scientific community have "moved on from these past 'inferior' ways" (Ninnes, 2001a, p. 91). Ninnes (2001a) also noted the lack of opportunity for students not only to investigate other ways of knowing indicative of indigenous knowledge representations but also to critically examine current scientific information and question the "assumptions about the superiority of scientific knowledge presented in the texts" (p. 91). Although Ninnes (2001a) addressed questions of indigenous content with regard to types of indigenous knowledge and in what form they appeared in the texts, he acknowledged an important caveat, framed from the *who*, *what*, *how* and *why*, that posed a noteworthy implication for this study as well as well as subsequent research in the broader context of indigenous knowledge: *Who* ultimately provides the source of indigenous content? *What* role do indigenous peoples play in generating this content? *Why* do publishers publish textbooks in the first place, that is, the purpose for their books? *How* important is it, from the publishers' perspective, to include indigenous content?

Ninnes (2001b) continued his text analyses with a survey of authors of three science textbooks that contained high frequencies of representations of indigenous knowledge. From the survey responses, Ninnes (2001b) determined six main reasons for inclusion of multicultural content in science textbooks. Part of the reason for inclusion included the need to meet mandates on cultural and gender issues as well as considerations of relevance and the nature of science that multicultural content promoted. Ninnes (2001b) cited that inclusion of multicultural content could be limited by the nature of the topic or idea, that is, some areas of science did not seem to support non-Western examples. The realization of limited topics posed an important consideration for the proposed study, and the assumption was made that certain chapter or units, such as those with botanical or ecological content, remained more appropriate to support indigenous knowledge representations.

Multicultural Science Education

One of the more controversial debates which appeared in the last decade of science education literature included the discussion of multiculturalism and its appropriate role as a theoretical framework within multicultural science education. If multiculturalism did indeed have a place in science education, then the science curriculum and accompanying instructional materials such as the textbook faced potential for a major overhaul in terms of their ability to sustain cultural approaches to science. Hodson (1993) sparked initial discourse in support of multicultural science education by providing a rationale based on "science as a cultural phenomenon" (p. 686). His theoretical basis for recommendations within science education set the stage for understanding learning as a personal experience framed within a socio-cultural context. The idea of a socio-cultural context within science education remained important as this necessitated consideration of not only curriculum design but also instructional materials and their ability to enhance cultural approaches to learning science. Although Hodson (1993) presented a thorough framework for incorporating multiculturalism into science curriculum, he did not address the issues of universalism, one of the important arguments against multicultural science, or nor did he provide a definition of science from which he constructed his framework.

Atwater and Riley (1993) attempted to further the discussion by providing viewpoints, definitions, and research themes within multicultural science education. Although these researchers offered a solid definition of multicultural science education within the broader scope of multicultural education, they, too, failed to solidify a working definition of science from which to embed cultural approaches to science education. The researchers also presented substantial barriers to research in multicultural education as well as a solid research agenda for future endeavors in multicultural science education including the need to address, in both curriculum content and instructional materials, beliefs held by diverse populations of students and views of science from Western and non-Western perspectives.

Pomeroy (1994) addressed many of the current issues facing science education in the United States today and cited specifically 1) the racial divide in demographics in the nation as a whole as well as within the scientific establishment and 2) the failure of educational systems to produce scientifically literate students. These two broad issues frame concerns with regard to culturally relevant science curricula and whether such curricula should intend to develop appreciation of other cultures or go deeper to explore issues that result from privilege and power. For Pomeroy (1994), the choice was between a system that perpetuated the "tokenism and hegemony characterized in the institution of Western science or…a model in which dominance and marginalism are replaced by the mutual respect and understanding necessary for teachers and students alike ultimately to become *cultural border crossers*" (Pomeroy, 1994, p. 50). The term *cultural border crossers* was significant as science-technology-society (STS) content may serve as the curricular bridge to support border crossings for students traditionally marginalized and underrepresented in science classrooms. Pomeroy (1994) also presented some important agenda items in relation to building a science education capable of supporting cultural diversity. One of the agenda items included identification of the contributions of those individuals traditionally left out of science textbook content, with the acknowledgement of the significant contributions of minority groups, including Native American tribes. The method proposed to address this concern remained the overhaul of textbooks; texts should be rewritten or changed to include an emphasis on the contributions of individuals "other than White Western males" (Pomeroy, 1994, p. 56). An important caveat remained the quality of any multicultural content that might be added as several researchers had found evidence of "poor scholarship" (p. 56) in line with pseudoscientific claims and other misinformation regarding the knowledge base and contributions of certain groups. Pomeroy (1994) also recognized that when content indicative of cultural perspectives was included, it most often occurred in textboxes or short segments of text. Pomeroy (1994) identified one last important agenda item of interest to this researcher: the study of science in 'folk knowledge' or 'native technologies' (p. 62) as a connection to indigenous content.

Pomeroy's (1994) final call to develop instructional materials and other resources within the context of indigenous practices and technologies resonated with the need for the content analysis proposed by this investigator, and her focus on quality and relevance remained significant. She concluded her article with an important consideration in the broader scope of multicultural education: securing a clear definition, which continues to appear as a challenge to current researchers and practitioners in the field of multicultural science education.

Williams (1994) and Good (1995) supplied initial considerations of universalism as a contrast to multiculturalism. Although Williams (1994) did not provide a definition of science in terms of science education, he adamantly opposed Hodson's (1993) cultural approach by framing an understanding of science within a means to seek the explanations that govern the natural world "at all times in all places " (p. 516). Williams (1994) challenged Hodson's (1993) framework as promoting reverse discrimination against

Western scientists and viewed changes in textbooks as a form of censorship. Good (1995) reiterated a universal position of science, but his main issue with multicultural science stemmed from the notion of this approach as neglected science as well as the choice of examples of science from other cultures. These examples, which included agriculture and native plant medicine, appeared overused as support for other worldviews in science. These points represented important considerations in the proposed study as the purpose was to consider the extent to which textbooks supported cultural diversity with appropriate content that illustrated the strengths and limitations of differing perspectives of science. The desired end result remained a balance of representations rather than one form of science as more significant than another.

Border Crossing and STS

An important pedagogical consideration introduced by Aikenhead (1997) and Hodson (1999) included the idea of border crossing, that is, students from non-Western cultures must move between their own worldviews and those imparted in science classrooms in order to find success in mainstream education. Aikenhead (1997) specifically applied a cultural perspective to science education that viewed “Western science as a subculture of Euro-American culture” (p. 218). Teachers facilitated this border crossing and needed curriculum and instructional materials to support their efforts. Hodson (1999) called for action research as a means to help teachers address issues with science curriculum. Both researchers viewed the science-technology-society (STS) method to science education as one proven to encourage border crossing.

Aiken (1994) described STS science teaching as a fundamental shift in approaches to learning within the traditional science curriculum. A more student-centered approach to science, STS created opportunities for learners to “make sense out of their everyday experiences…in a manner that embeds science in the technological and social environments of the student…while [supporting] students’ natural tendency to integrate their personal understandings of their social, technological and natural environments ” (Aikenhead, 1994, pp. 48 – 49). Aikenhead (1994) also summarized the goals of STS education with included an increase in interest in science in an effort to reverse trends in enrollment and achievement in science. Achievement in science for this study, framed from the subtext of the achievement gap, related to the broader issues posed by the makeup of the current prime-age workforce. STS curricula may advantage a higher minority subgroup of the populace by meeting their need for access to science curricula that prepares them for work and life in the 21st century. STS may also be expected meet a need, absent in the traditional science curriculum, for developing the socially responsible citizen of the 21st century.

Aikenhead (1994) also provided a spectrum of categories related to the sequence of incorporation of science-technology-society (STS) content; this sequence, outlined in eight levels, served to articulate the relative importance of STS content in a science course. Levels one through three followed the traditional path of science learning where students organized science through theories or the expertise of the scientist. Levels four through eight allowed the students to view the natural world through their own personal lenses allowing incorporation of science content as needed. Levels one through three included a motivation or casual approach to purposeful infusion of STS content framed from the traditional school science. Levels four through eight moved away from the pure science approach so that STS became the organizer of the science content and, by level eight, moved to the investigation of a major technological or social issue in society (Aikenhead, 1994).

Science-technology-society (STS) as a way of teaching has faced many of the same criticisms of multicultural science education that pit it against what has been considered valid science or the traditional science curriculum. STS as a way of teaching, just as indigenous knowledge represents a way of knowing, provided a connection to the relevant issues within the broader aspects of scientific literacy and the specific societal problems inherent in the study of the life sciences. More importantly, STS offered a means to creation of the curriculum bridge necessary to support the concept of border crossing for those students traditionally underrepresented in science opportunities while maintaining the level of rigor and challenge expected of traditional science curricula (Aikenhead, 1994).

Traditional Ecological Knowledge

The most recent discussions of multicultural science education, stemming from the science-technology-society method and aspects of constructivist thought, moved to expand understandings of non-Western science within a broader scope of indigenous knowledge (Aikenhead, 2001; Cobern, 1996; Snively and Corsiglia, 2001). A branch of indigenous science known as traditional ecological knowledge (TEK) provided the structure for defining science outside of the realm of universalist views, and Snively and Corsiglia (2001) worked to provide thorough definitions of science from its broadest sense to specific contexts within modern and traditional science. Aikenhead (2001) as well as Snively and Corsiglia (2001) recognized the strengths and limitations of incorporating traditional forms of science into curricula and called for an integration of

Western and non-Western viewpoints. What warranted further investigation included an examination of the instructional materials necessary to facilitate this integration with effective cultural approaches to learning which include examples of non-Western science as alternative ways of knowing.

Traditional ecological knowledge (TEK) continued to appear in the literature as an alternative approach to Western science and provided an important way to connect indigenous knowledge to science content found in high school biology textbooks. As such, TEK ultimately provided the subject matter, specifically ecology and botany, relevant for an examination within textbooks of worldviews outside of the realm of Western science. As example, Huntington (2000) and Pierotti and Wildcat (2000) framed TEK perspectives from the management of natural resources. Huntington (2000) provided methods for utilizing TEK in research, and what appeared was a qualitative effort at understanding the natural world through interviews, questionnaires, and fieldwork with groups of indigenous peoples. Pierotti and Wildcat (2000) contrasted the concepts of TEK with those grounded in Western thought and called for the placement of TEK within the scope of modern science. However, these two researchers recognized that indigenous science constantly evolves as a way of knowing the natural world. This observation help important implications for a study which investigated science textbooks that, once examined and appropriate recommendations made, may require updates and changes to support an evolving body of knowledge such as TEK.

Constructivism

Constructivist thought was included at this point in the literature review as it provided a support for cultural approaches such as border crossing and science-technology-society

(STS) within the larger conceptual framework of multicultural science education. Constructivism often found its concepts linked to issues of culture (Fox, 2001) and readily supported a “model of learning and a view of knowledge that is authentically sensitive to both culture and science” (Cobern, 1996, p. 307). Cobern (1996) supported the expectation that non-Western students would not necessarily understand science the same way that students of Western orientation would; non-Westerners would construct their knowledge of science from their respective culture’s view of the natural world. Such consideration held significance for an examination of not only content inclusion within science curricula and textbooks but also cultural values and beliefs of non-Western cultures represented in today’s classrooms.

Chapter 3

Methodology

Research Design

The investigation involved a content analysis of high school biology textbooks framed from a mixed methods approach. Emphasis was placed, in consideration of the research questions and practicality of interpreting text with the potential for multiple meanings, within qualitative methods. Therefore, the study represented a design "where qualitative and quantitative methods are used sequentially with an inductive theoretical thrust" (Morse, 2003, p. 202). The quantitative piece included the conceptual analysis of the frequency of discrete sections of text of the sample of biology textbooks. The qualitative piece included a relational analysis where inferences as well as implications with regard to the meanings, relationships and messages in the text was made by the researcher. Other quantitative techniques included tallies for existence and frequency of content including visuals and photographs as well as a measure for bias known as the Evaluation Coefficient (ECO). As content analyses are subject to human interpretations and, therefore, exhibit increased chance for error, explicit procedures for the analyses were followed. Intrarater and interrater reliabilities were calculated for the coding of multicultural content in the teacher editions, the coding of favorable and unfavorable terminologies in the Evaluation Coefficient (ECO), and the coding of the visuals and illustrations within the sample.

Content Analysis

The term *content analysis* has been in existence for over 60 years, first appearing in the English language in 1941. The term was later included in the 1961 edition of *Webster's Dictionary of the English Language* as 'the analysis of the manifest and latent content of a body of communicated material (as a book or film) through classification, tabulation, and evaluation of its key symbols and themes in order to ascertain its meaning and probable effect' (Krippendorff, 2004, p. xvii). Although its intellectual origins remain linked to the history of man with considerations of the first uses of voice, signs, symbols and more formalized forms of writing, content analysis as a recognized systematic investigation of text first appeared among the Church-imposed inquisitions of the 17th century. As representative of a more modern research method, content analysis has evolved, at the start of the 20th century, from a quantitative strategy used primarily to analyze newsprint to a method of research incorporated by a wide range of disciplines including the social sciences. As example, the field of anthropology integrates content analysis techniques as a means to investigate myths and folktales; ethnographers use content analysis to interpret field notes and case studies of their subjects. Content analysis suits the critical examination of historical documents, and social scientists have recognized the value of content analysis applied to educational materials as textbooks and such often serve as a reflection of the values, attitudes and politics of society (Krippendorff, 2004).

Content analysis offers an approach to data analysis that centers largely on the researcher's conception of the object of analysis, that is, the content. How the content is conceived remains an important consideration in developing a framework, including the purpose and processes, for the analysis. Among the scholarly literature regarding content analysis, three types of definitions surfaced, and each type of definition led to a specific conceptualization of not only the data to be analyzed but also the particular manner in which the analysis may proceed. Krippendorff (2004) has located definitions of content analysis among those that take content 1) "to be *inherent* in a text" (p. 19); 2) "to be *a property of the source of a text*" (p. 19); 3) to *emerge in the process of a researcher analyzing a text* relative to a particular context (p. 19).

The first definition, that is, taking content to be inherent in a text, aligned with Berelson's (1952) characterization of content analysis as a "research technique for the objective, systematic and quantitative description of the manifest content of communication" (p. 18). Berelson used the terms *objective* and *systematic* under the requirements of replicability and validity which underpin research investigations, yet his incorporation of a quantitative requirement neglected to consider the act of reading as a "fundamentally qualitative process, even when it results in numerical counts" (Krippendorff, 2004, p. 20). Krippendorff (2004) found Berelson's manifest attribute limiting; it appeared to imply that if researchers interpreted the same data differently, then the description of content remained limited to what was deemed common or to what everyone involved in the analyses agreed. Ultimately, Berelson and his definition of content analysis led to the familiar container metaphor, which reinforced the belief that messages remained containers of meaning with one meaning for each message and ultimately served as justification for regarding any conventional analysis as a content analysis, whether it revolved around word counts or provided opportunity for meaningful interpretations (Krippendorff, 2004).

Krippendorff (2004) indicated that definitions of the second type, that is, to take content as a property of the source of a text, should be also be regarded as limiting. Holsti attempted to elaborate the idea by "committing content analysis to an encoding/decoding paradigm in which message sources are causally linked to recipients through encoding processes, channels, messages, and decoding processes" (Krippendorff, 2004, p. 21). His focus on *the what*, *the how* and *to whom* neither accounted for inferences that sometimes must be made nor considered the content analysts and his or her individual conceptualization not only to what represented appropriate reading but also to how the reading remained relevant to a particular research question (Krippendorff, 2004).

Krippendorff (2004) defined content analysis as a "research technique for making replicable and valid inferences from texts (or other meaningful matter) to the contexts of their use" (p. 18). It is this definition that aligned with the third type relating to content analysis; content is taken "to emerge in the process of a researcher analyzing a text relative to a particular context" (p. 19). The idea of context remained key to the proposed content analysis of this study as the texts analyzed include a sample of biology textbooks used in secondary science classrooms. The content analysis for this study required that the analyst consider how the teacher and students used the textbooks as well as how these textbooks fostered and encouraged different reader conceptions or actions. In addition, the messages in the textbooks do not speak for themselves; they inform the reader. As such, the nature of the textbooks warranted the need for specific inferences to be made within the chosen context – "from print to what printed matter means to particular uses, from how analysts regard a body of texts to how selected audiences are affected by those texts, from available data to unobserved phenomena" (Krippendorff, 2004, p. 24).

Sample

Biology textbooks, representative of instructional materials in the high school courses found among the life sciences, were selected for the study as biology content, specifically botany and ecology, lent itself to incorporation of indigenous knowledge representations. The study included 34 biology textbooks for public school use and adopted for grades 9 – 12 from four adoption cycles including 1990 – 1994, 1994 – 1998, 1998 – 2004, and 2005 – 2006. Twenty-two textbooks aligned with secondary science course descriptions and learning objectives for *Biology I*, and twelve textbooks aligned with secondary science course descriptions and learning objectives for *Biology I Honors* courses available as part of the Florida Department of Education *Course Descriptions of Basic Education, Grades 9 – 12 and Adult* (FLDOE). The sample for the study was inclusive and not randomly selected; all 34 textbooks identified by the state as available for use with *Biology I* and *Biology I Honors* courses were analyzed as part of the investigation. Textbooks for *Biology II* and the *Advanced Placement Biology* courses were not considered as these texts supported advanced concepts and principles in the life sciences not planned for evaluation as part of this study.

Florida statutes did not mandate a six-year adoption cycle until 1999. Prior to the decision to incorporate a six-year cycle, textbooks for use in the sciences were adopted by specific content area – physics, chemistry, or biology – rather than by an all-inclusive adoption for sciences at the elementary, middle or secondary-level science. The adoption cycles selected for this study aligned with the period of intense research initiated by scholars addressing topics in the burgeoning field of multicultural science education and permitted the review of the extent of infusion of multicultural content into science textbooks at the high school level. Tables 1, 2, 3 and 4 contain the textbooks by adoption cycle and academic level as designated by honors. Appendix A provides a complete bibliography of the student and teacher editions used in this study.

Instruments/Measures

Indigenous Knowledge Tally

To determine the amount of coverage given to non-Western considerations of science, frequencies of the representations of indigenous knowledge were calculated by counting the discrete sections of the textbooks that included reference to some aspect of indigenous knowledge. For the study, a section of text was defined as a word phrase, complete sentence, paragraph, box of text or complete page dedicated to the discussion of indigenous knowledge; a section included the text discussing an aspect of indigenous knowledge separated from other representations of indigenous knowledge by text related to non-indigenous topics. Each page of each chapter of the textbooks in the sample was examined for discrete sections of text, and content within the student and teacher editions of the texts were tallied for comparison (Ninnes, 2000). The questions at the end of the section, chapter or unit as well as the laboratory exercises were excluded from the tally. Indigenous knowledge representations were recorded on a worksheet included as Appendix B.

Indigenous knowledge was defined as an interpretation of how the world works from a particular cultural perspective. For a discrete section of text to be characterized as representative of indigenous knowledge, the section had to meet two criteria. These criteria were adapted from Ninnes (2000) to identify content considered representative of indigenous knowledge and to facilitate categorization of the representations in the texts.

Table 1.

Textbook Sample by Level (1990 – 1994 Cycle)

Book Title/Year/Publisher
Biology I
Living Systems, 6th edition, 1989 Glencoe
Biology, 1989 Harcourt, Brace, Jovanovich
Heath Biology, 1989 Heath
Modern Biology, 1989 Holt, Rinehart and Winston, Inc.
Biology: The Living World, 2nd edition, 1989 Prentice-Hall
Biology I Honors
BSCS Blue Version, Biological Science, A Molecular Approach, 1990 Heath
BSCS Biological Science, An Ecological Approach, 6th edition Kendall/Hunt
Biology: The Study of Life, 3rd edition, 1990 Prentice-Hall

Table 2.

Textbook Sample by Level (1994 – 1998 Cycle)

Book Title/Year/Publisher
Biology I
Addison-Wesley, Biology, 1st edition, 1994 Addition-Wesley Publishing Company
Merrill Biology: An Everyday Experience, 4th edition, 1992 Glencoe/McGraw-Hill
Holt Biology: Visualizing Life, 1994 Holt, Rinehart and Winston, Inc.
Biology, 2nd edition, 1993 Prentice-Hall, Inc.
Biology I Honors
Merrill Biology: Living Systems, 7th edition, 1994 Glencoe/McGraw-Hill
Modern Biology, 1993 Holt, Rinehart and Winston, Inc.
Biological Science: An Ecological Approach, 7th edition, 1992 Kendall/Hunt Publishing Company
Biology Today, 1st edition, 1993 Mosby-Year Book, Inc.
Biology: The Study of Life, 5th edition, 1993 Prentice-Hall, Inc.

Table 3.

Textbook Sample by Level (1998 – 2004 Cycle)

Book Title/Year/Publisher
Biology I
Biology: Dynamics of Life, 3rd edition, 1998 Glencoe/McGraw-Hill
Biology: Principles and Explorations, 1998 Holt, Rinehart and Winston
Essentials of Biology, 1st edition, 1998 Holt, Rinehart, and Winston
Holt Biology: Visualizing Life, 1st edition, 1998 Holt, Rinehart and Winston
BSCS Biology, An Ecological Approach, 8th edition, 1997 Kendall Hunt
BSCS, A Human Approach, 1st edition, 1997 Kendall Hunt
Biology: The Living Science, 1st edition, 1998 Prentice Hall
Biology: The Web of Life, 1st edition, 1998 Scott Foresman/Addison Wesley
Biology: A Community Context, 1st edition, 1998 South-Western
Biology I Honors
Biology: Living Systems, 8th edition, 1998 Glencoe/McGraw Hill
Biology, 4th edition, 1998 Prentice Hall

Table 4.

Textbook Sample by Level (2005-2006)

Book Title/Year/Publisher
Biology I
Biology: Cycles of Life, 2006 AGS Publishing
The Dynamics of Life, 7th edition, 2006 Glencoe/McGraw-Hill
Florida Holt Biology, 2006 Holt, Rinehart and Winston
Prentice Hall Biology, Florida Edition, 1st edition, 2006 Pearson Education, Inc as Pearson Prentice Hall
Biology I Honors
Modern Biology, 2006 Holt, Rinehart and Winston
Biology: Exploring Life, Florida Edition, 1st edition, 2007 Pearson Education, Inc. as Pearson Prentice Hall

A discrete section of text was considered representative of indigenous knowledge if the text: 1) referenced a specific indigenous group, society or people or used a generic word or phrase that referred to indigenous populations as determined by the appropriate search terms from *The Contemporary Thesaurus of Social Science Terms and Synonyms: A Guide for Natural Language Computer Searching* (1993) and *The Contemporary Thesaurus of Search Terms and Synonyms: A Guide for Natural Language Computer Searching* (2000) and 2) stated a specific activity, aspect or idea relating to one of four areas characterized as a) technologies, b) cultural practices/social life, c) knowledge of the natural world or d) legends and myths. As the indigenous knowledge representations were tallied, each discrete section of text was categorized into one of the four types identified in the second criteria. The complete list of words, phrases or terms used to facilitate identification of indigenous knowledge was included for review as Appendix C.

Teacher Editions

Using the teacher editions, the general format of the text was reviewed to gauge the incorporation of cultural diversity content into program goals and objectives, philosophies and themes. The use of a teacher edition worksheet, included as Appendix D, allowed the researcher to record specific information regarding the presence or absence of 1) content reviewers' expertise within multicultural and diversity issues; 2) emphasis on reading and writing; 3) inclusion of a pacing guide; 4) specific content support for multicultural or diversity; 5) focus on students needs; 6) and science-technology-society (STS) content.

In addition to general format, the teacher editions were reviewed to determine the relationship of the multicultural content to the specific science content as exemplified by the chapter or section objectives. The degree to which the multicultural content supported the science content was recorded as a one (1), two (2) or three (3) with one (1) equating highly related (the multicultural content directly supported the goals and objectives; two (2) equating somewhat related (the multicultural content somewhat supported the stated goals and objectives; and (3) equating not related (no connection between the multicultural content and the stated goals and objectives). This information was recorded on a worksheet included as Appendix E; directions for coding multicultural content are included as Appendix F.

Archaeology of Statements

To determine the extent of the nature of indigenous representations, an archaeology was created by reading and analyzing each page of each chapter of the sample textbooks. An archaeology in this sense referred to a collection of statements regarding a particular idea or set of ideas, that is, those statements that related to appropriate representations of indigenous knowledge (Ninnes, 2000). The archaeology, created in conjunction with the indigenous knowledge tally, is included in part and as allowable for publication with copyright as Appendix G.

The statements were analyzed using a variety of techniques prescribed by Ninnes (2000; 2003) as a means to examine the nature of indigenous representations within the broader frames of ideological and textual features. The ideological features included the notion of essentialism as evidenced by 1) the masking of diversity through the use of homogenous or generic terms, modifiers or binaries related to indigenous peoples, events and vocabulary and 2) notions of traditionality as prescribed authenticity to specific indigenous groups. Textual features of the statements included 1) examination of temporal location versus contemporary portrayals of indigenous knowledges and 2) spatial arrangement including the physical layout on a page which separated text within a box or shaded area or the use of a round-off, a technique that offered the indigenous explanation then followed by the "correct" or "scientific" explanation (Ninnes, 2003, p. 178).

Evaluation Coefficient Analysis (ECO)

Pratt (1972) developed an Evaluation Coefficient Analysis (ECO) designed to measure bias in textbooks. The measure used a score sheet that allowed the researcher to record the page number, the word or phrase, and the direction, that is, (+) for favorable and (-) for unfavorable. Pratt recorded interrater reliability for the ECO at 0.947 and test-retest reliability at 0.755.

Two vocabulary lists were developed. The first Eurocentric science vocabulary list reflected terms divided among three subsets: *nature of science*, *ecology*, and *indigenous representations*. The second list reflected multicultural terms related to the same three subsets as the Eurocentric list. *The New Dictionary of Cultural Literacy* (2002) provided the list of terms used as the basis for the Eurocentric list. The multicultural list included words and phrases found among *The Graywolf Annual Five: Multicultural Literacy*, the *Dictionary of Multicultural Education*, the *Thesaurus of ERIC Descriptors*, and *The Contemporary Thesaurus of Social Science Terms and Synonyms* as well as current research in indigenous knowledge. Vocabulary lists for the Eurocentric and multicultural terms are included as Appendix H and Appendix I, respectively. The worksheet for the ECO is included as Appendix J.

Visuals and Illustrations

To determine the quality and quantity as well as the extent of the illustrations, photographs and other visuals to represent examples of non-Western science, the illustrations and photographs were first tallied and categorized as containing either non-human or human content. A visual was included in the study if the depiction was enclosed in a clearly defined boundary on the page, that is, the photograph, illustration or picture had to possess a discernable boarder. Maps, graphs, or charts were not considered as visuals for this portion of the study. Based on a classification system developed by Powell and Garcia (1985), visuals with human content were further categorized into one of four areas: children or youth, adults, aerial, and appendage. Visuals coded as *aerial* depicted “individuals massed together in a specific geographic location” (Powell and Garcia, 1985, p. 524). Visuals coded as *appendage* depicted “only an appendage of the human body, e.g., hand, arm, leg, foot” (Powell and Garcia, p. 524). Child or youth and adult images were also considered in terms of percentages of gender and racial groups represented in the visual or photograph. In addition, the visuals or photographs with humans were tallied as *passive* or *active* in consideration of the activity depicted in the visual. The tally sheet for visuals is included as Appendix K.

Data Analysis

The data analysis included tallies for existence and frequency of indigenous content, calculated as number of occurrences per chapter by unit. Units remained one of the ten created as needed for the study: 1) introduction to biology; 2) nature of cells; 3) genetics; 4) evolution; 5) microbial world; 6) plants; 7) invertebrates; 8) vertebrates; 9) human biology; 10) ecology. The rationale for the 10-unit system is explained in chapter four.

The Evaluation Coefficient (ECO) was added as a measure of the relationship between indigenous and Western forms of science. Indigenous knowledge was rated with a plus sign (+) and considered favorable within the context of this study, and Western forms of science were rated with a negative sign (-) and considered unfavorable. The following formula was used:

$$\frac{100\,F}{F + U}$$

where F = favorable terms and U = unfavorable terms. The coefficient range was 0.00 (completely unfavorable) to 100.00 (completely favorable) with a coefficient of 50.0 representing a neutral stance.

Reliability

Content analysis as a research method uses subjective classification schemes by the assigned coders, and, therefore, holds potential limitations due to unreliable measures (Krippendorf, 2004). To solve this problem in the investigation, intrarater and interrater reliabilities were calculated. According to Neuendorf (2002), Cohen's *kappa* represented "the most widely used reliability coefficient" (p. 150) in content analyses. As such, Cohen's *kappa* (*k*) was used to measure rater agreements; the formula for *kappa* is:

$$k = \frac{PA_0 - PA_E}{1 - PA_E}$$

where "PA_0 stands for 'proportion agreement, observed' and PA_E stands for 'proportion agreement, expected by chance'" (Neuendorf, 2002, p. 151). Although common standards on acceptable levels for reliability for the social sciences varied in the literature with regard to content analysis, Cohen's *kappa* for this study was set at 0.75.

One researcher was responsible for the data collection in this study. Two additional coders were used to calculate interrater reliabilities, and trial analyses, using the coding form and directions, were carried out on textbooks prior to the data collection to check for rater agreements until $k = 0.75$ was reached. The coding directions were modified during the trials to allow the coders to properly differentiate between "somewhat related" and "highly related" in the coding of the multicultural components and their relationship to the objectives for each section of text; theses two categories for coding presented the most difficulty for coders. Intrarater reliabilities were calculated for the teacher edition segment of the study by having the researcher code and then recode one teacher edition per each set, once at the beginning of the data collection period and a second time two weeks later, using the coding form and directions, as previously mentioned and found in Appendix F. The mean intrarater reliability for the researcher was $k = 0.81$. Interrater reliabilities were calculated for the teacher edition segment of the study by having an additional coder, trained on the coding scheme, code a randomly selected teacher's edition textbook; intrarater reliabilities for the additional coder were calculated by having the coder code the selected teacher edition a second time after a wait period of two weeks. The intrarater reliability for the additional coder was k = 0.77; interrater reliability was k = 0.77. The same process was carried out for the Evaluation Coefficient Analysis (ECO); the additional rater was trained on the data collection process outlined in Pratt's *How to Find and Measure Bias in Textbooks* (1972), and the vocabulary lists and scoring sheets previously mentioned and included as Appendix H and Appendix I, respectively, were used for the ECO analysis. The mean intrarater reliability for the researcher was $k =$

0.93. Intrarater reliability for the additional coder was k = 0.94. The interrater reliability was k = 0.95.

Determining reliability for the visuals and illustrations segment of the study created difficulty because of the limited numbers of photographs in the sample that depicted human subjects. The average number of visuals depicting human subjects per textbook in the sample was nineteen. Although mean intrarater reliabilities were calculated at k = 0.97 and k = 0.99 for the researcher and coder, respectively, the reliability may be affected by the limited number of photographs that were to be analyzed. This fact was also noted in the limitations of the study as the selection of visuals was restricted to two of the ten units in each textbook; therefore, the total visuals and illustrations were not inclusive of each unit found in the textbooks in the sample.

Chapter 4

Results

Chapter 4 provides the results of the content analysis of the 34 textbooks used in this study. The analysis represented an attempt to determine the extent to which multicultural science education content, including incorporation of indigenous knowledge, had been infused within the content of high school biology textbooks. The study evaluated the textbook as the primary instructional tool and auxiliary framework for multicultural science education instruction by comparing mainstream science content to indigenous knowledge perspectives portrayed in the text content. Specifically, the study addressed: 1) the extent to which biology textbooks adopted in the most recent adoption cycle for science (2005 – 2006) included content coverage that supported perspectives of indigenous knowledge compared to biology textbooks adopted in Florida's last three adoption cycles; 2) the extent to which multicultural content had been incorporated in the goals and objectives of the 2005 – 2006 adoption textbooks compared to the goals and objectives found in the textbooks adopted in Florida's last three adoption cycles; 3) the extent of the nature of representations of indigenous knowledge included in high school biology textbooks adopted in 2005 – 2006 compared to biology textbooks adopted in Florida's last three adoption cycles; 4) the extent that indigenous representations as people, events, and related vocabulary had been incorporated into the content of high school biology textbooks from 2005 – 2006 compared to textbooks adopted in Florida's last three adoption cycles; and 5) the extent to which the illustrations, photographs and other graphics of examples of non-Western science related in quantity and quality to visuals of Western science in high school biology textbooks adopted in 2005 – 2006 compared to those adopted in Florida's last three adoption cycles.

Tables have been used to organize data collected from the segments of the study related to the indigenous knowledge tally, multicultural content of the teacher editions, Evaluation Coefficient Analysis (ECO), and visuals and illustrations. In addition, the 34 high school biology textbooks used in the analysis have been organized to reflect four (4) sets of texts based on the year of the adoption cycle. Set 1 contained the eight (8) textbooks selected for *Biology I* and *Biology I Honors* found in the 1990 – 1994 adoption cycle. Set 2 contained the nine (9) *Biology I* and *Biology I Honors* textbooks found in the 1994 – 1998 adoption cycle. Set 3 contained the eleven (11) *Biology I* and *Biology I Honors* textbooks found in the 1998 – 2004 adoption cycle. Set 4 contains the six (6) *Biology I* and *Biology I Honors* textbooks found in the 2005 – 2006 adoption cycle. None of the textbooks appeared on all four of the adoption lists.

As some textbooks shared common titles, a coding system was adapted from the work of Eide and Heikkinen (1991) and their content analysis of teacher resource manuals. Tables 5 and 6 provide the textbook codes used for this study. Each text was referred to by the last name of the first author followed by a numerical code. The numerical code provided the set numeral (1, 2, 3, or 4) followed by the book numeral in the set. As example, the first textbook in Set 1 was *Biology Living Systems* (Glencoe, 1989) by Oram. Reference to this textbook appeared in the analysis as Oram 1-1.

Table 5.

List of Book Codes by Textbook Set and First Author –Sets 1 and 2

Book Code	First Author	Title and Publisher	Year
Set 1			
1-1	Oram	*Biology Living Systems* (Glencoe)	1989
1-2	Goodman	*Biology* (Harcourt, Brace, Jovanovich)	1989
1-3	McLaren	*Biology* (Heath)	1989
1-4	Towle	*Modern Biology* (Holt, Rinehart, Winston)	1989
1-5	Alexander	*Biology* (Prentice Hall)	1989
1-6	Milani	*BSCS A Molecular Approach* (Heath)	1990
1-7	Milani	*BSCS An Ecological Approach* (Kendall Hunt)	1987
1-8	Schraer	*Biology The Study of Life* (Prentice Hall)	1991
Set 2			
2-1	Essenfeld	*Biology* (Addison-Wesley)	1994
2-2	Kaskel	*Biology An Everyday Experience* (Glencoe)	1992
2-3	Johnson	*Biology: Visualizing Life* (Holt, Rinehart, Winston)	1994
2-4	Miller	*Biology* (Prentice Hall)	1993
2-5	Oram	*Biology Living Systems* (Glencoe)	1994
2-6	Towle	*Modern Biology* (Holt, Rinehart, Winston)	1993
2-7	Milani	*BSCS An Ecological Approach* (Kendall Hunt)	1992
2-8*	Gottfried	*Biology Today* (Mosby)	1993
2-9	Schraer	*Biology The Study of Life* (Prentice Hall)	1993

*Teacher Edition entitled *Teaching Biology Today* (Mosby, 1993) by Ann S. Lumsden

Table 6.

List of Book Codes by Textbook Set and First Author – Sets 3 and 4

Book Code	First Author	Title and Publisher	Year
Set 3			
3-1	Biggs	*Biology The Dynamics of Life* (Glencoe)	1998
3-2	Johnson	*Biology Principles & Explorations* (H,B,J)	1998
3-3	Pignatiello	*Essentials of Biology* (Heath)	1998
3-4	Johnson	*Biology Visualizing Life* (Holt, Rinehart, Winston)	1998
3-5	Cairney	*BSCS An Ecological Approach* (Kendall Hunt)	1998
3-6*	Bybee	*BSCS A Human Approach* (Kendall Hunt)	1997
3-7	Miller	*Biology The Living Science* (Prentice Hall)	1998
3-8	Strauss	*Biology The Web of Life* (Scott Foresman)	1998
3-9*	Leonard	*Biology A Community Context* (Addison-Wesley)	1998
3-10	Oram	*Biology Living Systems* (Glencoe)	1998
3-11	Miller	*Biology* (Prentice Hall)	1998
Set 4			
4-1	Parke	*Biology Cycles of Life* (Addison-Wesley)	2006
4-2	Biggs	*Biology The Dynamics of Life* (Glencoe)	2006
4-3	Johnson	*Holt Biology* (Holt, Rinehart, Winston)	2006
4-4	Miller	*Biology* (Prentice Hall)	2006
4-5	Postlethwait	*Modern Biology* (Holt, Rinehart, Winston)	2006
4-6	Campbell	*Biology Exploring Life* (Prentice Hall)	2006

*Teacher Edition exists as separate manual by same author and same title as student edition

A general review of the sample revealed that textbook content in 32 of the texts was organized into a system of units ranging from a 5-unit to an 11-unit design; the remaining 2 textbooks in the sample listed chapters with no unit designations or other identifiable system of content organization. The average number of units per textbook in the sample was 8.35 with an 8-unit design representing the modal system of organization. The general layout for the 8-unit plan incorporated content dedicated to the following broad topics: 1) *nature of cells (introduction)*; 2) *genetics and evolution*; 3) *ecology*; 4) *microbial word* (*bacteria, fungi, protists*); 5) *plants*; 6) *invertebrates*; 7) *vertebrates*; and 8) *human biology*. For this study, the chapters and units of the textbooks in sample were reorganized as needed to reflect a 10-unit design for each textbook with the following broad topic designation for each unit: 1) *introduction to biology*; 2) *cells*; 3) *genetics*; 4) *evolution*; 5) *microbial world*; 6) *plants*; 7) *invertebrates*; 8) *vertebrates*; 9) *human biology*; and 10) *ecology*.

In order to achieve this 10-unit design, most of the textbooks required a realignment of chapters to reflect the unit designations listed in the above paragraph. As example, when the *nature of cells* unit appeared in a textbook with no separate unit for the *introduction to biology*, the appropriate chapters were separated from the *nature of cells* and assigned as *introduction to biology*. A distinct unit for *evolution* as well as a distinct unit for *genetics* was created for any textbook that had originally placed these two topics together under one unit. If a textbook included *invertebrates* and *vertebrates* within one distinct unit labeled *animals*, then chapters in that particular unit were divided appropriately and reassigned to reflect a unit for *invertebrates* and another one for *vertebrates*. If one chapter included content appropriate for two distinct units, then the chapter was counted twice, once for each content area included within the chapter. This occurred most often when authors included fungi and plants within the same chapter. In this case, the chapter was counted within the unit *microbial world* as well as the unit *plants*.

The 10-unit division served not only to create uniformity of textbook content but also to facilitate the analysis of frequencies for each unit topic designated in the 10-unit layout. Tables 7, 8, 9, and 10 depict the number of chapters per the 10-unit system used in this study. The average number of chapters per textbook in the sample was 37.0. The average number of chapters per unit in the 10-unit system for the sample was as follows: *introduction to biology* (2.5 chapters); *cells* (3.4 chapters); *genetics* (3.9 chapters); *evolution* (3.0 chapters); *microbial world* (3.0 chapters); *plants* (3.7 chapters); *invertebrates* (3.7 chapters); *vertebrates* (4.1 chapters); *human biology* (7.2 chapters); and *ecology* (3.9 chapters).

For 31 of the 34 textbooks in the sample, the teacher edition represented an annotated version of the student edition with notes in the margins and additional resource or instructional pages included as an auxiliary guide for teachers; these additional pages were most often referred to as teacher interleafs. For three of the textbooks in the sample, a separate manual served as the teacher edition: Lumsden 2-8, Bybee 3-6, and Leonard 3-9. The teacher edition which accompanied the student edition, Gottfried 2-8, *Biology Today*, was of a different title, *Teaching Biology Today*, and was written by a different author, Ann S. Lumsden, hence the designation Lumsden 2-8. Lumsden 2-8 represented a collection of chapter objectives and overviews, lecture outlines, answers to the end-of-chapter *Thought Questions* found in the student edition as well as reproducible exams.

Table 7.

Number of Chapters Per Unit – Set 1

Book Code	Total Number Σ_{ch}	Σ_{units}	Intro	Cells	Gen	Evol	Micro	Plants	Inverts	Verts	Human	Ecol
Oram 1-1	35	8	3	2	4	3	2	3	6	6	8	3
Goodman 1-2	54	11	5	4	5	4	5	6	5	5	11	4
McLaren 1-3	50	8	4	4	4	5	3	6	4	6	9	5
Towle 1-4	53	10	4	5	4	5	5	5	7	6	7	5
Alexander 1-5	39	8	3	3	2	3	4	5	4	4	7	4
Milani 1-6	26	6	2	5	3	2	2	2	2	4	5	2
Milani 1-7	25	5	1	1	2	2	2	3	2	2	4	6
Schraer 1-8	39	8	4	2	5	2	2	4	2	4	10	3

Σ_{ch} = total number of chapters
Σ_{units} = total number of original units

Table 8.

Number of Chapters Per Unit – Set 2

Book Code	Total Number Σ_{ch}	Σ_{units}	Intro	Cells	Gen	Evol	Micro	Plants	Inverts	Verts	Human	Ecol
Essenfeld 2-1	48	9	4	3	5	4	4	5	5	6	8	4
Kaskel 2-2	32	8	1	1	4	2	2	4	2	5	10	3
Johnson 2-3	34	6	2	3	3	3	4	3	2	2	8	3
Miller 2-4	49	10	4	4	4	3	4	6	5	6	10	3
Oram 2-5	30	7	2	4	5	2	2	3	5	5	9	4
Towle 2-6	53	10	4	5	4	5	5	5	7	6	7	5
Milani 2-7	24	5	1	1	2	2	2	3	2	2	4	5
Gottfried 2-8	40	8	2	5	4	3	2	2	1	3	13	5
Schraer 2-9	39	8	4	2	5	2	2	4	2	4	10	3

Σ_{ch} = total number of chapters
Σ_{units} = total number of original units

Table 9.

Number of Chapters Per Unit – Set 3

Book Code	Total Number Σ_{ch}	Σ_{units}	Intro	Cells	Gen	Evol	Micro	Plants	Inverts	Verts	Human	Ecol
Biggs 3 -1	43	10	2	5	5	3	4	4	5	4	6	5
Johnson 3-2	42	9	1	5	4	4	4	4	4	4	8	4
Pignatiello 3-3	35	n/a	2	3	4	3	3	3	3	6	7	3
Johnson 3-4	35	6	2	3	4	3	4	3	4	4	7	3
Milani 3-5	24	5	1	1	2	2	2	3	2	2	4	5
Bybee 3-6	16	6	4	4	3	3	0	0	0	0	6	2
Miller 3-7	40	8	2	3	4	4	3	4	4	5	7	4
Strauss 3-8	38	9	2	3	4	4	3	4	4	4	6	4
Leonard 3-9	n/a	8	0	0	1	0	1	0	0	0	2	4
Oram 3-10	30	7	2	4	5	2	2	3	5	5	9	4
Miller 3-11	49	10	4	4	4	3	4	6	5	6	10	3

Σ_{ch} = total number of chapters
Σ_{units} = total number of original units

Table 10.

Number of Chapters Per Unit – Set 4

Book Code	Total Number Σ_{ch}	Σ_{units}	Intro	Cells	Gen	Evol	Micro	Plants	Inverts	Verts	Human	Ecol
Parke 4 -1	19	n/a	3	5	3	2	2	2	2	2	1	3
Biggs 4-2	39	10	1	4	4	4	3	4	5	4	6	4
Johnson 4-3	43	9	2	4	5	3	4	4	5	5	7	4
Miller 4-4	40	10	2	4	4	4	3	4	4	5	6	4
Postlethwait 4-5	51	10	3	5	5	4	4	5	7	6	7	5
Campbell 4-6	36	9	3	5	5	2	3	4	2	2	7	3

Σ_{ch} = total number of chapters
Σ_{units} = total number of original units

The teacher edition for Bybee 3-6 represented a comprehensive resource manual for teachers which included guidelines for implementation, assessment and evaluation, cooperative learning, correlation of the national science standards, masters for overheads and handouts, optional activities, and educational technology including use of the videodiscs. The teacher edition for Leonard 3-9 provided an introduction to instructional strategies, assessments, national science education standards, background and suggested resources for each unit, and unit exams with assessment rubrics.

Indigenous Knowledge Tally

Frequency of Representation

The frequency of indigenous knowledge representations was tallied for the student and teacher editions of the sample and recorded as the average number of indigenous knowledge representations per chapter by unit or topic area. More indigenous knowledge representations occurred in the teacher editions compared to the student editions, and the indigenous content identified in the teacher edition was typically incorporated as textboxes found in the margins and labeled multicultural (or cultural) perspectives (or strategies). In addition, the highest averages for indigenous knowledge representations were recorded for the textbooks in the sample in two units: *plants* and *ecology*. For the sample, *plants* had a range of 0.0 to 2.0 average number of indigenous knowledge representations per chapter by unit or topic area with a mean of 0.38 for the student editions and a range of 0.0 to 3.33 average number of indigenous knowledge representations per chapter by unit or topic area with a mean of 0.63 for the teacher editions. For the sample, *ecology* had a range of 0.0 to 0.75 average number of indigenous knowledge representations per chapter by unit or topic area with a mean of

0.19 for the student editions and a range of 0.0 to 1.25 average number of indigenous knowledge representations per chapter by unit or topic area with a mean of 0.38 for the teacher editions.

Textbooks in Set 1

Tables 11 and 12 depict the averages of indigenous knowledge content found in Set 1 for the student and teacher editions, respectively. Limited amounts of content related to indigenous knowledge appeared within the set; no averages were recorded in the units of *introduction to biology*, *cells*, *genetics*, *invertebrates* and *vertebrates* for any of the texts in the set. No difference occurred in averages recorded for the student edition and the teacher edition with the exception of the teacher edition for Milani 1-7 in *ecology*. For this text, the teacher edition had a slightly higher average compared to the student counterpart. The exception was Milani 1-7 teacher edition and the unit *ecology*, which included a one-sentence annotation with regard to indigenous content located in the margin.

Indigenous knowledge representations were most common among the units designated as *ecology*, *microbial world*, *plats* and *human biology*. Averages of indigenous knowledge content in the unit *plants* were recorded for four of these six textbooks. Milani 1-7 provided the highest average of representations related specifically to the unit topics of *ecology*, *microbial world*, and *plants* with *microbial world* representing the highest average. Oram 1-1 provided the least total amount of coverage of indigenous knowledge with indigenous content recorded for one unit: *human biology*.

Table 11.

Average Number of Indigenous Knowledge Representations per Chapter by Unit/Topic Area for Set 1 – Student Editions

Unit/ Topic	Oram 1-1	Goodman 1-2	McLauren 1-3	Towle 1-4	Alexander 1-5	Milani 1-6	Milani 1-7	Schraer 1-8
Introduction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cells	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Genetics	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Evolution	0.00	0.00	0.00	0.00	0.33	0.00	0.00	0.00
Microbial World	0.00	0.00	0.00	0.00	0.00	0.00	1.50	0.00
Plants	0.00	0.33	0.17	0.40	0.00	0.00	0.33	0.00
Invertebrates	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Vertebrates	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Human Biology	0.25	0.18	0.00	0.00	0.00	0.00	0.00	0.00
Ecology	0.00	0.25	0.20	0.00	0.00	0.00	0.50	0.00

Table 12.

Average Number of Indigenous Knowledge Representations per Chapter by Unit/Topic Area for Set 1 – Teacher Editions

Unit/ Topic	Oram 1-1	Goodman 1-2	McLauren 1-3	Towle 1-4	Alexander 1-5	Milani 1-6	Milani 1-7	Schraer 1-8
Introduction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cells	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Genetics	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Evolution	0.00	0.00	0.00	0.00	0.33	0.00	0.00	0.00
Microbial World	0.00	0.00	0.00	0.00	0.00	0.00	1.50	0.00
Plants	0.00	0.33	0.17	0.40	0.00	0.00	0.33	0.00
Invertebrates	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Vertebrates	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Human Biology	0.25	0.18	0.00	0.00	0.00	0.00	0.00	0.00
Ecology	0.00	0.50	0.20	0.00	0.00	0.00	0.67	0.00

Table 13.

Average Number of Indigenous Knowledge Representations per Chapter by Unit/Topic Area for Set 2 – Student Editions

Unit/ Topic	Essenfeld 2-1	Kaskel 2-2	Johnson 2-3	Miller 2-4	Oram 2-5	Towle 2-6	Milani 2-7	Gottfried 2-8	Schraer 2-9
Introduction	0.00	0.00	0.50	0.25	0.00	0.00	0.00	0.00	0.00
Cells	0.00	0.00	0.00	0.00	0.25	0.00	0.00	0.00	0.00
Genetics	0.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Evolution	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00
Microbial World	0.00	0.00	0.00	0.00	0.50	0.00	0.50	0.00	0.00
Plants	1.00	0.25	2.00	0.16	0.67	0.20	0.33	0.50	0.00
Invertebrates	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Vertebrates	0.17	0.00	0.00	0.16	0.40	0.00	1.00	0.00	0.00
Human Biology	0.25	0.00	0.00	0.00	0.33	0.00	0.00	0.00	0.00
Ecology	0.25	0.00	0.33	0.33	0.75	0.00	0.20	0.60	0.00

Table 14.

Average Number of Indigenous Knowledge Representations per Chapter by Unit/Topic Area for Set 2 – Teacher Editions

Unit/ Topic	Essenfeld 2-1	Kaskel 2-2	Johnson 2-3	Miller 2-4	Oram 2-5	Towle 2-6	Milani 2-7	Lumsden 2-8	Schraer 2-9
Introduction	0.25	0.00	1.50	0.25	0.00	0.00	0.00	0.00	0.00
Cells	0.00	0.00	0.00	0.25	0.75	0.00	0.00	0.00	0.00
Genetics	0.60	0.00	0.00	0.00	0.20	0.00	0.00	0.00	0.00
Evolution	0.00	0.00	0.00	0.00	2.00	0.00	0.00	0.00	0.00
Microbial World	0.25	0.00	0.50	0.25	0.50	0.00	0.50	0.00	0.00
Plants	1.40	0.25	3.33	0.16	1.33	0.20	0.33	0.00	0.00
Invertebrates	0.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Vertebrates	0.67	0.00	0.50	0.16	0.60	0.17	1.00	0.00	0.00
Human Biology	0.50	0.00	0.38	0.00	0.44	0.00	0.00	0.00	0.00
Ecology	0.50	0.00	1.00	0.33	2.00	0.00	0.40	0.00	0.00

Textbooks in Set 2

Tables 13 and 14 depict the averages of indigenous knowledge content identified in Set 2 for the student and teacher editions, respectively. Eight of the nine student editions were identified to include indigenous knowledge content. Among these eight texts, all 10 units were identified to include indigenous knowledge content. Seven of the nine teacher editions were identified to include indigenous knowledge. Among these seven texts, all 10 units were identified to include indigenous content. Averages of indigenous knowledge content were recorded in the unit *plants* for each of the student and teacher editions of the textbooks noted to include some form of indigenous knowledge. Lumsden 2-8, as previously noted, represented a separate manual for teacher use and, as such, did not include content in the scope required for a tally of indigenous knowledge.

Among the student editions, Oram 2-5 and Essenfeld 2-1 had the most indigenous knowledge representation across the 10 unit topics. Oram 2-5 had indigenous content within seven of the 10 units; Essenfeld 2-1 had indigenous content within six of the 10 units. For Oram 2-5, indigenous knowledge representations were most frequent in the unit *evolution*, three-fourths as frequent in the unit *ecology*, two-thirds as frequent in *plants*, half as frequent in *microbial world*, two-fifths as frequent in the unit *vertebrates*, one-third as frequent in *human biology* and one-fourth as frequent in *cells*. For Essenfeld 2-1, indigenous knowledge representations were most frequent in the unit *plants*, three-fifths as frequent in the unit *genetics*, and one fourth to one fifth as frequent in the units of *human biology*, *ecology*, *invertebrates* or *vertebrates*. Towle 2-6 had the lowest average of indigenous content recorded in the student editions for one unit: *plants*.

For the teacher editions, Essenfeld 2-1 and Oram 2-5 also had the most indigenous knowledge representations across the 10 unit topics; both of these editions included indigenous content in eight of the 10 units. In Essenfeld 2-1, indigenous knowledge content was most frequent in the unit *plants*, three-fifths as frequent in the units of *genetics, invertebrates* and *vertebrates*, almost one-third as frequent in the units of *human biology* and *ecology*, and almost four-fifths as frequent for the units of *introduction* and *microbial world*. The average of representation in the Essenfeld 2-1 teacher edition compared to the student edition increased in all of the units with the exception of *genetics*, which remained the same for student and teacher edition. *Introduction* and *microbial world* went from no representation in the student edition to 0.25 in the teacher edition. *Human biology* and *ecology* doubled in its average in the teacher edition; *invertebrates* tripled in its average. An average increase of two-fifths for the unit *plants* and four times for the unit *vertebrates* occurred in the teacher edition compared to averages for the student edition for Essenfeld 2-1.

For Oram 2-5 teacher edition, indigenous knowledge representations were most frequent in *evolution* and *ecology*, two-thirds as frequent in the unit *plants*, a little more than two-thirds as frequent in the unit *cells*, a little less than one-third as frequent in the unit *vertebrates*, one-fourth as frequent in *microbial world*, one-fifth as frequent in *human biology*, and one-tenth as frequent in *genetics*. The average of representation in the Oram 2-5 teacher edition increased in all of the units compared to the student edition with the exception of the unit *microbial world*, which remained the same for student and teacher edition. *Genetics* went from no representation in the student edition to 0.20 in the teacher edition. The average of *cells* tripled; the average of *evolution* and *plants* doubled.

The average increased one-fifth for *vertebrates* and one-tenth for *human biology* compared to the student edition.

Towle 2-6 had the lowest average of indigenous knowledge among the teacher editions in one unit: *vertebrates*. Kaskel 2-2 had the least amount of total indigenous content among the teacher editions. A noted previously for the student edition, this representation was recorded within one unit: *plants*. Kaskel 2-2 was also the only text in set 1 with no difference in average of representations of indigenous knowledge in the student edition compared to the teacher edition. The least common occurrence of indigenous representation among the 10 units for student and teacher editions collectively occurred in *plants* and the *unit* vertebrates in Miller 2-4 student and teacher editions.

Textbooks in Set 3

Tables 15 and 16 depict the averages of indigenous knowledge content identified in Set 3 for the student and teacher editions, respectively. Ten of the 11 student editions included indigenous knowledge content. Among these ten texts, all 10 units were identified to include indigenous content. Eight of the eleven teacher editions included indigenous knowledge content. Among these eight texts, all 10 units were identified to include indigenous content. Averages within *plants* and *ecology* occurred for each one of the teacher editions noted to include indigenous knowledge content. Averages occurred for the unit *plants* in six of the student editions noted to contain indigenous content; averages for *ecology* were found in five of the student editions noted to contain indigenous content. Bybee 3-6 and Leonard 3-9, as previously noted, represented separate texts for the teacher resource and, as such, did not include content that could be tallied for indigenous knowledge within the scope of this portion of the study.

Table 15.

Average Number of Indigenous Knowledge Representations per Chapter by Unit/Topic Area for Set 3 – Student Editions

Unit/ Topic	Biggs 3-1	Johnson 3-2	Pignatiello 3-3	Johnson 3-4	Cairney 3-5	Bybee 3-6	Miller 3-7	Strauss 3-8	Leonard 3-9	Oram 3-10	Miller 3-11
Introduction	0.00	0.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.50
Cells	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.00
Genetics	0.00	0.00	0.00	0.00	0.00	0.33	0.25	0.25	1.00	0.00	0.00
Evolution	0.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00
Microbial World	0.00	0.00	0.00	0.00	0.50	0.00	0.33	0.00	0.00	0.50	0.00
Plants	0.25	1.00	0.00	1.33	0.33	0.00	0.00	0.50	0.00	0.67	0.00
Invertebrates	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.00	0.00	0.00
Vertebrates	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.40	0.17
Human Biology	0.00	0.00	0.00	0.00	0.00	1.50	0.00	0.00	0.00	0.33	0.00
Ecology	0.00	0.00	0.00	0.00	0.20	0.00	0.50	0.25	0.25	0.75	0.00

Table 16.

Average Number of Indigenous Knowledge Representations per Chapter by Unit/Topic Area for Set 3 – Teacher Editions

Unit/ Topic	Biggs 3-1	Johnson 3-2	Pignatiello 3-3	Johnson 3-4	Cairney 3-5	Bybee* 3-6	Miller 3-7	Strauss 3-8	Leonard* 3-9	Oram 3-10	Miller 3-11
Introduction	0.00	2.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.50
Cells	0.20	0.60	0.00	0.00	0.00	0.00	0.00	0.33	0.00	0.75	0.25
Genetics	0.00	0.25	0.00	0.00	0.00	0.00	0.75	0.75	0.00	0.20	0.00
Evolution	0.67	0.50	0.00	0.00	0.00	0.00	0.33	0.25	0.00	2.00	0.00
Microbial World	0.00	0.75	0.00	0.50	0.50	0.00	1.00	0.00	0.00	0.50	0.75
Plants	1.00	2.00	0.00	2.00	0.33	0.00	0.25	1.25	0.00	1.33	0.33
Invertebrates	0.20	0.50	0.00	0.00	0.00	0.00	0.00	0.50	0.00	0.00	0.00
Vertebrates	0.25	0.50	0.00	1.00	0.00	0.00	0.20	0.75	0.00	0.60	0.50
Human Biology	0.33	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.44	0.10
Ecology	0.20	0.25	0.00	0.33	0.60	0.00	1.00	1.25	0.00	2.00	0.33

*exists as a separate edition and, therefore, does not represent an annotated version of student edition

Among the student editions, Oram 3-10 had the highest average of indigenous knowledge representation across the 10 unit topics; this student edition included indigenous content within seven of the 10 unit. Strauss 3-9 had indigenous content in four of the 10 units with the highest frequency in the unit *plants* and one-fourth the frequency in *genetics*, *invertebrates*, and *ecology*. The single unit with the highest average among the student editions was found in *human biology* in Bybee 3-6; the second highest average for a single unit occurred in *plants* in Johnson 3-4. The single unit with the lowest average of representation among the student editions occurred in *vertebrates* in Miller 3-11.

Frequency of indigenous representations increased noticeably for the teacher editions compared to the student editions in Set 3. For the teacher editions, Johnson 3-2 included indigenous content in each of the 10 units; Strauss 3-8 and Oram 3-10 included indigenous content in eight of the 10 units; Biggs 3-1 and Miller 3-11 included indigenous content in seven of the 10 units; Miller 3-7 included indigenous content in six of the 10 units.

For Johnson 3-2 teacher edition, indigenous knowledge content was most frequent in *introduction* and *plants*, slightly more than one-third as frequent in *microbial world*, slightly less than one-third in *cells*, one-fourth as frequent in *evolution*, *invertebrates*, and *vertebrates*, one-eighth as frequent in *genetics* and *ecology*, and one-fifteenth as frequent in *human biology*. The average for *plants* doubled in the teacher edition compared to the student edition. For the remaining nine units, the student edition had no average of indigenous content compared to the teacher edition; the average for these nine units in the teacher edition ranged from 0.13 to 2.00.

In Strauss 3-8 teacher edition, indigenous knowledge was most frequent in *plants* and *ecology*, four-fifths as frequent in *introduction*, half as frequent in *genetics* and *vertebrates,* two-fifths as frequent in *invertebrates*, slightly more than one-fourth as frequent in *cells*, and one-fifth ad frequent in *evolution*. Compared to its student edition counterpart, Strauss 3-8 teacher edition increased in average among all of the units. Averages in *introduction*, *cells*, *evolution*, and *vertebrates* went from no representation in the student edition to 1.00, 0.33, 0.25, and 0.75 respectively, in the teacher edition. The average for *ecology* increased five times in the teacher edition compared to the student edition. Averages for *genetics* tripled and doubled for *invertebrates*; the average for *plants* increased by two-fifths in the teacher edition.

For Oram 3-10 teacher edition, the highest average of indigenous representations occurred in *evolution* and *ecology*. The average of representations in the Oram 3-10 teacher edition increased in all of the units compared to the student edition with the exception of the unit *microbial world*, which remained the same for student and teacher edition. *Genetics* went from no representation in the student edition to 0.20 in the teacher edition. The average of *cells* tripled in the teacher edition. *Ecology* increased more than two and a half times in average and *evolution* and *plants* doubled in average in the teacher edition compared to the student edition for Oram 3-10. The average for *vertebrates* increased one-fifth and one-tenth for *human biology* compare to the student edition.

For Biggs 3-1, indigenous knowledge was most frequent in *plants*, two-thirds as frequent in *evolution,* one-third as frequent *human biology*, one-fourth as frequent in *vertebrates*, and one-fifth as frequent *cells*, *invertebrates*, and *ecology*. Compared to its student edition counterpart, Biggs 3-1 teacher edition increased in average among all of the units that contained indigenous content with the exception of *evolution* and *vertebrates*, which remained the same for student and teacher edition. Averages in *cells*, *invertebrates*, *human biology*, and *ecology* went from no representation in the student edition to 0.20, 0.20, 0.33 and 0.20, respectively, in the teacher edition. Biggs 3-1 teacher edition had four times the frequency of content in *plants* compared to its student counterpart.

For Miller 3-11 teacher edition, indigenous knowledge was most frequent *microbial world*, two-thirds as frequent in *introduction* and *vertebrates*, a little more than one-third as frequent in *plants* and *ecology*, one-third as frequent in *cells*, and a little more than one-tenth as frequent in *human biology*. Compared to its student edition counterpart, Miller 3-11 teacher edition increased in average among all of the units that contained indigenous content with the exception of *introduction*, which remained the same for student and teacher editions. Averages in *cells*, *microbial world*, *plants*, *human biology* and *ecology* went from no representation in the student edition to 0.25, 0.75, 0.33, 0.10 and 0.33 respectively, in the teacher edition. The average for *vertebrates* increased a little more than three times in the teacher edition compared to the student edition. Averages for *genetics* tripled and doubled for *invertebrates*; the average for *plants* increased by two-fifths in the teacher edition. Miller 3-11 also had the lowest frequency of indigenous knowledge among the teacher editions in one unit: *human biology*. Cairney 3-5 had the least amount of total indigenous content among the teacher editions.

Table 17.

Average Number of Indigenous Knowledge Representations per Chapter by Unit/Topic Area for Set 4 – Student Editions

Unit/ Topic	Parke 4-1	Biggs 4-2	Johnson 4-3	Miller 4-4	Postlethwait 4-5	Campbell 4-6
Introduction	0.00	0.00	0.00	0.50	0.00	0.00
Cells	0.00	0.00	0.00	0.00	0.00	0.00
Genetics	0.00	0.00	0.00	0.00	0.00	0.00
Evolution	0.00	0.00	0.00	0.00	0.00	0.00
Microbial World	0.00	0.00	0.00	0.00	0.00	0.00
Plants	0.00	0.50	1.25	0.75	0.00	0.00
Invertebrates	0.00	0.00	0.00	0.00	0.00	0.00
Vertebrates	0.00	0.50	0.00	0.00	0.00	0.00
Human Biology	0.00	0.17	0.00	0.00	0.00	0.00
Ecology	0.00	0.00	0.25	0.75	0.20	0.00

Table 18.

Average Number of Indigenous Knowledge Representations per Chapter by Unit/Topic Area for Set 4 –Teacher Editions

Unit/ Topic	Parke 4-1	Biggs 4-2	Johnson 4-3	Miller 4-4	Postlethwait 4-5	Campbell 4-6
Introduction	0.00	0.00	0.00	0.50	0.33	0.00
Cells	0.00	0.00	0.25	0.00	0.60	0.00
Genetics	0.00	0.00	0.20	0.00	0.00	0.00
Evolution	0.00	0.00	0.00	0.00	0.50	0.00
Microbial World	0.00	0.33	0.00	0.00	0.00	0.33
Plants	0.00	1.50	2.00	0.75	0.40	0.00
Invertebrates	0.00	0.20	0.40	0.00	0.14	0.00
Vertebrates	0.00	0.50	1.60	0.00	0.83	0.00
Human Biology	0.00	0.50	0.29	0.00	0.14	0.00
Ecology	0.00	0.25	0.25	0.75	0.40	0.00

Textbooks in Set 4

Tables 17 and 18 depict the averages of indigenous knowledge found in Set 4 for the student and teacher editions, respectively. Four of the six student editions included some form of indigenous knowledge content. Among these four texts, *introduction to biology*, *cells*, *plants*, *vertebrates*, *human biology*, and *ecology* were identified to include indigenous content. Five of the six teacher editions included indigenous content. Among these five texts, all 10 units were identified to include indigenous content. Averages for *ecology* were found in four of the five student editions found to have indigenous content; averages occurred for the unit *plants* in three of the five student editions found to include indigenous content. Averages for *ecology* were found all five of the teacher editions found to have indigenous content; frequencies occurred for the unit *plants* in four of the five teacher editions found to include indigenous content.

Among the student editions, Biggs 4-2 and Miller 4-4 had the most frequent indigenous knowledge representation across the 10 unit topics; both of these student editions included indigenous content within three of the 10 units. For Biggs 4-2, indigenous knowledge was most common in the unit *plants* and *vertebrates* and a little more than one-third as frequent in the unit *human biology*. For Miller 4-4, indigenous content was most frequent in *plants* and *ecology* and two-thirds as frequent in *introduction to biology*. Biggs 4-2 also had the single unit with the lowest average of representation among the student editions within *human biology*. The highest average per unit for student editions occurred in Johnson 4-3 in the unit *plants*.

Average of indigenous representations increased noticeably for the teacher editions compared to the student editions in Set 4. Postlethwait 4-5 included indigenous representations in eight of the 10 units. Indigenous knowledge was most frequent in *vertebrates*, two-thirds as frequent in *cells*, slightly more than half as frequent in *evolution*, half as frequent in *plants* and *ecology*, slightly more than one-third as frequent in *introduction*, and slight less than one-fifth as frequent in *invertebrates* and *human biology*. Compared to its student edition counterpart, Postlethwait 4-5 teacher edition increased in average among all of the units with indigenous content. Averages in *introduction*, *cells*, *evolution*, *plants*, *invertebrates*, *vertebrates*, and *human biology* went from no representation in the student edition to 0.33, 0.60, 0.50, 0.40, 0.14, 0.83, and 0.14 respectively, in the teacher edition. The average for *ecology* doubled for the teacher edition.

Johnson 4-3 included indigenous representations in seven of the 10 units. Indigenous knowledge was most frequent in *plants*, slightly more than three-fourths as frequent in *vertebrates*, one-fifth as frequent in *invertebrates*, slightly less than one-sixth as frequent in *human biology*, one-eighth as frequent in *cells* and *ecology*, and one-tenth as frequent in *genetics*. Compared to its student edition counterpart, Johnson 4-3 teacher edition increased in average among all of the units with indigenous content with the exception of *ecology*, which remained the same for the student and teacher editions. Averages in *cells*, *genetics, invertebrates*, *vertebrates*, and *human biology* went from no representation in the student edition to 0.25, 0.20, 0.40, 1.60, and 0.29, respectively, in the teacher edition. The average for *plants* increased by three-fifths for the teacher edition.

Biggs 4-2 included indigenous representations in six of the 10 units topics. Indigenous knowledge was most frequent in *plants*, one-third as frequent in *vertebrates* and *human biology*, slightly less than one-fifth as frequent in *microbial world*, one-sixth as frequent in *ecology*, and slightly more than one-eighth as frequent in *invertebrates*. Compared to its student edition counterpart, Biggs 4-2 teacher edition increased in average among all of the units with indigenous content with the exception of *vertebrates*, which remained the same for student and teacher editions. Averages in *microbial world*, *vertebrates*, and *ecology* went from no representation in the student edition to 0.33, 0.20, 0.25, respectively, in the teacher edition. The average for *plants* tripled for the teacher edition and increased slightly more than three times for *human biology*. Campbell 4-6 had the least amount of indigenous content among all the teacher editions for Set 4; the single unit with the lowest average of indigenous content, however, occurred within *invertebrates* and *human biology* in Postlethwait 4-5.

Kinds of Indigenous Representations

As the averages for indigenous knowledge representations were higher for the teacher editions, the content located in the teacher editions was used to examine the kinds of representations. The content was grouped into one of the following four categories: 1) technologies; 2) cultural practices/social life; 3) knowledge/views of the natural world; and 4) legends/myths. The only exception to this case fell within three of the books in the sample: Lumsden 2-8, Bybee 3-6 and Leonard 3-9. As these three textbooks had separate manuals for the teacher resources, the content from the student edition counterpart was used for the purpose of classifying indigenous content into one of the four types.

Although Ninnes (2000) acknowledged that these categories were not mutually exclusive, that is, an indigenous technology may have been included in a cultural practice, the investigator determined one kind of representation for each indigenous knowledge accounted for in the tally. The primary idea dictated the placement in a category of indigenous knowledge. The kinds of representations served to demonstrate the scope of indigenous knowledge included in the sample.

Representations in Set 1

Indigenous Technologies Set 1

The textbooks included in Set 1 illustrated a range of indigenous knowledge between two categories: technologies and cultural practices/social life. Indigenous technologies included examples of the cultivation of plants (Goodman 1-2: 434; Towle 1-4: 356), domestication of dogs (Milani 1-7: 896), plants and animals for food and clothing (McLaren 1-3: 355), lichens as an environmentally contaminated food source for Eskimos (Milani 1-7: 432), and pine nuts as a useful product of trees (McLaren 1-3: 355).

Indigenous Cultural Practices and Social life Set 1

Cultural and social life included the practices and rituals of a Navaho medicine man (Milani 1-7: 371), activities of the hunter-gatherers (Milani 1-7: 896), the common grounds of Indian farmers (Milani 1-7: 896), the effects of life at high altitudes for the Quechua Indians of the Andes (Goodman 1-2: 680), the frequency of blood allele A for Blackfoot Indians of North America (Alexander 1-5: 186) and the life of Lillie Rosa Parks, a Mohawk who became a physician and later worked on the Oneida Indian Reservation in Wisconsin (Oram 1-1: 523).

Indigenous Knowledge of the Natural World Set 1

Knowledge of the natural world included one reference to medicinal plants (Goodman, 1-2: 436); no examples that could be categorized as legends or myths were found in Set 1.

Representations in Set 2

Indigenous Technologies Set 2

The textbooks included in Set 2 illustrated a wide range of indigenous knowledge between two categories: technologies and cultural practices/social life. Indigenous technologies included the use of buffalo hides for food, shelter and other products (Essenfeld 2-1: 6, 829), the use of vegetation in the Plains to build thatch shelter (Essenfeld 2-1: 6), selective breeding of plants and animals (Essenfeld 2-1: 127, 189; Johnson 2-3: 430), cultivation of corn and potatoes (Essenfeld 2-1: 368, 405; Oram 2-5: 314), advanced system of agriculture (Essenfeld 2-1: 365; Johnson 2-3: 315), soaking of corn in solutions to create hominy (Oram 2-5: 60), use of latex to make rubber balls and waterproof shoes (Essenfeld 2-1: 365, Johnson 2-3: 440), maple syrup production (Essenfeld 2-1: 411), addition of sponge spicules to pottery to strengthen the clay (Essenfeld 2-1: 479), use of shells for money (Essenfeld 2-1: 479), use of toxins in frog glands for poison arrow darts (Essenfeld 2-1: 578, Miller 2-4: 201; Milani 2-7: 360), extraction of quinine to treat malaria (Kaskel 2-2: 425), control of biological pests with the neem tree and other methods (Johnson 2-3: 259; Oram 2-5: 441), derivations of medicines from plants (Johnson 2-3: 409), use of Kola nuts for chewing gum and medications (Johnson 2-3: 417), use of May apple to kill parasitic worms (Johnson 2-3: 438), use of peyote as an appetite suppressant (Johnson 2-3: 703), use of moss to treat burns and bruises (Miller 2-4: 461), preservation of fish through freeze-drying (Oram 2-5: 98), extraction of red dye from cactus (Oram 2-5: 796), use of reindeer for coats, shoes, food and other products (Oram 2-5: 807, 825; Milani 2-7: 327), and use of the scouring rush or horsetail plant as a pot scrubber (Towle 2-6: 373, Milani 2-7: 345).

Indigenous Cultural Practices and Social Life Set 2

Components of indigenous cultural activities and social life included the concept of a world view, that is, the interdependence and role of all life forms including humans (Essenfeld 2-1: 375, 875; Johnson 2-3: 9, Oram 2-5: 460), peyote as a part of religious ceremonies (Essenfeld 2-1: 407; Johnson 2-3: 703), role of snakes in religious ceremonies (Essenfeld 2-1: 598), use of mescaline in rites of passage (Essenfeld 2-1: 803), impact of smallpox and other diseases on native peoples after settlement by Europeans (Essenfeld 2-1: 786), use of bird feathers in rituals (Johnson 2-3: 586; Towle 2-6: 570), use of tobacco and alcohol in ceremonies for peace, war, harvest or rain (Johnson 2-3: 699, 706), stories from Ayer's Rock that connect the tribe and the animals key to everyday life (Miller 2-4: 5), corn as a sacred plant and part of rituals (Oram 2-5: 438), use of amaranth and the red dye extracted from its flowers in religious ceremonies (Oram 205: 440; Gottfried 2-8: 537), art and crafts that include bird symbols on pottery (Oram 2-5: 470); tradition of naming practices for infants (Oram 2-5: 502), rituals related to rite of passage of young girls into womanhood (Oram 2-5: 530), religious rituals to protect trees from commercial harvesting (Oram 2-5: 867), effects of life at high altitudes (Oram 2-5: 621), the life of Lillie Rosa Parks, a Mohawk who became a physician and later worked on the Oneida Indian Reservation in Wisconsin (Oram 2-5:568), salt as a part of prayer practices (Oram 2-5: 560), whale hunting as a community practice (Essenfeld 2-1, 628). In addition, students were given the opportunity to research Native American poetry and investigate indigenous groups on different continents and contrast and compare their cultures (Oram 2-5: 829).

Indigenous Knowledge of the Natural World Set 2

Knowledge of the natural world included experience of plant properties for medicinal purposes including the practice of chewing on willow bark to relieve pain (Essenfeld 2-1: 365, 377; Johnson 2-3: 11), use of the pulp of a poisonous plant to attract insect food sources (Essenfeld 2-1: 529), development of a calendar based on movement of celestial bodies (Johnson, 2-3: 438), system of classifying birds (Johnson 2-3: 325). In addition, Johnson 2-3 (438) showed a picture of a native doctor teaching a Western doctor about the medicinal properties of rainforest plants.

Legends and Myths Set 2

Legends and myths had the least amount of representations. Those included in this category related the legend of the Pitjendara tribe that told of Liru and Kunia, two snakes that fought a battle that created the face of Ayer's Rock. Other legends included how the owl got his large eyes and short neck (Oram 2-5: 210, 460), the Samoan legend of the creation of their island by an egg that broke in the water (Oram 2-5: 308), the Maori belief that a bird dropped an egg that contained all of the people and animals of New Zealand (Oram 2-5: 308), the Sioux legend of how the crow became black (Oram 2-5: 350), and the Papago myth of how butterflies were created (Oram 2-5: 460).

Representations in Set 3

Indigenous Technologies Set 3

Although indigenous content in Set 3 occurred in all 4 categories of representations, the widest range of indigenous knowledge existed between two categories: technologies and cultural practices/social life. The indigenous technologies included innovations such as animal domestication and agricultural practices (Biggs 3-1:

43; Strauss 3-8: 908; Miller 3-7: 197), use of snow and ice to build housing (Biggs 2-1: 43), use of drying, freeze-drying or salt to resist decay (Biggs 2-1: 226; Oram 3-10: 98), cultivation of corn and creation of corn products (Biggs 2-1: 631; Johnson 3-2: 590, 594, Johnson 3-4: 414), use of bean for food sources including the mixing of beans to create succotash (Biggs 2-1: 632), domestication of cacao seeds to make chocolate (Biggs 2-1: 671; Strauss 3-8: 488), application of frog toxins to make poison arrow darts (Biggs 2-1: 30; Strauss 3-8: 613; Miller 3-11: 701), solution for soaking willow bark to treat aches and pains (Johnson 3-2: 601), use of latex to make rubber balls and to waterproof shoes (John 3-2: 603; Johnson 3-4: 419), use of shells to make wampum currency (Johnson 3-2: 666; Johnson 3-4: 488), products and medicines from the need tree (Johnson 3-4: 1998), Kola nuts chewed as gum and used to make coal and medicines (Johnson 3-4: 404), hunting and gathering as an alternative to agriculture (Johnson 3-4: 235), experts on behavior of animals and environmental processes (Johnson 3-4: 235), use of reindeer for coats, shoes, food and other products (Cairney 3-5: 303; Oram 3-10: 746), use of the scouring rush or horsetail plant as a pot scrubber (Oram 3-5: 322), use of the roots of the yucca plant for soap and shampoo and the fibers for baskets, shoes, and mats (Bybee 3-6: E129), selective breeding of horses and other animals (Miller 3-7: 197; Strauss 3-8: 132), use of wood for shelter and hides for tepees (Strauss 3-8: 17), selective breeding and cultivation of potato (Strauss 3-8: 235: Oram 3-10: 314), use of pine nuts for trading and bartering (Strauss 3-8: 484), addition of sponge spicules to pottery to add strength to the clay (Strauss 3-8: 517), aquatic mammals as source of food and clothing (Strauss 3-8: 657; Oram 3-10: 210), practice of recycling broken pottery and grinding stones (Strauss 3-8: 922), use of the prickly pear cactus and the red dye extracted from the bodies of an insect that lived on the plant (Oram 3-10: 796). In addition, students were asked to think of ways that Native Americans use rocks as tools (Johnson 3-2: 303) and to investigate the uses of fern and fern fronds in medicine and construction of shelter (Miller 3-7: 565).

Indigenous Cultural Practices and Social Life Set 3

Aspects of cultural practices and social life included the role of corn in the culture of some tribes (Biggs 2-1: 631; Oram 3-10: 438; Miller 3-11: 527), role and importance of animals (Biggs 2-1: 695), religious rite in the transition from childhood to adulthood and other rites of passage (Biggs 2-1: 1054; Bybee 3-6: E153; Oram 3-10: 530), community sweat lodge for steam baths as part of spiritual cleansing (Johnson 3-2: 58), genetic defects such as albinism as special gifts of insight and connection with nature (Johnson 3-2: 123, 154), proverbs and world view relating to man's relationship with Earth (Johnson, 3-2: 226; Johnson 3-4: 9), use of feathers in ceremonies and rituals (Johnson 3-2: 796), ceremonial use of tobacco (Johnson 3-2: 955), mention of a Cree Indian, Dr. Haines, and his work in ethnobotany (Johnson 3-2: 419), impact of hantavirus, smallpox and other diseases on isolated populations (Johnson 3-2: 457, 470; Johnson 3-4: 349; Miller 3-7: 502), intellectual property rights (Johnson 3-2: 578), bones and claws for jewelry (Johnson 3-4: 565), complex language patterns (Bybee 3-6: 255), resistance to assimilation (Miller 3-7: 197), adaptations to biotic and abiotic factors of various biomes (Miller 3-7: 341; Strauss 3-8: 863), diets with fatty meats but no heart disease (Strauss 3-8: 601), frequency of blood alleles in native populations (Strauss 3-8: 150), use of amaranth and the red dye extracted from its flowers in religious ceremonies (Oram 3-10: 440), arts and crafts that include bird symbols on pottery (Oram 3-10: 470); tradition of naming practices for infants (Oram 2-5: 502), rituals related to rite of passage of young girls into womanhood (Oram 2-5: 530), religious ritual to protect trees from commercial harvesting (Oram 2-5: 867), effects of life at high altitudes (Oram 3-10: 621), the life of Lillie Rosa Parks, a Mohawk who became a physician and later worked on the Oneida Indian Reservation in Wisconsin (Oram 2-5:568), salt as a part of prayer practices (Oram 2-5: 560), and stories from Ayer's Rock that connect the tribe and the animals key to everyday life (Miller 3-11: 5).

Indigenous Knowledge of the Natural World Set 3

Knowledge of the natural world for Set 3 included indigenous understanding of the medicinal value of plants as ethnobotany (Johnson 3-2: 16; Johnson 3-4: 419), classification system of birds (Johnson 3-2: 338; Johnson 3-4: 319), use of roots and other plants to relieve pain (Strauss 3-8: 407; Miller 3-11: 988), development of a calendar based on movement of celestial bodies (Oram 3-10: 33), In addition, Johnson 3-4 (418) showed a picture of a native doctor teaching a Western doctor about the medicinal properties of rainforest plants. Students were asked to investigate the process researchers used to meet with native peoples regarding the medicinal value of plants in the rainforests (Biggs 2-1: 589).

Legends and Myths Set 3

Examples of legends and myths for Set 3 appeared as the Hopi legend that told of the mockingbird's role in determining the different Indian tribes (Johnson 2-3: 594), the Cochiti legend of the beetle's carelessness in dropping the stars in the sky and causing the formation of the Milky Way (Johnson 3-2: 627), the legend of "bear medicine" where natives tell of stories of how bears have taught people how to use roots and herbs for medicines (Johnson 3-4: 13), traits of animals as an important part of folklore and legends such as how the owl got his big eyes and short neck (Oram 3-10: 40; Miller 3-11: 794), the Samoan legend of the creation of their island by an egg that broke in the water (Oram 3-10: 308), the Maori belief that a bird dropped an egg that contained all of the people and animals of New Zealand (Oram 3-10: 308), the Sioux legend of how the crow became black (Oram 3-10: 350), and the Papago myth of how butterflies were created (Oram 3-10: 460), the legend of the Pitjendara tribe that told of Liru and Kunia, two snakes that fought a battle that created the face of Ayer's Rock (Miller 3-11: 5), the Sioux legend that attempted to explain the origin of land (Miller 3-11: 342), a Native American myth that told of how the first people climbed into a tree (Miller 3-11: 494), a story of Little Deer that related Native American respect for animals (Miller 3-11: 749), and the Muskogee or Creek story of the spider who took the sun so that all things could live in the light (Miller 3-11: 1022).

Representations in Set 4

Indigenous Technologies Set 4

Although indigenous content in Set 4 occurred in all 4 categories of representations, the widest range of indigenous knowledge existed between two categories: technologies and cultural practices/social life. Examples of indigenous technologies included the use of snow and ice to build housing (Biggs 4-2: 47), use of May apple as a laxative and topical treatment for warts (Biggs 4-2: 572), agroforestry as an advanced agricultural practice (Biggs 4-2: 600), cultivation of corn (Biggs 4-2: 610; Johnson 4-3: 499, 518), practice of baking rhizomes for a starch source (Biggs 4-2: 572; Johnson 4-3: 510), domestication of cocao seeds to make chocolate (Biggs 4-2: 657), use of frog toxins to create poison arrow darts (Biggs 4-2: 812), use of the woody vine, curare, to secure poisons for darts (Johnson 4-3: 83), collection of latex from rubber trees (Johnson 4-3: 520), practice of spinning cotton into thread to be woven into cloth (Johnson 4-3: 522), use of wild parsnip as an insect repellent (Johnson 4-3: 558), practice of carving shells into wampum beads for money, (Johnson 4-3: 646), extraction of dyes from mollusks (Johnson 4-3: 646), practice of cutting oyster shells into thin layers for use as window panes (Johnson 4-3: 646), hunting and gathering as an alternative to agriculture (Johnson 4-3: 825; Miller 4-4: 140,141, 624; Postlethwait 5-4: 391, 889), experts on behavior of animals and environmental processes (Johnson 4-3: 825; Postlethwait 4-5: 359, 889), use of bows and spears for hunting (Miller 4-4: 140), domestication of wild plants to meet needs for food, shelter and medicine (Miller 4-4: 622), creation of herbal products (Miller 4-4: 647), use of wood and bark for clothing, floor mats, blankets, dishes, rope, canoes, totem poles, and structural beams (Postlethwait 4-5: 89), selective breeding of plants and animals (Postlethwait 4-5: 309), use of stone to make tools and weapons (Postlethwait 4-5: 878), extraction from bark of cinchona tree to treat malaria (Campbell 4-6: 384). In addition, students were asked to describe examples where available materials are used to meet needs, such as shelter and food, created by life in a particular biome.

Indigenous Cultural Practices and Social Life Set 4

Aspects of cultural and social life for Set 4 included use of hallucinogenic mushrooms in religious ceremonies (Biggs 4-2: 962), impact of life at high altitudes (Biggs 4-2: 976), rites of passage from childhood into adulthood (Biggs 4-2: 1014), symbolic place of corn within the culture of certain tribes (Biggs 4-2: 610; Johnson 3-4: 499), genetic defects such as albinism as special gifts of insight and connection with nature (Johnson 4-3: 174, 154; Postlethwait 4-5: 287), practice of digging for camas roots as an importance tribal activity (Johnson 4-3: 558), totem poles as symbols for family, clan or tribe (Johnson 4-3: 598; Postlethwait 4-5: 659), use of snake in cultural or religious settings (Johnson 4-3: 775; Postlethwait 4-5: 827), use of feathers in rituals and ceremonies (Johnson 4-3: 786; Postlethwait 4-5: 848), rituals and ceremonies required in a whale hunt (Johnson 4-3: 808), value of water in cultural traditions (Postlethwait 4-5: 40), Seminole relationship to the Everglades (Postlethwait 4-5: 125), proverbs and world view relating to man's relationship with Earth (Postlethwait 4-5: 287); use of peyote in ritual and religious rites (Postlethwait 4-5: 575), and use of frog and toad toxins as hallucinogenic drugs for religious rituals (Postlethwait 4-5: 806).

Indigenous Knowledge of the Natural World Set 4

The categories for knowledge of the natural world and legends and myths had the least amount of indigenous representations. Knowledge of the natural world included examples of the practice of ethnobotany in terms of how native cultures use plants including the use of natural herbal products (Biggs 4-2: 567, 836; Johnson 4-3: 517; Miller 4-4: 647), folk remedies made from bones, eyes and other parts of the tiger (Johnson 4-3: 813), practice by hunter-gatherers of learning plant cycles and medicinal value of plants (Miller 4-4: 141).

Legends and Myths Set 4

Legends and myths included North American native cultures' belief that the world was an island resting on the back of a great turtle (Johnson 4-3: 782), and the theme that Earth gave rise to life as a component of the legends of many native cultures (Postlethwait 4-5: 287).

Teacher Editions

General Format – Set 1

A separate annotated version of the teacher edition existed for all eight texts included in Set 1. A general review of the format, indicated in Table 19, revealed that none of the texts in Set 1 incorporated multicultural or diversity content into the overall program objectives or goals, and none of the authors or content reviews had expertise, schooling or background in multicultural or diversity issues. A review of the program objectives, philosophies and themes for each text revealed a variety of approaches and rationales for teaching and learning biology. Oram 1-1, McLaren 1-3, Alexander 1-5 and Schraer 1-8 emphasized mastery of critical biological concepts, principles and associated skills. Oram 1-1 gave a tangential address of diversity within its *People in Biology* segment by including the statement that "there are many contributors equally as important as those considered to be the classic examples" (p. 5T). Goodman 1-2 also emphasized mastery of concepts but framed the approach to learning from the realization of the impact of technology and other advances in science on the field of biology (p. T10). Towle 1-4 represented a complete curricular redesign from prior editions to provide teachers with "the most authoritative science content with a fresh and inviting voice" (p. T8) and addressed diversity from the following view:

> The diversity of high school biology classrooms makes it almost impossible to meet the needs of all teachers with a single textbook. Teachers vary widely in backgrounds, interests, and philosophies. In addition, local and state requirements often oblige teachers to follow a curriculum with which they are unfamiliar. (p. T30)

Table 19.

General Format of Teacher Editions – Set 1

Textbook Code	Reviewers' Background in Diversity	Reading and/or Writing	Pacing or Planning Guide	Multicultural Content in Program Goals	Student Needs	STS Content
Oram 1-1	No	Yes	Yes	No	No	No
Goodman 1-2	No	Yes	Yes	No	Yes	Yes
McLaren 1-3	No	Yes	No	No	Yes	No
Towle 1-4	No	No	Yes	No	Yes	Yes
Alexander 1-5	No	Yes	Yes	No	No	Yes
Milani 1-6	No	No	Yes	No	No	Yes
Milani 1-7	No	Yes	No	No	No	No
Schraer 1-8	No	No	Yes	No	Yes	Yes

Milani 1-6 and Milani 1-7 represented the Blue and Green version, respectively, of texts developed as a part of the BSCS series. Milani 1-6 emphasized a molecular approach based on biotechnology and included aspects of the "New Biology – a science of recombinant DNA, monoclonal antibodies, the human genome, bioenergetics, restriction enzymes, and other topics far removed from the biology courses of 20 years ago" (p. T3). Milani 1-7 took the opposite approach with a focus on the role of humans as a part of nature rather than separated from it.

Four of the texts in Set 1 (Goodman 1-2, McLaren 1-3, Towle 1-4, Schraer 1-8) focused on meeting student needs. Goodman 1-2, McLaren 1-3, and Towle 1-4 considered ability level of students along the lines of basic, average or standard, and advanced learners and provided ways to structure the curriculum to support these levels of learning. In addition, Towle 1-4 and Schraer 1-8 included background research and strategies associated with students who have special needs or physical, visual, hearing, speech, or other impairments to learning.

Science-technology-society (STS) content appeared in some format among five of the eight texts in Set 1. Goodman 1-2 placed STS content in the broader social context and used this premise as the means to organize the biology content of the text. As example, Goodman 1-2 chapter two framed the scientific method through the study of acid rain as an environmental issue; chapters 14, 29, and 40 utilized the content of genetics, plant biology and medical technology within the context of technology applications to the study of these three areas (p. T29). In addition, Goodman 1-2 included 11 *Biotech* topics to facilitate discussion of technological and societal issues in science. These topics included biostereometrics, the cell, gene therapy, ancient climates, AIDS, algal blooms, growing plants in space, thermal vents, endangered species, artificial body parts, and rain forests (p. xiii).

Towle 1-4 did not use the traditional categorization of science-technology-society content as STS. Rather, STS content appeared as topics included as 10, two-page inserts characterized as *Intra-Science* where students considered a scientific question or process from a variety of perspectives. Topics included Alaskan wildlife, desalination, killer bees, extra-terrestrial life, aquaculture, world hunger, agricultural pests, endangered species, the human heart, and air pollution (p. xi). Alexander 1-5 incorporated textboxes entitled *Discoveries* as a means to present STS content. *Discoveries* included 12 entries among the following topics : sharkskin and yacht racing, cell techniques, mass extinction, archaebacteria, plant carcinogens, discovery of Phylum Loricifer, fireflies, dinosaurs, bone grafts, laser surgery, influenza, and Alzheimer's disease. Milani 1-6 incorporated STS content with direct application to personal issues and societal problems in the broader context of biological content related to genetic engineering and population growth (p. T7). Schraer 1-8 included STS features as textboxes which addressed topics under two categories: *issues* and *technology*. *Issues* included 11 topics related to scanning tunnel microscopes, monoclonal antibodies, artificial joints, magnetic resonance imaging, nitrogen-fixing corn, endangered species, DNA fingerprinting, plant evolution, gene therapy, bioremediation, and biodegradable plastics. *Technology* included 11 topics related to acid rain, food irradiation, passive smoking, noise pollution, vanishing habitats, surrogate mothers, genetic screening, endangered species, animal experimentation, greenhouse effect, and nuclear wastes (p. xv).

General Format – Set 2

Eight of the nine teacher editions included in Set 2 existed as annotated versions of the student editions. As previously noted, the teacher manual Lumsden 2-8 represented a separate manual which included a collection of chapter objectives and overviews, lecture outlines, answers to the end-of-chapter *Thought Questions* found in the student edition, reproducible chapter exams with answer keys, and transparencies for lectures and class handouts. As such, Lumsden 2-8 included no comprehensive program goals or other content organized in such a manner appropriate for the scope of the teacher's edition section of the study.

A general review of the format of the texts, indicated in Table 20, revealed that Essenfeld 2-1, Johnson 2-3, Oram 2-5 incorporated multicultural or diversity content into the overall program objectives or goals, and at least one of the content reviewers for these three texts had expertise, schooling or background outside of science or science education including but not limited to multicultural or diversity issues.

Essenfeld 2-1 listed the "integration of multicultural perspectives and contributions to sciences" (p. T5) as one of its program goals and framework for organizing content. Johnson 2-3 dedicated a section of the teacher interleafs to support the cultural diversity found in science. This section included background for the teacher regarding links to cultural content via teacher annotations related to cultural perspectives, special features referred to as *Discoveries in Science* that showcase role models in science, *Science in Action* as a means to profile individuals who have overcome cultural challenges, and optional multicultural lessons plans to encourage study of diversity in science (p. 31T).

Table 20.

General Format of Teacher Editions – Set 2

Textbook Code	Reviewer's Background in Diversity	Reading and/or Writing	Pacing or Planning Guide	Multicultural Content in Program Goals	Student Needs	STS Content
Essenfeld 2-1	Yes	Yes	Yes	Yes	Yes	Yes
Kaskel 2-2	No	Yes	Yes	No	Yes	Yes
Johnson 2-3	Yes	Yes	No	Yes	Yes	Yes
Miller 2-4	No	Yes	No	No	Yes	Yes
Oram 2-5	Yes	Yes	Yes	Yes	Yes	Yes
Towle 2-6	No	Yes	Yes	No	Yes	Yes
Milani 2-7	No	Yes	Yes	No	No	No
Schraer 2-9	No	No	Yes	No	Yes	Yes

Oram 2-5 included a teacher interleaf on multicultural awareness which highlighted goals of multicultural education including the “strength and value of cultural diversity” as well as “social justice and equal opportunity for all people” (p. 24T).

The program goals for Kaskel 2-2 included emphasis on the presentation of introductory level content in a format that was easy for the student to read; multicultural or diversity content was not incorporated into the program goals and objectives. Miller 2-4 focused on the significance of developments in science today and in the future as the overarching program goals and included the importance of critical thinking and concept development framed from the evolutionary relationships among organisms (p. T6). Towle 2-6 framed the program objectives with emphasis on “thorough coverage to teach thematically…thorough coverage for developing scientific literacy…thorough coverage for developing process and inquiry skills” (pp. T16 – T 20). The thorough coverage did not include incorporation of program goals related to multicultural or diversity content. Milani 2-7 presented biological concepts and principles through the notion of experimentation with the intent of acknowledging the practical nature of biology as a topic of study and its relevance in everyday life. Schraer 2-9 emphasized the mastery of biological concepts and principles as the key program goal. Neither Milani 2-7 nor Schraer 2-9 incorporated multicultural content into program goals or objectives.

Science-technology-society (STS) content appeared in some format among all eight of the texts in Set 1. Essenfeld 2-1 incorporated STS content via one-page inserts that appeared 11 times in the text and addressed the “interdependence of scientific progress and the needs of society” (p. T8). Topics included artificial polymers, nature versus nurture, gel electrophoresis, proteins, Cro-Magnon culture, medicine versus malaria, seed banks, plant fibers, breeding fish, artificial intelligence, and species of the Nile (p. xiii). Kaskel 2-2 included STS content as an introduction to controversial issues in science; each unit contained a one-page insert with topics which covered the benefits of technology, ancient forests, animal experimentation, steroids, farms of the future, sperm banks, organ transplants, and genetic engineering. Johnson 2-3 included six, two-page sections of text dedicated STS topics included as legal issues with tissue testing, genetic screening, deforestation, testing for HIV, endangered species, and transplant technology (p. 13T). Miller 2-4 included 13, one-page inserts with emphasis on STS content in the following areas: yellow fever, tissue testing, diversity issues, taxonomy, classification systems, plants and animals, agricultural pests, dinosaurs, women in society, anabolic steroids, world hunger, drug use, and endangered species (p. xvi). Oram 2-5 included STS content as biology-technology-society (BTS) divided into 21 topics categorized as *Issues* and 19 topics included as *Biotechnology*. Topics within *Issues* encompassed rare animals as pets, skin cancer, inbreeding, genetic profiling, dying with dignity, genetic engineering, biodiversity, interbreeding, man versus nature, deforestation, animal testing, in vitro fertilization, liquid diets, asbestos, organ transplants, steroids, Alzheimer’s disease, persons with disabilities, old versus young, agriculture, and forest fires (p. xix). *Biotechnology* included the brain at work, cold storage, artificial skin, product testing, aging, transgenic organisms, DNA fingerprinting, in utero treatments for genetic disorders, fossil dating, tools for classification, plants as energy trappers, cloning humans, image technology, treatment for respiratory distress, insulin use, noise pollution, fetal surgery, antigens, and bionics (p. xxiv).

Towle 2-6 did not use the traditional categorization of science-technology-society content as STS. Rather, STS content appeared as topics included as 10, one-page inserts characterized as *Intra-Science* where students considered the collaborative efforts scientists used to solve a specific problem. Topics included vanishing forests, forms of medicines, human genome, extra-terrestrial life, agricultural pests, curing AIDS, world hunger, endangered species, organ transplants, and global warming (p. T15). Milani 2-7 included STS content as the context for presenting biological concepts and principles, so no separate textboxes or inserts were included to address STS. Schraer 2-9 included STS features as textboxes addressed topics under two categories: *issues* and *technology*. *Issues* included 11 topics related to scanning tunnel microscopes, monoclonal antibodies, artificial joints, magnetic resonance imaging, nitrogen-fixing corn, endangered species, DNA fingerprinting, plant evolution, gene therapy, bioremediation, and biodegradable plastics. *Technology* included 11 topics related to acid rain, food irradiation, smoking, noise pollution, vanishing habitats, surrogate mothers, genetic screening, endangered species, animal experimentation, greenhouse effect, and nuclear wastes (p. xv).

General Format – Set 3

Nine of the 11 teacher editions included in Set 3 existed as annotated versions of the student's edition. As previously noted, Bybee 3-6 and Leonard 3-9 had separate texts for the teacher resource and, as such, the teacher manuals did not include program goals or other content organized in such a manner appropriate for the scope for this section of the study. As depicted in Table 21, a review of the format of the nine texts revealed that Biggs 3-1, Pignatiello 3-3, Miller 3-7, Strauss 3-8, and Oram 3-10 incorporated multicultural or diversity content into the overall program objectives or goals.

Table 21.

General Format of Teacher Editions – Set 3

Textbook Code	Reviewers' Background in Diversity	Reading Writing	Pacing or Planning Guide	Multicultural Support General Format	Student Needs	STS Content
Biggs 3-1	No	No	Yes	Yes	Yes	Yes
Johnson 3-2	Yes	Yes	Yes	No	No	Yes
Pignatiello 3-3	Yes	Yes	Yes	Yes	Yes	No
Johnson 3-4	Yes	Yes	Yes	No	No	Yes
Cairney 3-5	No	Yes	Yes	No	No	Yes
Miller 3-7	No	Yes	No	Yes	No	Yes
Strauss 3-8	No	No	Yes	Yes	Yes	Yes
Oram 3-10	Yes	No	Yes	Yes	Yes	Yes
Miller 3-11	No	No	No	No	Yes	Yes

Of the five, Pignatiello 3-3 and Oram 3-10 were the only texts to have at least one content reviewer with expertise, schooling or background outside of science or science education including but not limited to areas of study or work that involved multicultural or diversity issues. Although Johnson 3-2 and 3-4 did not include multicultural content as a component of the overarching program goals, these two texts did have content reviewers with expertise or experience in diversity and multicultural issues.

As part of the text's program objectives, Biggs 3-1 contained a one-page interleaf devoted to cultural diversity with emphasis on cultural heritage and ethnicity found among society today. Specifically related to the content of the text, any multicultural content was incorporated into program goals through biographical sketches, which featured successful scientists from a variety of ethnic backgrounds and the use of interdisciplinary curricular connections in art and literature (p. 28T). The program goals for Pignatiello 3-3 served to build "biological literacy among students from varied cultural and linguistic backgrounds" with the additional note that these "students are often otherwise isolated in the biology classroom because the textbook and materials used in their classrooms are inaccessible to them" (p. T3). Miller 3-7 included instructional pathways as part of its program objectives to assist teachers in meeting diverse needs of students, and multicultural content, although not a central feature, remained one of the six core areas for these goals. Strauss 3-8 listed the support of "heterogeneous student populations and diverse teaching styles" (p. T11) as one of the program goals. Oram 3-11 included a teacher interleaf on cultural diversity, which highlighted goals of multicultural education incorporated in the text including the "strength and value of cultural diversity" as well as "social justice and equal opportunity for all people" (p. 24T).

Johnson 3-2 incorporated the focus on revolutions in cell biology as the primary focus for the program goals with the incorporation of technology to support interactive explorations via the use of a CD-ROM package (p. 19T). Johnson 3-4 emphasized depth rather than breadth of coverage with a focus on essential fundamental science concepts (p. T20). Concerned more with science as a search rather than as dogma, the primary program objective of Cairney 3-5 intended to "lead each student to conceive of biology as science, and of the process[es] of science as reliable method[s] of gaining objective knowledge (p. T3). Miller 3-11 focused on the significance of developments in science today and in the future as the overarching program goals and included the importance of critical thinking and concept development framed from the evolutionary relationships among organisms (p. T6).

All of the texts in Set 3 included in the analysis contained some form of STS content with the exception of Pignatiello 3-3. Biggs 3-1 incorporated eight topics under *Biology & Society* to support STS content; these topics included saving the Everglades, impact of extinctions, bioengineered foods, forest fires, over population of species, impact of zoological parks, aesthetic values of species, and megavitamins. Johnson 3-2 included five STS articles covering topics in biological diversity, human genome, biological weapons, biotechnology, and breast cancer (p. 15T). Johnson 3-4 included six articles, which explored conflicts between technology and society with emphasis on DNA profiling, genetic engineering, ozone layer, new drug development, diversity of species, and the financial impact of aging (p. T17). Cairney 3-5 included STS content as the context for presenting biological concepts and principles, so no separate textboxes, inserts or articles were included to address STS topics.

Miller 3-7 incorporated STS content among topics designed to feature important issues in biology as well as new discoveries in the field. Nine, one-page inserts found under the heading of *Biology and You* addressed topics in patents, wetlands, viral evolution, famine, aquaculture, birds, wildlife, iodine deficiency, and AIDS (p. xxiv). Strauss 3-8 included STS content in the teacher annotations. STS content was identified in three main areas of *Environmental Awareness*, *Issues in Biology*, and *Frontiers in Biology*. Fourteen environmental topics covered the food web, acid rain, seed banks, the English pepper moth, classification systems, agriculture, greenhouse gases, computer technology, agricultural pests, mollusks, coral reefs, amphibians, alternative fuel cars, and biodiversity. *Issues in Biology* included 12 topics, which stemmed from considerations of science and society, genetics of behavior, human genome, ethics, mass extinctions, fossil records, classification systems, effects of smoking, steroids, fetal alcohol syndrome, wetlands, and biodiversity. *Frontiers in Biology* included 19 topics in the areas of eyesight, artificial chloroplasts, cell division, genetic counseling, healthy eating, genetic engineering, beneficial bacteria, malaria, fungi, sponges and jellyfish, alternatives to pesticides, poisons, mammals, insects, artificial skin, dialysis, immune systems, prenatal care, and technology (p. xix). Oram 3-11 included STS content as biology-technology-society (BTS) divided into 21 topics categorized as *Issues* and 19 topics included as *Biotechnology*. Topics within *Issues* encompassed rare animals as pets, skin cancer, inbreeding, genetic profiling, dying with dignity, genetic engineering, biodiversity, interbreeding, man versus nature, deforestation, animal testing, in vitro fertilization, liquid diets, asbestos, organ transplants, steroids, Alzheimer’s disease, persons with disabilities, old versus young, agriculture, and forest fires (p. xix).

Biotechnology included the brain at work, cold storage, artificial skin, product testing, aging, transgenic organisms, DNA fingerprinting, in utero treatments for genetic disorders, fossil dating, tools for classification, plants as energy trappers, cloning humans, image technology, treatment for respiratory distress, insulin use, noise pollution, fetal surgery, antigens, and bionics and artificial limbs (p. xxiv). Miller 3-11 included 21, one-page inserts with emphasis on STS content in the following areas: new breed of cat, chromosome numbers, DNA, Carbon-14 dating, copper mining, algae, agriculture, microorganisms, flowers, cloning plants, leeches, cephalopods, paleontologists, imaging technology, carbon monoxide, organ transplant, spread of disease, penicillin, Lyme disease, gypsy moths, and ecosystems.

General Format – Set 4

A separate annotated version of the teacher's edition existed for all six texts included in Set 4. A general review of the format, indicated in Table 22, revealed that none of the texts in Set 4 incorporated multicultural or diversity content into the overall program objectives or goals, and none of the texts included authors or content reviews with expertise, schooling or background in multicultural or diversity issues. A review of the program objectives, philosophies and themes for each text revealed a variety of approaches and rationales for teaching and learning biology with a heavy emphasis on standardized testing, specifically the Florida Comprehensive Achievement Test (FCAT). All of the texts in Set 4 included pacing guides and supported STS content.

Table 22.

General Format of Teacher Editions – Set 4

Textbook Code	Background in Other Fields	Standardized Testing/ FCAT	Reading and/or Writing	Pacing or Planning Guide	Multicultural Support	Student Needs	STS Content
Parke 4-1	No	No	Yes	Yes	No	Yes	Yes
Biggs 4-2	No	Yes	Yes	Yes	No	Yes	Yes
Johnson 4-3	No	Yes	Yes	Yes	No	Yes	Yes
Miller 4-4	No	Yes	Yes	Yes	No	Yes	Yes
Postlethwait 4-5	No	Yes	Yes	Yes	No	Yes	Yes
Campbell 4-6	No	Yes	Yes	Yes	No	No	Yes

Program objectives for Parke 4-1 targeted students who performed below grade level and stressed practical concepts and skills in biology. A major component of the program goals for Biggs 4-2, Johnson 4-3, and Campbell 4-6 included features to help teachers prepare students for the science FCAT administration with correlation to Sunshine State Standards (SSS). Miller 4-4 emphasized the development of 21st century skills along with the integration of the Sunshine State Standards (SSS) into the course content. Although Postlethwait 4-5 included a detailed correlation to the SSS, the focus remained on student preparation of standardized testing in general. Program goals for the text targeted student comprehension of biological concepts and terminologies supported by current and accurate textual content (p. T2).

Parke 4-1 incorporated STS content as a means to help students make connections among issues in science and technology. These *Technology and Society* segments appeared as textboxes included 20 times and occurred at least once in each chapter with topics that covered genetic disorders, radon, hydrogenation of food, saline usage, microscopes, high-tech medications, enzymes, hormones, gene chips, hemophilia, human genome, LASIK, skin cancer, DNA, organisms in seawater, classification systems, communication technologies, genetic engineering, aquaculture, and surgical robots. Biggs 4-2 focused on the impact of biology on society with STS content labeled as *Biology & Society* and *Biotechnology*. Topics in *Biology & Society* covered 14 areas: organic foods, Everglades, origin of life, superbugs that defy drugs, ecosystem balance, coral reef destruction, gypsy moths, illegal wildlife trade, modern zoological parks, weight loss, transplant donors, and the debate over smallpox. *Biotechnology* content covered 10 topics in good and bad cholesterol, scanning probe microscopes, new vaccines, molecular clocks, diversity of diatoms, hybrid plants, mouse cells, sea turtles, imaging technologies, and human growth hormone. Johnson 4-3 incorporated STS content within textbox segments known as *BioWatch*. *BioWatch* appeared as 13 segments with topics on foods as fuel, muscle fatigue, prenatal testing, making of an egg, malaria vaccine, leeches, amniotic egg, obesity and health, asthma, spinal cord injury, anabolic steroids, hormones and body fat, and ultrasound imaging. Miller 4-4 included STS content as *Technology & Society* with seven, one-page inserts dedicated to topics in ecological exploration from space, stem cell research, species diversity, technological designs, sunscreen and skin cancer, remote sensing, and artificial skin. Postlethwait 4-5 added 12, one-page articles on STS topics that included topics on the information age, preventing diabetes, mitochondria, stem cell research, DNA repair, genetic engineering, ecosystem restoration, marine viruses, leeches, migration patterns, computer imaging, and puberty in girls. Campbell 4-6 embedded STS content as textboxes, which covered 20 topics in scientific collaboration, fluoridation, aerobic performance, greenhouse gases, genetically modified foods, environmental effects on phenotypes, dinosaur evolution, kelp forests, giant fungi, rainforest conservation, bioremediation, genetic engineering, coral reefs, pesticides, animal behavior, organ donors, thermoregulation, fetal surgery, Alaskan wilderness, and genetically modified salmon.

Multicultural Components of the Teacher Editions

Twenty-six multicultural descriptors, listed in Table 23, were identified from the social science terms and other search words available in *The Contemporary Thesaurus of Social Science Terms and Synonyms* (1993) and *The Contemporary Thesaurus of Search Terms and Synonyms: A Guide for Natural Language Computer Searching* (2000).

Table 23.

List of Multicultural Descriptors

Descriptor
Bilingual
Cross-cultural
Cultural
Cultural activities
Cultural awareness
Cultural differences
Cultural education
Cultural enrichment
Cultural heritage
Cultural pluralism
Culturally relevant education
Culture
Diverse needs
Diversity
English (Second Language)
Ethnic groups
Ethnicity
Global education
Interdisciplinary
Limited English Speaking
Minority
Minority groups
Multicultural
Multiculturalism
Multicultural education
Social studies

As previously stated, the descriptors were used to identify multicultural components within the teacher editions. Of the 26 descriptors, 12 were found within the collective sample of teacher editions. Fourteen of the 34 teacher editions contained none of the descriptors used in the study: Oram 1-1, Towle 1-4, Alexander 1-5, Milani 1-6, Milani 1-7, Schraer 1-8, Milani 2-7, Lumsden 2-8, Schraer 2-9, Pignatiello 3-3, Cairney 3-5, Bybee 3-6, Leonard 3-9, and Campbell 4-6. Of the remaining 20 texts, 1,448 descriptors were identified with as few as one descriptor identified per text to as many as 141 per text. *Multicultural* remained the most commonly used descriptor; *English Second Language* was the second most commonly used descriptor. Tables 24 and 25 depict a summary of the descriptors by set for the complete sample. The degree of relationship of the multicultural content to the stated science objectives was also determined. Table 26 shows number of multicultural components and their relationship to science content by set.

Set1 and Set 2

Limited multicultural content was found among the teacher's editions included in Set 1; only two texts contained multicultural components as defined within this study. The highest average of multicultural content, depicted in Table 27, occurred in *human biology* for Goodman 1-2; the only average for multicultural content for McLaren 1-3 occurred in *ecology*. In addition, the relationship of the multicultural content recorded for Set 1 and depicted in Table 28 indicated that of the eight descriptors used to locate multicultural content, half were categorized as *somewhat related* to the stated science objects and the other half were *not related* to the stated science objectives.

Table 24.

Summary of Multicultural Descriptors by Teacher Edition – Sets 1 and 2

Book Code	Number of Components	Descriptor	Number per Descriptor
Set 1			
Goodman 1-2	7	Social Studies	7
McLaren 1-3	1	Cultural	1
Set 2			
Essenfeld 2-1	119	Culture	1
		English Second Language	38
		Multicultural	60
		Multiculturalism	8
		Social Studies	12
Kaskel 2-2	4	Social Studies	4
Johnson 2-3	109	Cultural	46
		Limited English Speaking	31
		Multicultural	9
		Social Studies	23
Miller 2-4	2	Social Studies	2
Oram 2-5	141	Global Education	11
		Limited English Speaking	75
		Multicultural	54
		Social Studies	1
Towle 2-6	133	Interdisciplinary	58
		Limited English Speaking	61
		Social Studies	14

Table 25.

Summary of Multicultural Descriptors by Teacher Edition – Sets 3 and 4

Book Code	Number of Components	Descriptor	Number per Descriptor
Set 3			
Biggs 3-1	72	Cross-cultural	2
		Cultural	43
		English Second Language	27
Johnson 3-2	43	Multicultural	43
Johnson 3-4	29	Multicultural	29
Miller 3-7	71	Diversity	69
		Social Studies	2
Strauss 3-8	123	Diverse Needs	61
		Multicultural	62
Oram 3-10	141	Global Education	11
		Limited English Speaking	75
		Cultural	54
		Social Studies	1
Miller 3-11	121	English Second Language	61
		Multicultural	59
		Social Studies	1
Set 4			
Parke 4-1	100	Culture	1
		English Second Language	89
		Global Education	9
		Social Studies	1
Biggs 4-2	58	Cultural	38
		English Second Language	20
Johnson 4-3	47	Cultural	43
		English Second Language	1
		Social Studies	3
Miller 4-4	75	English Second Language	75
Postlethwait 4-5	52	Cultural	45
		Social Studies	7

Table 26.

Number of Multicultural Components by Relationship to Science Objectives by Set

Category Code	Relationship to Objectives	Number	Percent
Set 1			
1	Highly related	0	0.0
2	Somewhat related	4	50.0
3	Not related	4	50.0
Set 2			
1	Highly related	51	10.0
2	Somewhat related	265	52.2
3	Not related	192	37.8
Set 3			
1	Highly related	32	5.3
2	Somewhat related	285	47.4
3	Not related	283	47.3
Set 4			
1	Highly related	75	22.6
2	Somewhat related	134	40.4
3	Not related	123	37.0
	Total	1,448	

Table 27.

Average Number of Multicultural Components per Chapter by Unit – Teacher Editions – Sets 1 and 2

	Intro	Cells	Gen	Evol	Micro	Plants	Inverts	Verts	Human	Ecol
Set 1										
Goodman 1-2	0.00	0.25	0.20	0.00	0.00	0.16	0.00	0.00	0.36	0.00
McLaren 1-3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20
Set 2										
Essenfeld 2-1	2.75	2.00	2.60	1.50	2.75	3.00	2.40	1.83	2.88	2.75
Kaskel 2-2	1.00	0.00	0.50	0.50	0.00	0.00	0.00	0.00	0.00	0.00
Johnson 2-3	3.50	1.00	1.33	2.67	3.25	5.00	4.00	2.00	4.63	3.33
Miller 2-4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.17	0.00	0.33
Oram 2-5	4.00	5.50	4.40	7.00	4.00	1.63	1.20	2.60	2.67	2.75
Towle 2-6	3.00	2.40	2.25	2.00	2.20	3.20	2.00	2.17	3.29	2.60

Table 28.

Number of Multicultural Components by Relationship to Science Objectives –Sets 1 and 2

Book Code	Relationship to Science Objectives Highly	Somewhat	Not Related
Set 1			
Goodman 1-2	0	3	4
McLaren 1-3	0	1	0
Total	0	4	4
Set 2			
Essenfeld 1-2	3	69	47
Kaskel 2-2	0	4	0
Johnson 2-3	14	41	54
Miller 2-4	0	1	1
Oram 2-5	16	77	48
Towle 2-6	18	73	42
Total	51	265	192

None of the multicultural content for the texts in Set 1 was found to be *highly related* to the stated science objectives.

Set 2 showed a marked increase compared to Set 1 in the average of multicultural content found within the texts. As shown in Table 27, six of the eight teacher editions contained some average of multicultural content. Kaskel 2-2 and Miller 2-4 had the lowest average of content among the units of *introduction to biology*, *genetics*, and *evolution* for Kaskel 2-2 and *vertebrates* and *ecology* for Miller 2-4. Oram 2-5 had the highest averages for the most number of units with *evolution* and *cells* at the highest total averages compared to the other texts. Table 28 indicated that of the total descriptors used to locate multicultural content, a little more than half were categorized as *somewhat related* to the stated science objects and a little more than one-third were *not related* to the stated science objectives.

Set 3 and Set 4

As depicted in Table 29, seven of the 11 teacher's editions in Set 3 were found to include multicultural content in all 10 of the units represented in each text. Oram 3-10 had the highest averages for the most number of units with *evolution* and *cells* at the highest total averages compared to the other texts. As depicted in Table 30, the relationship of the multicultural content recorded for Set 3 indicated that about half of the content was somewhat related to supporting the science objectives or intent for the chapter or section of text. The other half was divided not related to the science objectives or intent for the chapter of section of text.

Table 29.

Average Number of Multicultural Components per Chapter by Unit – Teacher Editions – Set 3

	Intro	Cells	Gen	Evol	Micro	Plants	Inverts	Verts	Human	Ecol
Set 3										
Biggs 3-1	2.00	1.20	1.20	1.67	2.00	3.00	1.00	1.25	1.83	2.00
Johnson 3-2	1.00	1.00	0.25	1.25	1.25	1.25	1.25	1.25	0.88	1.00
Johnson 3-4	0.50	0.33	0.25	0.33	1.50	1.00	0.50	1.00	0.86	0.67
Miller 3-7	2.00	0.67	3.75	2.33	1.33	2.00	0.75	1.60	1.29	2.75
Strauss 3-8	2.50	3.00	1.00	3.00	5.00	3.25	3.50	3.25	3.00	3.25
Oram 3-10	4.00	5.50	4.40	7.00	4.00	1.63	1.20	2.60	2.67	2.75
Miller 3-11	3.00	2.50	2.75	3.33	2.50	2.50	1.80	2.33	2.33	2.33

Table 30.

Number of Multicultural Components by Relationship to Science Objectives –Sets 3 and 4

Book Code	Relationship to Science Objectives: Highly	Somewhat	Not Related
Set 3			
Biggs 3-1	0	35	37
Johnson 3-2	0	5	38
Johnson 3-4	0	4	25
Miller 3-7	2	42	27
Strauss 3-8	10	57	56
Oram 3-10	16	77	48
Miller 3-11	4	65	52
Total	32	285	283
Set 4			
Parke 4-1	35	45	20
Biggs 4-2	8	27	23
Johnson 4-3	0	8	39
Miller 4-4	32	43	0
Postlethwait 4-5	0	11	41
Total	75	134	123

As depicted in Table 31, five of the six teacher's editions in Set 4 were found to include some type of multicultural content. Johnson 4-3 represented the only text in the set to not have content within each unit; no multicultural content was present in *introduction to biology*. Parke 4-1 had the highest averages for the most units compared to the other four texts in the set. As previously depicted in Table 30, the relationship of the multicultural content recorded for Set 4 indicated that 23% of the content was directly related to supporting the science objectives or intent for the chapter or section. The remaining content was divided almost equally between somewhat or not related to the science objectives or intent for the chapter of section of text.

Table 31.

Average Number of Multicultural Components per Chapter by Unit – Set 4

Book Code	Intro	Cells	Gen	Evol	Micro	Plants	Inverts	Verts	Human	Ecol
Parke 4-1	6.00	5.20	5.00	5.00	1.50	0.50	0.50	4.00	8.00	3.33
Biggs 4-2	2.00	1.75	1.25	1.00	1.67	2.25	1.20	1.50	1.83	0.75
Johnson 4-3	0.00	1.00	0.80	0.33	1.50	2.00	1.40	1.40	0.86	1.00
Miller 4-4	2.50	1.75	2.00	1.50	1.67	2.50	2.50	1.60	1.67	1.50
Postlethwait 4-5	1.00	1.00	0.80	0.50	0.75	1.00	1.00	1.67	1.00	1.20

Archaeology of Statements

The archaeology of statements, created in conjunction with the indigenous knowledge tally, represented an archive of the discrete sections of text determined by the representations of indigenous knowledge and collected as part of the indigenous knowledge tally. As the teacher editions, compared to the student editions, were determined to include higher frequencies of indigenous knowledge content in the sample, the archaeology was created from the indigenous knowledge representations tallied from content found in teacher editions. Indigenous knowledge content was incorporated from the student editions when no annotated teacher edition was available. Gottfried 2-8 student edition was used for the archaeology in Set 2, and Bybee 3-6 and Leonard 3-9 student editions were used for the archaeology in Set 3.

The archaeology of statements allowed the examination, framed from the prior work of Ninnes (2000, 2003), of the nature of representations from ideological and textual perspectives. Ideologically, examinations of the archived statements permitted detection of features that supported notions of traditionality and generalizations or homogenizing terminologies. Textually, examinations of the archived statements allowed identification of techniques such as spatial placement of text, use of verb tense, and incorporation of universalizing language that served to privilege one way of knowing over other ways of knowing.

Archaeology for Set 1

Six teacher editions for Set 1 contained a total of 20 statements, which provided a limited range of content for an in-depth examination of the ideological and textual features designed for this segment of the study. The examination of essentialist identities in these texts produced mixed results. The notion of traditionality, exemplified by such "phrases as 'traditional lifestyle' or traditional setting' or the use of the word *traditional* as an adjective to describe a particular indigenous group" (Ninnes, 2003, p. 173) did not appear in any of the texts included in Set 1. Reference to generic groups or what might be considered homogenization occurred 14 times among the archived statements. There remained generic reference to early hunters, early humans, and early peoples (Towle 1-4: 356; Milani 1-7: 371; 896) as well as four references to the collective Native Americans and American Indians (Towle 1-4: 372; Milani 1-7: 456). Reference to Indian farmers and Indian groups also occurred (Milan 1-7: 896; Oram 1-1: 680). Reference to specific indigenous groups, either by name or in connection with a geographical region, occurred 11 times in Set 1. Authors made reference to specific groups such as Dr. Monika-Hill as a Mohawk who worked on the Oneida Indian Reservation (Oram 1-1: 523), the Quechua Indians of the Andes (Goodman 1-2: 680), the Amazon Indians (Goodman 1-2: 827), the Incas of Peru (Goodman 1-2: 830), the Indians of the Southwest (McLaren 1-3: 355), a Navajo medicine man (Milani 7-1: 372), the Eskimos (Milani 7-1: 432), and the Blackfoot Indians (Alexander 1-5: 186).

Examination of textual features included various aspects of temporal contexts and spatial organizations. Two of the statements, each set within a text box, represented techniques of spatial organization. The first statement (Oram 1-1: 523) contained a text box as an abbreviated biography of Dr. Monika-Hill, a Mohawk Indian who worked as a physician on the Oneida Indian Reservation in Wisconsin. Her biography related that she "ran a 'kitchen clinic' stocked with herbals (plants used for medical treatment) and medicines provided by the doctors in Green Bay for the people of the reservation" (Oram

1-1: 523). The statement that associated kitchen clinic with herbals and medicines with doctors in the Green Bay area represents a round-off, a technique that ends a thought with the scientific knowledge or "correct" view (Ninnes, 2003). The "primitive farm on the Oneida Reservation" (Oram 1-1: 523) represents use of vocabulary that suggests one way as better than another.

The second statement (Goodman 1-2: 680) included a text box entitled *Thinking About Biology: Effects of High Altitude*. The text related the impact of life at higher altitudes and the physiological differences of these individuals, named specifically as Quechua Indians of the Andes. Text separated from the narrative suggested that the content remained as a side issue to the main purpose of the text.

Two additional examples incorporated a round-off technique in the text where an indigenous explanation was followed by the "scientific" explanation. Towle 1-4 included the depiction of cultivation practices of early peoples and their successes in higher crop yields. However, the author stated that this practice "unfortunately…led to decreased genetic variation" (p. 356) which resulted in the loss of potentially beneficial traits; he concluded the section with the suggestion that scientists remained the key to rediscovering the wild varieties. A second example occurred when Milani 1-7: 371 stated:

> Primitive people thought that disease came from an evil spirit that entered the body. The cure for the illnesses was to frighten or coax the spirit out of the body. That became the function of a medicine man, or shaman, who may have used masks, rattles, and charms. Even early humans, however, did not entirely rely on magic. If a "patient" had a toothache, the medicine man might…have applied

> coca leaves to ease the pain….Today, your dentist might say your toothache was caused by a buildup in the population of tooth-decaying bacteria.

Here, the author suggested that in modern times, that is, “today,” the dentist as the science expert provided “scientific” solution and explanation of the problem.

About half of the examples of indigenous knowledge in the archaeology of statement for Set 1 existed as historical examples of the past. As example, Towle 1-4 included the use of horsetails as pot scrubbers by Native Americans and early settlers. About one-fourth of the statements in Set 1 included the past compared to contemporary perspectives. Goodman 1-2 related the past practice, prior to modern medicine, of using plants to treat illnesses. The author followed with the idea that some medicinal plants are still in use and proceeded to list the plants that produced the extract for modern drugs such as morphine, codeine, and quinine. Goodman 2-1 also stated that at “one time, humans depended completely on wild plants and animals for food and clothing” (p. 825). He followed with the thought that wild plants and animals still provided an important resource for people.

Milani 1-7 asked the reader to compare “the so-called primitive way of getting food with the so-called modern way. There are only a few hunting-gathering tribes left in the world today. Those people hunt and fish and gather berries, nuts, leaves, roots and insect larvae” (Milani 1-7: 54). Milani 1-7 did not privilege one way over the other by referring to both the “primitive” and “modern” concepts as “so-called,” and suggested that the hunter-gatherer tribes still practice certain techniques today.

Archaeology for Set 2

The archaeology for Set 2 incorporated 87 statements archived from seven teacher editions and one student edition, Gottfried 2-8. The archaeology of statements for Set 2 provided a reasonable amount of content to support examination of the ideological and textual features designed for this segment of the study. The archived statements came primarily from the indigenous content found in Essenfeld 2-1, Johnson 2-3, and Oram 2-5, which also included the highest frequencies of indigenous representations as determined from the tally.

Notions of Essentialism

Although the notion of traditionality, exemplified by such phrases as 'traditional lifestyle' or traditional setting' or the use of the word *traditiona*l as an adjective to describe a particular indigenous group (Ninnes, 2003, p. 173), did not appear in the texts in Set 2, there remained generic reference within Essenfeld 2-1, Kaskel 2-2, Johnson 2-3, and Miller 2-4 to natives, native people(s), indigenous people, and native tribes. The phrase *Native American* was used most often to refer to an indigenous group, appearing 52 times in the archived statements. Ten of these occurrences included the modifier *some*, *many*, *various* or *other* which suggested diversity within the group by limiting the indigenous identity, practice or belief to a particular group. The generic phrase *American Indian* appeared 3 times with no modifier or link to a specific geographic region to indicate diversity within the identity.

Occasionally, the textbooks in Set 2 referenced specific groups by name. As example, Essenfeld 2-1 mentioned the Tainos and the Inuit, and Johnson 2-3 mentioned the Arfak, Cherokee, Papagos, Pimas, and Apache. Oram 2-5 mentioned 17 groups by name: Eskimos, Samoans, Maoris, Sioux, Hopi, Zuni, Iroquois, Pagago, Nez Perce, Naskapi, Navajos, Lapps (or Sami), Masai, Mohawk, Oneida, Aymara, and Quechua. Miller 2-4 and Towle 2-6 mentioned only one group by name: the Pitjendara and the Eskimos, respectively. At times, the textbooks in Set 2 incorporated various geographic regions to specify a particular indigenous group. As example, Essenfeld 2-1 referenced Native Americans in the plains regions as well as the southwestern parts of the United States, Native Americans of the Great Lakes region, and Native Americans of the Pacific coast of North America; Johnson 2-3 mentioned Native Americans of Central and South America and natives of the Caribbean; Oram 2-5 mentioned Native Americans of both North and South America, Native Americans in northeastern North America, and Northeastern Native Americans; and Milani 2-7 mentioned natives of Central and South America.

Textual Features of Indigenous Representations

The archived statements were examined for grammatical devices such as verb tense as a means to consider the representations of indigenous knowledge within temporal contexts and contemporary perspectives. For the statements where tense was discernable and the indigenous representation could realistically characterize an extant technology or practice, the use of present tense occurred three times as often as the use of past tense. Almost half of the statements represented a historical depiction of the indigenous representation with no connection to contemporary perspective or counterparts. One-fourth of the statements placed the indigenous knowledge in the past and balanced the statement with the inclusion of the contemporary perspective of the indigenous technology or practice. As example, Essenfeld 2-1 discussed the centuries-old tribal customs of rainforest regions in many South American countries and included how the use of frog toxin remained a contemporary practice (p. 578). Johnson 2-3 related the use of the May apple by the Cherokees to kill parasitic worms and partnered this with current information regarding extracts from sweet potatoes used for making steroid hormones for cortisone and birth control pills (p. 438).

One instance of the use of universalizing language occurred in Miller 2-4 with the use of first person plural as *we* creating a boundary between the two ways of knowing:

> The stories of the rock also detail the connections between the tribe and animals important in their everyday lives…The stories even explain the origins of dreams. We might say that the rock provides the Pitjendara with answers that other societies seek through a process known as science (p. 5)

Archaeology for Set 3

The archaeology for Set 3 incorporated 123 statements archived from eight teacher editions and two student editions, Bybee 3-6 and Leonard 3-9. The archaeology of statements for Set 3 provided a reasonable amount of content to support examination of the ideological and textual features designed for this segment of the study. The archived statements came primarily from the indigenous content found in Johnson 3-2, Strauss 3-8 and Oram 3-10, which also included the highest frequencies of indigenous representations as determined from the tally.

Notions of Essentialism

The notion of traditionality, exemplified by such phrases as 'traditional lifestyle' or traditional setting' or the use of the word *traditiona*l as an adjective to describe a particular indigenous group (Ninnes, 2003, p. 173), appeared twice in Set 3. Johnson 3-2 included the "onslaught of scientific interest in traditional medicine has both positive and negative consequence" (p. 16). Bybee 3-6 stated that "traditional societies are societies that have not been influenced by the modern or Western cultures around them….most traditional cultures have had contact with modern cultures, but the timing and the extent of this contact have varied" (p. E227). There remained generic reference within Biggs 3-1, Johnson 3-2, Johnson 3-4, Milani 3-7, Strauss 3-8, and Miller 3-11 to early agricultural societies, native people(s), indigenous people(s), native farmers, rural and primitive cultures, primitive people, ancient peoples, or native tribes. The phrase *Native American(s)* was used most often to refer to an indigenous group, appearing 60 times in the archived statements. Twelve of these occurrences included the modifier *some*, *many,* or *other* which suggested diversity within the group by limiting the indigenous identity, practice or belief to a particular group. The generic phrase *American Indian* appeared five times with no modifier or link to a specific geographic region to indicate diversity within the identity. *Aztec(s)* appeared 14 times and *Hopi* appeared 10 times within Set 3.

Frequently, the textbooks in Set 3 referenced specific groups by name. As example, Johnson 3-2 mentioned the Kwakiutl, Haida Indians of the American Northwest coast, Hopi, Arfak, Navajo, Havasupai, Sioux, Ute, Aztecs, Mayans, Cochiti, Filipinos, Winnebago, Cree, and the Yanomamo tribe of Brazil and Venezela. Milani 3-7 mentioned the Palouse, Nez Perce, Pueblo Indians, Hopi, Zuni, Anasazi, Navajo, Eskimos, Aztec(s), Pontiac people, and Incas. Miller 3-11 referenced the Pitjendara tribe of central Australia, Aztecs, Mayans, Incas, Eskimos, Samoans, Maoris, Sioux, Tewa Tribe of New Mexico, Hopi, Zuni, Iroquois, Papago, Naskapi, Apache, Lapps (or Sami), and Masai herders. With limited occurrence, the textbooks in Set 3 incorporated various geographic regions to specify a particular indigenous group. As example, Biggs 2-1 referenced Native Americans of both North and South America. Johnson 3-2 referenced Native American communities in Arizona and New Mexico, Native Americans of Central and South America, native farmers in Mexico, native North Americans. Johnson 3-4 referenced American Indians of South America and indigenous people in Brazil. Milani 3-7 referenced Native American cultures of the northwestern United States and Canada. Strauss 3-8 referenced native people of Peru, Indians of South America and Native Americans living in the Amazon region.

Textual Features of Indigenous Representations

The archived statements were examined for grammatical devices such as verb tense as a means to consider the representations of indigenous knowledge within temporal contexts and contemporary perspectives. For the statements where tense was discernable and the indigenous representation could realistically characterize an extant technology or practice, the use of present tense occurred slight more often times than the use of past tense. One-third of the statements represented a historical depiction of the indigenous representation with no connection to contemporary perspective or counterparts. One-third of the statements placed the indigenous knowledge in the past and balanced the statement with the inclusion of the contemporary perspective of the indigenous technology or practice, and the indigenous content in these instances most often related to an indigenous technology. As example, Strauss 3-8 included: "Wood has been used for the construction of shelter for many years. However, wood is not the only living thing from which shelters are made…Native Americans living in the southwestern part of the United States use thatch for the roofs of their shelter" (p. 17). Miller 3-11 included: “Native tribes in the tropics often poison their arrow tips by rubbing them in these [tropical tree] frogs” (p. 701).

One instance of the use of universalizing language occurred in Miller 3-11 with the use of first person plural as *we* creating a boundary between the two ways of knowing:

> The stories of the rock also detail the connections between the tribe and animals important in their everyday lives…The stories even explain the origins of dreams. We might say that the rock provides the Pitjendara with answers that other societies seek through a process known as science (p. 5)

Archaeology for Set 4

The archaeology for Set 4 incorporated 61 statements archived from six teacher editions. The archived statements came primarily from the indigenous content found in Biggs 4-2, Johnson 4-3, and Postlethwait 4-5, which also included the highest frequencies of indigenous representations as determined from the tally.

Notions of Essentialism

The notion of traditionality, exemplified by such phrases as ‘traditional lifestyle’ or traditional setting’ or the use of the word *traditiona*l as an adjective to describe a particular indigenous group (Ninnes, 2003, p. 173), appeared once in Biggs 4-2: “Many traditional remedies manufactured in certain countries are made with body parts from threatened species” (p. 836). There remained generic reference within all of the texts in Set 4 that included indigenous content to phrases such as native cultures, native people, and hunter-gatherers. The phrase *Native American* was used most often to refer to an indigenous group, appearing 17 times in the archived statements. Three of these occurrences included the modifier *many,* which suggested diversity within the group by limiting the indigenous identity, practice or belief to a particular group.

Occasionally, the textbooks in Set 4 referenced specific groups by name. As example, Biggs 4-2 mentioned the Inuit groups in North America, Mayas, Aztecs, Aymara, and Quechua Indians of South America. Johnson 4-3 mentioned the Hopi, Aztecs, Maya, Inca, Winnebago, Makah, and Aborigines. Postlethwait 4-5 mentioned the Masai of Kenya, Seminoles of Florida, Hopi, Kalahari Bushmen, Andaman natives of Myanmar, African Pygmies, Aztecs, and Aborigines. It appeared common for the textbooks in Set 4 to incorporate various geographic regions to specify a particular indigenous group. As example, Biggs 4-2 referenced groups living in southwester United States, certain groups of Native North Americans, and North Americans of both North and South America. Johnson 4-3 referenced Native American communities in Arizona and New Mexico, Native Americans of the Pacific Northwest, northwest Indians, and northwest tribes. Postlethwait 4-5 referenced the Masai of Kenya, Pacific Northwest Native Americans, and many tribes of South and Central America.

Textual Features of Indigenous Representations

The archived statements were examined for grammatical devices such as verb tense as a means to consider the representations of indigenous knowledge within temporal contexts and contemporary perspectives. For the statements where tense was discernable and the indigenous representation could realistically characterize an extant technology or practice, the use of past tense occurred twice as often as present tense. Almost one-third of the statements represented a historical depiction of the indigenous representation with no connection to contemporary perspective or counterparts. One-fourth of the statements placed the indigenous knowledge in the past and balanced the statement with the inclusion of the contemporary perspective of the indigenous technology or practice.

Evaluation Coefficient Analysis (ECO)

The results for the Evaluation Coefficient Analysis (ECO), depicted in Tables 32, 33, 34, and 35, varied greatly among the four sets. To facilitate the reporting of the results, consideration of the subsets of *nature of science*, *ecology*, and *indigenous representations* within the Eurocentric and multicultural vocabulary lists were used to organize the findings for this segment of the study.

Nature of Science

The findings of the ECO revealed that the *nature of science* remained the area least likely to incorporate any terminology regarded as multicultural. Twenty of the student editions in the sample reflected a 0.00 coefficient and 16 of the teacher's editions reflected a 0.00 coefficient for nature of science; 16 of the 34 textbooks reflected a 0.00 coefficient for both the student and teacher edition for nature of science. Nature of science coefficients ranged from 0.00 to 30.00 with 0.00 as the modal score. Cairney 3-5 had the highest coefficient for nature of science at 30.00 for both the student and teacher edition; Biggs 4-2 had the second highest coefficient at 16.00 for both the student and teacher edition. Student edition coefficients compared to teacher edition coefficients reflected no major difference between scores.

Table 32.

Evaluation Coefficient Analysis – Student and Teacher Editions – Set 1

Textbook Code	Nature of Science SE	Nature of Science TE	Ecology SE	Ecology TE	Indigenous Representations SE	Indigenous Representations TE
Oram 1-1	0.00	1.82	38.07	36.72	77.78	77.78
Goodman 1-2	0.00	0.00	36.77	36.67	62.50	50.00
McLaren 1-3	0.00	0.00	22.42	21.79	100.00	100.00
Towle 1-4	0.00	0.00	29.07	28.90	50.00	50.00
Alexander 1-5	0.00	0.00	18.95	19.59	100.00	100.00
Milani 1-6	5.97	5.48	14.06	13.64	0.00	0.00
Milani 1-7	0.00	0.00	15.08	15.91	27.78	25.00
Schraer 1-8	0.00	0.00	27.23	28.77	0.00	0.00
Mean			25.21	25.25	52.26	50.35

Table 33.

Evaluation Coefficient Analysis – Student and Teacher Editions – Set 2

Textbook Code	Nature of Science SE	Nature of Science TE	Ecology SE	Ecology TE	Indigenous Representations SE	Indigenous Representations TE
Essenfeld 2-1	2.56	3.03	24.13	23.40	9.68	18.75
Kaskel 2-2	0.00	0.00	18.78	19.83	100.00	100.00
Johnson 2-3	0.00	0.00	19.77	22.12	5.00	32.69
Miller 2-4	0.00	0.00	18.01	17.80	88.89	91.18
Oram 2-5	4.65	4.00	30.79	33.85	50.46	48.15
Towle 2-6	0.00	0.00	29.14	26.85	57.14	57.14
Milani 2-7	10.00	15.38	36.56	36.36	27.78	25.00
Gottfried 2-8	4.11	0.00	24.93	0.00	20.00	0.00
Schraer 2-9	0.00	0.00	27.23	28.77	0.00	0.00
Mean			24.48	26.12	39.88	46.61

Table 34.

Evaluation Coefficient Analysis – Student and Teacher Editions – Set 3

Textbook Code	Nature of Science SE	Nature of Science TE	Ecology SE	Ecology TE	Indigenous Representations SE	Indigenous Representations TE
Biggs 3-1	1.15	1.55	27.54	28.90	50.00	47.06
Johnson 3-2	0.00	2.56	14.85	16.86	28.57	60.00
Pignatiello 3-3	0.00	0.00	18.95	20.00	0.00	0.00
Johnson 3-4	0.00	0.00	25.29	26.42	0.00	35.29
Cairney 3-5	30.00	30.00	31.78	32.42	0.00	14.29
Bybee 3-6	0.00	0.00	9.21	0.00	75.00	0.00
Miller 3-7	2.13	1.39	22.41	25.46	56.52	54.24
Strauss 3-8	3.38	3.17	20.11	20.18	43.33	43.33
Leonard 3-9	0.00	0.00	28.40	0.00	28.57	0.00
Oram 3-10	4.65	4.00	30.79	33.85	50.46	48.15
Miller 3-11	0.00	0.00	33.15	32.57	100.00	72.22
Mean			23.86	26.30	39.31	41.62

Table 35.

Evaluation Coefficient Analysis – Student and Teacher Editions – Set 4

Textbook Code	Nature of Science SE	Nature of Science TE	Ecology SE	Ecology TE	Indigenous Representations SE	Indigenous Representations TE
Parke 4-1	1.96	1.89	17.71	28.63	0.00	0.00
Biggs 4-2	16.00	16.00	34.48	36.07	81.82	68.00
Johnson 4-3	0.00	0.00	23.40	27.89	57.14	56.86
Miller 4-4	9.59	7.61	20.49	21.97	30.76	30.76
Postlethwait 4-5	0.00	0.00	22.41	25.78	38.24	41.18
Campbell 4-6	1.67	1.48	18.80	16.37	0.00	0.00
Mean			22.88	26.12	34.66	32.80

Ecology

Mean scores were calculated for the coefficients recorded under *ecology* for the student and teacher editions per each set. Lumsden 2-8, Bybee 3-6 and Leonard 3-9 teacher editions were excluded from the mean scores for the *ecology* coefficients as each of these teacher editions did not contain the type of content appropriate for the ECO calculations planned for this portion of the study. The mean coefficients for the student and teacher editions averaged mid-to-low twenties for each of the four sets of texts with a range of coefficients from14.06 to 38.07 for the inclusive sample of student editions and 13.64 to 36.72 for the inclusive sample of teacher editions. The mean coefficients for each student edition compared to each teacher edition varied slightly for each set, and the collective mean coefficients did not indicate high levels of multicultural or favorable content. Across all four sets, the mean scores for *ecology* for the student editions showed a slight decrease, and the teacher's editions showed a slight increase from Set 1 to Set 3, and then a slight decease from Set 3 to Set 4.

Indigenous Representations

Mean scores were calculated for the coefficients recorded for *indigenous representations* for the student and teacher editions in each set. As for the *ecology* segment, Lumsden 2-8, Bybee 3-6 and Leonard 3-9 teacher editions were excluded from the mean scores for the *indigenous representations* coefficients as each of these teacher editions did not contain the type of content appropriate for the ECO portion of the study. The mean coefficients for student and teacher editions ranged from 32.80 to 52.26 among the four sets of texts with a range of coefficients from 0.00 to 100.00 for the inclusive sample of student editions and 0.00 to 100.00 for the inclusive sample of teacher editions.

Although the mean coefficients for each student edition compared to each teacher edition varied slightly for each set, within the sets coefficients varied greatly from student to teacher edition. As example, in Set 1, Goodman 1-2 teacher edition coefficient decreased by 20% compared to the student edition. In Set 2, Essenfeld 2-1 teacher edition coefficient doubled compared to the student edition, and for Johnson 2-3, the teacher edition increased more than six times compared to the student edition. In Set 3, Johnson 3-2 teacher edition coefficient almost doubled compared to the student edition, and Miller 3-11 teacher edition coefficient decreased by more than 25% compared to the student edition counterpart. In addition, two of the student editions, Johnson 3-4 and Cairney 3-5, had coefficients of 0.00 for *indigenous representation* but their teacher edition counterparts had coefficients to 35.29 and 14.29, respectively. Across all four sets, the mean scores for *indigenous representations* for both the student and teacher editions showed a decrease from Set 1 to Set 4.

Visuals and Illustrations

A total of 4,994 visuals and illustrations were identified within two units considered to reflect multicultural content in the form of non-Western or indigenous knowledge: *introduction to biology* and *ecology*. Of the total number of visuals, 663 (13%) were classified as human. Tables 36, 37, 38 and 39 depict the number and percent of visuals or illustrations by unit per set. Visuals tallied as human were further classified as one of the following: child/youth, adult, aerial, or appendage. For aerial depictions, the image had to include “sizeable groups of individuals performing similar activities” (Powell and Garcia, 1985, p. 524) with gender and race not clearly discernable.

Table 36.

Number and Percent of Visuals/Illustrations – Introduction to Biology and Ecology Units – Set 1

Textbook Code	Oram 1-1	Goodman 1-2	McLaren 1-3	Towle 1-4	Alexander 1-5	Milani 1-6	Milani 1-7	Scharer 1-8
Total Number of Visuals	170	140	123	128	164	102	296	128
Total Number with Humans	20	19	12	12	18	12	34	22
Percent with Humans	11.8	13.6	9.8	9.4	11.0	11.8	11.5	17.2

Table 37.

Number and Percent of Visuals/Illustrations – Introduction to Biology and Ecology Units – Set 2

Textbook Code	Essenfeld 2-1	Kaskel 2-2	Johnson 2-3	Miller 2-4	Oram 2-5	Towle 2-6	Milani 2-7	Gottfried 2-8	Schraer 2-9
Total Number of Visuals	168	107	165	188	175	129	144	208	124
Total Number with Humans	23	10	34	21	20	13	9	18	19
Percent with Humans	13.7	9.3	20.6	11.2	11.4	10.1	6.3	8.7	15.3

Table 38.

Number and Percent of Visuals/Illustrations – Introduction to Biology and Ecology Units – Set 3

Textbook Code	Biggs 3-1	Johnson 3-2	Pignatiello 3-3	Johnson 3-4	Milani 3-5	Bybee 3-6	Miller 3-7	Strauss 3-8	Leonard 3-9	Oram 3-10	Miller 3-11
Total Number of Visuals	221	120	49	139	147	32	159	255	77	175	185
Total Number with Humans	29	13	12	29	9	7	27	22	27	20	20
Percent with Humans	13.1	10.8	24.5	20.9	6.1	21.9	17.0	8.6	35.1	11.4	10.8

Table 39.

Number and Percent of Visuals/Illustrations – Introduction to Biology and Ecology Units – Set 4

Textbook Code	Parke 4-1	Biggs 4-2	Johnson 4-3	Miller 4-4	Postlethwait 4-5	Campbell 4-6
Total Number of Visuals	39	160	127	181	125	144
Total Number with Humans	12	12	30	34	22	22
Percent with Humans	30.8	7.5	23.6	18.8	17.6	15.3

An appendage visual included a “diagram that displays only an appendage of the human body, e.g., hand, arm, leg, foot; extensions of an appendage, e.g., fingers, toes,; or close-up photography of parts of the body, e.g., nose ear, or mouth, and presented in manner that hinders the identification of the individual by gender” (Powell and Garcia, 1985, p. 524). Tables 40 and 41 depict percentages by categories for visuals and illustration by Sets 1 and 2 and Sets 3 and 4, respectively.

Set 1

Table 40 depicts that, on the average, 10% of the human representations in the images were children or youth, 79% were adults, 4.0% were aerial shots, and 7% appeared as appendages. Images of appendages included hands or fingers manipulating laboratory apparatus such as a microscope or test tube; on the average, 82% of the appendages were white, 9% minority, and 9% unidentifiable. Appendage images recorded as unidentifiable represented hands or fingers inside of gloves manipulating laboratory apparatus.

Tables 42 and 43 depict percent of images of children or youth and adults by gender and race for the units *introduction to biology* and *ecology*, respectively. Towle 1-4 and Alexander 1-5 had no images of children. On average for the set, a little more than half of the images of children or youth were unidentifiable with regard to gender; 14% were classified as male and 35% were female. On average for the set, 25% of the images of children and youth were unidentifiable with regard to race, 33% of the images represented minorities and 42% represented images of whites. When children were depicted, they appeared in a limited range of activities; children and youth were pictured twice as often as active compared to passive.

Table 40.

Percentages by Categories for Visuals/Illustrations Categories – Sets 1 and 2

Book Code	Child	Adult	Aerial	Appendage
Set 1				
Oram 1-1	9.1	81.8	0.0	9.1
Goodman 1-2	10.0	70.0	10.0	10.0
McLaren 1-3	16.7	83.3	0.0	0.0
Towle 1-4	0.0	91.7	0.0	8.3
Alexander 1-5	0.0	82.4	5.9	11.8
Milani 1-6	16.7	75.0	8.3	0.0
Milani 1-7	10.8	75.7	8.1	5.4
Schraer 1-8	17.4	74.0	0.0	8.7
Mean	10.1	79.2	4.0	6.7
Set 2				
Essenfeld 2-1	8.0	80.0	4.0	8.0
Kaskel 2-2	27.3	63.6	9.1	0.0
Johnson 2-3	45.7	51.4	0.0	2.9
Miller 2-4	17.4	69.6	4.3	8.7
Oram 2-5	13.6	72.7	9.1	4.5
Towle 2-6	7.1	78.7	7.1	7.1
Milani 2-7	10.0	90.0	0.0	0.0
Gottfried 2-8	10.5	73.7	5.3	10.5
Schraer 2-9	15.8	84.2	0.0	0.0
Mean	17.3	73.8	4.3	4.6

Table 41.

Percentages by Categories for Visuals/Illustrations Categories – Sets 3 and 4

Book Code	Child	Adult	Aerial	Appendage
Set 3				
Biggs 3-1	35.7	57.1	3.6	3.6
Johnson 3-2	33.3	53.3	6.7	6.7
Pignatiello 3-3	23.1	69.2	0.0	7.7
Johnson 3-4	44.9	51.7	3.4	0.0
Milani 3-5	10.0	90.0	0.0	0.0
Bybee 3-6	57.1	28.6	14.3	0.0
Miller 3-7	14.8	70.4	14.8	0.0
Strauss 3-8	27.3	54.6	13.6	4.5
Leonard 3-9	31.4	54.3	11.4	2.9
Oram 3-10	9.5	71.4	14.3	4.8
Miller 3-11	14.3	66.7	4.8	14.3
Mean	27.4	60.7	7.9	4.0
Set 4				
Parke 4-1	21.4	50.0	21.4	7.2
Biggs 4-2	30.8	69.2	0.0	0.0
Johnson 4-3	35.7	46.4	3.6	14.3
Miller 4-4	8.1	86.5	0.0	5.4
Postlethwait 4-5	31.8	63.6	4.5	0.0
Campbell 4-6	33.4	50.0	8.3	8.3
Mean	26.9	70.0	6.3	5.9

Table 42.

Percent of Images of Children/Youth by Gender and Race for Introduction to Biology and Ecology Units – Set 1

Book Code	Gender Male	Female	Unidentified	Race Non-white	White	Unidentified
Oram 1-1	0.0	50.0	50.0	50.0	50.0	0.0
Goodman 1-2	0.0	50.0	50.0	0.0	50.0	50.0
McLaren 1-3	50.0	0.0	50.0	0.0	0.0	100.0
Towle 1-4*	0.0	0.0	0.0	0.0	0.0	0.0
Alexander 1-5*	0.0	0.0	0.0	0.0	0.0	0.0
Milani 1-6	33.3	33.3	33.3	50.0	50.0	0.0
Milani 1-7	0.0	25.0	75.0	50.0	50.0	0.0
Schraer 1-8	0.0	50.0	50.0	50.0	50.0	0.0
Mean	13.9	34.7	51.4	33.3	41.7	25.0

*not included in Mean

Table 43.

Percent of Images of Adults by Gender and Race Introduction to Biology and Ecology Units – Set 1

Book Code	Gender Male	Female	Unidentified	Race Non-white	White	Unidentified
Oram 1-1	50.0	44.4	5.6	38.9	55.6	5.6
Goodman 1-2	78.6	21.4	0.0	35.7	64.3	0.0
McLaren 1-3	66.7	33.3	0.0	27.3	54.5	18.2
Towle 1-4	69.2	15.4	15.4	54.5	9.1	36.4
Alexander 1-5	66.7	33.3	0.0	20.0	73.3	6.7
Milani 1-6	60.0	30.0	10.0	22.2	66.7	11.1
Milani 1-7	48.4	35.5	16.1	16.7	53.3	30.0
Schraer 1-8	58.8	41.2	0.0	11.8	76.5	11.8
Mean	62.3	31.8	5.9	28.4	56.7	14.9

When gender was identifiable, female children or youth were depicted three times as often in active poses compared to male children or youth. Activities that involved children or youth included learning to drive a car, using a microscope or other laboratory equipment, walking in the hallway at school, playing in a park, or riding a bike. Photographs of children were also most likely to be included with content related to malnutrition or famine.

On average, adults in Set 1 were pictured twice as often as male compared to female with 6% of the images of adults as unidentifiable with regard to gender; 57% of the images depicted adults as white and 28.4% as minority with 14% percent of the images of adults unidentifiable with regard to race. Adults were depicted in variety of science and non-science activities including the manipulation of laboratory apparatus and field equipment, collecting specimens, operating computer equipment, leading discussions or conferences, recycling cans and other materials, operating heavy equipment, running or jogging for exercise, or diving or working underwater. Ten percent of the images of females and 8% of the images of males were classified as passive for the texts in Set 1. When race was identifiable, an average of 14% of the adult white images and 5% of the adult minority images were classified as passive.

Set 2

As depicted in Table 40, on the average 17% of the images represented children or youth, 74% represented adults, 4.0% were aerial shots, and 5% appeared as appendages. Images of appendages for Set 2 included hands or fingers manipulating laboratory apparatus such as a microscope, test tube or Petri dish; on the average, 67% of the appendages were white and 33% unidentifiable. Appendage images recorded as unidentifiable reflected hands inside of gloves undertaking the types of actions indicative of laboratory work.

Tables 44 and 45 depict percent of images of children or youth and adults by gender and race for *introduction to biology* and *ecology*, respectively. On average, 18% of the images of children or youth were unidentifiable in regard to gender; 37% were classified as male and 45% were classified as female. On average, 12% of the images of children and youth were unidentifiable with regard to race; a little more than half of the images represented minorities and a little more than a third of the images represented whites. Children were depicted in a wide range of science and non-science activities in Set 2 including recycling plastics and newspapers, performing an experiment, manipulating a microscope, using a magnifying glass, or climbing a tree. Of the images where gender was identifiable, male children, on average, were depicted twice as often as passive compared to female children. Of the images where race was identifiable, minority children or youth were three times as likely to be pictured as passive compared to images of white children or youth.

On average, adults in Set 2 were twice as likely to be depicted as male compared to female with 9% of the images as unidentifiable with regard to gender. On average, 47% of the images depicted adults as white and 34% as minority; 19% of the images of adults were unidentifiable with regard to race. Adults were depicted in variety of roles: diving among kelp beds, herding animals, working with computers, protesting at an event, welding pipes, operating heavy equipment, planting seedlings, recycling plastics, building an igloo, cooking, experimenting, hunting food, and collecting honey.

Table 44.

Percent of Images of Children/Youth by Gender and Race – Set 2

Book Code	Gender Male	Female	Unidentified	Race Non-white	White	Unidentified
Essenfeld 2-1	50.0	0.0	50.0	100.0	0.0	0.0
Kaskel 2-2	50.0	25.0	25.0	60.0	40.0	0.0
Johnson 2-3	44.4	55.6	0.0	42.9	47.6	9.5
Miller 2-4	57.1	42.9	0.0	66.7	33.3	0.0
Oram 2-5	50.0	50.0	0.0	50.0	0.0	50.0
Towle 2-6	0.0	100.0	0.0	0.0	100.0	0.0
Milani 2-7	33.3	66.7	0.0	33.3	66.7	0.0
Gottfried 2-8	50.0	0.0	50.0	50.0	0.0	50.0
Schraer 2-9	0.0	66.7	33.3	66.7	33.3	0.0
Mean	37.2	45.2	17.6	52.2	35.7	12.2

Table 45.

Percent of Images of Adults by Gender and Race – Set 2

Book		Gender			Race	
Code	Male	Female	Unidentified	Non-white	White	Unidentified
Essenfeld 2-1	55.0	40.0	5.0	39.1	47.9	13.0
Kaskel 2-2	57.1	28.6	14.3	50.0	30.0	20.0
Johnson 2-3	66.7	33.3	0.0	44.4	55.6	0.0
Miller 2-4	43.7	43.8	12.5	25.0	68.8	6.2
Oram 2-5	64.7	23.5	11.8	20.0	53.3	26.7
Towle 2-6	75.0	8.3	16.7	27.3	27.3	45.4
Milani 2-7	54.5	36.4	9.1	30.0	60.0	10.0
Gottfried 2-8	63.2	31.6	5.2	46.6	26.7	26.7
Schraer 2-9	57.9	36.8	5.3	23.5	52.9	23.5
Mean	59.8	31.4	8.9	34.0	47.0	19.0

When gender was identifiable, an average of 5% of the adult female and 6% of the adult male images were classified as passive. When race was identifiable, an average of 6% of the white images of adults and 4% of the minority images of adults were classified as passive.

Set 3

As depicted in Table 41, an average 27% of the images represented children or youth, 61% represented adults, 8% were aerial shots, and 4% appeared as appendages. Images of appendages for Set 3 included hands or fingers manipulating laboratory apparatus or holding wildlife for tagging or feeding purposes. On average, 89% of the appendage images were white and 11% were unidentifiable with regard to race. Appendage images recorded as unidentifiable reflected hands inside of gloves undertaking the types of actions indicative of laboratory work.

Tables 46 and 47 depict percent of images of children or youth and adults by gender and race for *introduction to biology* and *ecology*, respectively. On average, 7% of the images of children or youth were unidentifiable with regard to gender. Children or youth were depicted almost equally as either male or female. On average, 20% of the images of children and youth were unidentifiable with regard to race; children or youth were depicted almost equally as minority or white. Children were depicted in a wide range of science and non-science activities including using hand lenses, mixing chemicals, mixing soil, recycling paper, eating lunch at the food court, collecting rainwater, using a microscope, planting seeds, riding a bike, skateboarding, playing tennis, taking water samples, working at the computer, adding seed to a feeder, watering plants, making pasta, picking up litter, and using a Bunsen burner.

Table 46.

Percent of Images of Children/Youth by Gender and Race – Set 3

Book		Gender			Race	
Code	Male	Female	Unidentified	Non-white	White	Unidentified
Biggs 3-1	41.2	52.9	5.9	64.7	29.4	5.9
Johnson 3-2	42.9	42.9	14.2	33.3	50.0	16.7
Pignatiello 3-3	30.8	69.2	0.0	54.5	45.5	0.0
Johnson 3-4	37.5	50.0	12.5	37.5	56.3	6.2
Milani 3-5	50.0	50.0	0.0	0.0	50.0	50.0
Bybee 3-6	40.0	40.0	20.0	20.0	60.0	20.0
Miller 3-7	60.0	40.0	0.0	50.0	25.0	25.0
Strauss 3-8	50.0	50.0	0.0	25.0	50.0	25.0
Leonard 3-9	46.7	33.3	20.0	55.5	38.9	5.6
Oram 3-10	50.0	50.0	0.0	50.0	0.0	50.0
Miller 3-11	60.0	40.0	0.0	57.1	28.6	14.3
Mean	46.3	47.1	6.6	40.7	39.4	19.9

Table 47.

Percent of Images of Adults by Gender and Race – Set 3

Book Code	Gender: Male	Female	Unidentified	Race: Non-white	White	Unidentified
Biggs 3-1	38.9	27.8	33.3	18.8	31.2	50.0
Johnson 3-2	54.5	36.4	9.1	25.0	50.0	25.0
Pignatiello 3-3	66.7	33.3	0.0	66.7	33.3	0.0
Johnson 3-4	66.7	20.0	13.3	26.7	53.3	20.0
Milani 3-5	50.0	20.0	30.0	22.2	44.4	33.3
Bybee 3-6	50.0	50.0	0.0	33.3	66.7	0.0
Miller 3-7	66.7	23.8	9.5	25.0	55.0	20.0
Strauss 3-8	46.1	30.8	23.1	23.1	46.1	30.8
Leonard 3-9	57.1	42.9	0.0	33.3	55.6	11.1
Oram 3-10	64.7	23.5	11.8	20.0	53.3	26.7
Miller 3-11	42.9	50.0	7.1	21.4	71.4	7.1
Mean	54.9	32.6	12.5	28.7	50.9	20.4

An average of 8% of the male children or youth and 5% of the female children or youth were classified as passive when gender was identifiable; an average of 12% of the minority children or youth and 4% of the white children or youth were classified as passive when race was identifiable.

On average, 55% of the images in Set 3 depicted adult males and 33% depicted adult females with 13% of the images as unidentifiable with regard to gender. On average, 51% of the images depicted adults as white and 29% as minority; 20% of the images of adults were unidentifiable with regard to race. Adults were depicted in variety of science and non-science roles: measuring plants, using a syringe, recording bird songs, diving in the kelp beds, performing field studies, taking cultures, operating heavy equipment, performing experiments, collecting water samples, counseling patients, tagging wildlife, recording notes, protesting at an event, teaching a class, voting in an election, dancing at a USO event, measuring flowers, fishing, using a computer and other technological equipment, recording data, mixing chemicals, helping a stranded whale return to the ocean, releasing wildlife into natural habitat, measuring age of tree, moving barrels of hazardous waste materials, planting seedlings, carrying out a census, recycling aluminum cans, cleaning pipes, pulling combs from beehive, plowing a field, gardening, pickling cactus, spraying mattresses with pesticides, riding a bike to work, seining for fish, cleaning up an oil spill, riding horse, hiking, and sailing. An average of 11% of the male adult images and 5% of the female adult images were classified as passive when gender was identifiable; an average of 7% of the adult minority images and 6% of the adult white images were classified as passive when race was identifiable.

Set 4

As depicted in Table 41, an average 27% of the images represented children or youth, 70% represented adults, 6% were aerial shots, and 6% appeared as appendages. Images of appendages for Set 4 included hands or fingers manipulating laboratory apparatus, holding an animal for feeding purposes, illustrating an example of skin irritations such as poison ivy or holding a seedling. All of the appendage images were identified as white with regard to race.

Tables 48 and 49 depict percent of images of children or youth and adults by gender and race for *introduction to biology* and *ecology* for Set 4. None of the textbooks had images as unidentifiable in regard to gender or race. On average, children or youth were depicted almost equally as either male or female with 48% categorized as male and 52% as female. On average, children or youth were depicted as minority in 59% of the images and as white in 41% of the images. Children were depicted in a wide range of activities including working in the lab, collecting water samples, eating lunch, taking measurements, draining samples, using binoculars, recycling and composting, working with test tubes, using a computer, potting plants, taking a census, seining for specimens, and mixing soil. An average of 6% of the male children or youth and 7% of the female children or youth were classified as passive when gender was identifiable; an average of 8% of the minority children or youth and 6% of the white children or youth were classified as passive when race was identifiable.

On average, 49% of the images in Set 4 depicted adult males and 42% depicted adult females with 9% of the images as unidentifiable with regard to gender. On average, over half of the images depicted adults as white and one-fourth as minority.

Table 48.

Percent of Images of Children/Youth by Gender and Race – Set 4

Book Code	Gender Male	Female	Unidentified	Race Non-white	White	Unidentified
Parke 4-1	50.0	50.0	0.0	80.0	20.0	0.0
Biggs 4-2	42.9	57.1	0.0	66.7	33.3	0.0
Johnson 4-3	35.7	64.3	0.0	56.3	43.7	0.0
Miller 4-4	75.0	25.0	0.0	25.0	75.0	0.0
Postlethwait 4-5	45.5	54.5	0.0	75.0	25.0	0.0
Campbell 4-6	37.5	62.5	0.0	50.0	50.0	0.0
Mean	47.8	52.2	0.0	58.8	41.2	0.0

Table 49.

Percent of Images of Adults by Gender and Race – Set 4

Book Code	Gender: Male	Gender: Female	Gender: Unidentified	Race: Non-white	Race: White	Race: Unidentified
Parke 4-1	57.1	42.9	0.0	28.5	42.9	28.5
Biggs 4-2	40.0	60.0	0.0	11.1	55.6	33.3
Johnson 4-3	54.5	45.5	0.0	31.6	63.2	5.2
Miller 4-4	50.0	44.1	5.9	28.6	62.9	8.5
Postlethwait 4-5	52.9	35.3	11.8	25.0	62.5	12.5
Campbell 4-6	38.5	23.0	38.5	16.7	50.0	33.3
Mean	48.8	41.8	9.4	23.6	56.2	20.2

Twenty percent of the images of adults were unidentifiable with regard to race. Adults were depicted in variety of roles: working with manatees, checking satellite mirrors, working on a diary farm, giving a shot, using a computer, reading a vial, leading a nature hike, using a microscope, recording data, administering an MRI, running a race, collecting water samples, pipetting liquids, skiing, picking native flowers, operating heavy equipment, holding a public forum, biking to work, working with charts, performing field studies, listening to a patient's heartbeat, cleaning up oil spills, cooking pasta, reading tree rings, tagging wildlife, measuring antlers, mimicking a courtship dance, racing in a wheelchair, photographing wildlife, and gridding plots of land. An average of 11% of the male adult images and 2% of the female adult images were classified as passive when gender was identifiable; an average of 2% of the adult minority images and 10% of the adult white images were classified as passive when race was identifiable.

Chapter 5

Discussion of Findings, Conclusions,

and Recommendations

This final chapter includes an 1) overview of the study, 2) consideration of the limitations of the study, 3) discussion of the findings, including a brief summation of additional findings, 4) conclusions, 5) implications and 6) recommendations.

Overview

The purpose of this investigation was to determine the extent to which multicultural science content had been infused within high school biology textbooks. The study evaluated the textbook as an instructional tool and framework for multicultural science education instruction by comparing mainstream to indigenous knowledge perspectives portrayed in the text content. For this investigation, the inclusive sample utilized 34 student editions of Florida state-adopted high school biology texts found on four adoption lists covering 1990 – 1994, 1994 – 1998, 1998 – 2004, and 2005 – 2006, respectively. Teacher editions, most of which appeared as annotated versions of the student edition counterparts, were examined when appropriate for the study. Texts were organized into four sets based on the year of adoption cycle.

Issues associated with multicultural education included content debates that centered on representation and identity and encompassed larger aspects of inclusion and exclusion: the considerations of dominant versus non-dominant cultural viewpoints and their appropriate roles within K – 12 curricula and related instructional materials. Against this backdrop, emphasis on the achievement gap underscored the notion that society desires a populace who can “do science,” and the question remained whether the science curricula, most commonly conceptualized as the textbook, could not only support preparation of a workforce facing an increase in minority membership but also hold interest so that those traditionally underrepresented in science had access to meaningful opportunities for learning.

To address this matter, the fundamental research question investigated the extent to which multicultural science content, exemplified by indigenous knowledge representations, had been infused within the content of high school biology textbooks. More specifically, to address concerns of the ability of textbooks to support effective multicultural science education, the following questions were offered for consideration:

1. To what extent did the biology textbooks adopted in the 2005 – 2006 cycle include content coverage that supported perspectives of indigenous knowledge compared to biology textbooks adopted in Florida’s prior adoption cycles occurring within 1990 – 1994, 1994 – 1998, and 1998 – 2004?
2. To what extent had multicultural perspectives been incorporated in the goals and objectives of the 2005 – 2006 adoption textbooks compared to the goals and objectives found in the textbooks of the earlier adoption cycles occurring within 1990 – 1994, 1994 – 1998, and 1998 – 2004?

3. To what extent did the nature of representations of indigenous knowledge included in high school biology textbooks adopted in 2005 – 2006 compare to the representations of indigenous knowledge in the textbooks adopted in the cycles occurring within 1990 – 1994, 1994 – 1998, and 1998 – 2004?
4. To what extent had representations of indigenous knowledge, including people, events and related vocabulary, been incorporated into the content of high school biology textbooks adopted in 2005 – 2006 compared to the earlier adoption cycles occurring within 1990 – 1994, 1994 – 1998, and 1998 – 2004?
5. To what extent did the illustrations and photographs of non-Western science relate in quantity and quality to visuals of Western science in the 2005 – 2006 textbooks compared to the earlier adoption cycles of 1990 – 1994, 1994 – 1998, and 1998 – 2004?

A variety of strategies were incorporated to effectively address the research questions. A tally was used to determine the frequency as well as kind of indigenous representations occurring in each of the units of the textbooks in the sample, and an archeology of statements, created from information collected in the tally, was used to examine the nature of representations in the subtext of ideological and textual features. A review of the general format of teacher editions allowed the researcher to determine inclusion of multicultural content within the overarching program goals and themes. The number of multicultural components, identified by descriptors, were determined and then examined for their degree of relation to the science content found within the chapter or section objectives.

The Evaluation Coefficient Analysis (ECO), an instrument developed to measure bias in textbooks, was used to compare the number of multicultural terms to Eurocentric terms found in the two of the 10 textbook units considered most likely to support indigenous knowledge representations and alternative ways of knowing: *introduction to biology* and *ecology*. The multicultural vocabulary list and the Eurocentric vocabulary list each contained three subsets of terms: *nature of science*, *ecology* and *indigenous representations*. Coefficients were calculated for each subset and compared within and among the four sets of texts in the sample.

Visuals, illustrations, and photographs were tallied as to containing human or non-human content. Visuals classified as human were further categorized as aerial, adult, child, or appendage. Visuals were also examined to determine percentages of male and female depictions as well as white and non-white depictions per child or youth and adult figures. Human images were also evaluated with regard to degree of activity as *active* or *passive*.

Limitations of the Study

A primary limitation of the study remained that the sample was inclusive and not random and was restricted to textbooks adopted by one state, Florida, from 1990 – 2006, which limited the findings to this time frame and context for any broader use by interested parties within the state. In addition, the textbooks were grouped into four sets based on the adoption cycles that occurred from 1990 – 2006, and none of the texts in the inclusive sample appeared in all four of the sets. Oram with *Biology Living Systems*, Milani et al. with *An Ecological Approach*, and Miller and Levine with *Biology* represented the three author groups and respective texts that appeared on at least three of the four set lists found in the sample. Not having textbooks representative of each of the four sets limited explicit comparison of content from later editions to earlier editions across the adoption cycles.

A second limitation of the study also related to the sample with regard to the expected range of content in the textbooks selected for the study. As previously mentioned in the literature review, the concept for the proposed research was based primarily on the work of Ninnes (2000; 2001a; 2001b; 2003), who selected textbooks known to contain the quantity and quality of indigenous representations necessary for the depth of comparisons planned for his various investigations. For this particular study, the quantity and quality of indigenous representations proved an unknown and ultimately varied greatly by individual textbook as well as by set. As a result, the limited quantity of collective indigenous content that was tallied posed a challenge for the researcher to create the degree of depth in evaluation comparable to Ninnes (2000; 2001a; 2001b; 2003), especially for the archaeology of statements where ideological and textual features were key to the analysis.

Moreover, the very nature of the textbooks, including aspects of the adoption process, served as a third limitation in this study as not every possible socio-cultural issue within society, particularly those issues that might readily promote inclusion of indigenous knowledge representations, could be covered by science textbook content. Indigenous knowledge representations may appear limited or be left out entirely of the content due to space restrictions, pressure to align to state standards, or lack of vocabulary within the context of indigenous knowledge that appear on the designated checklists or among other criteria used by textbook publishers to determine content for textbooks (Whitman, 2004).

A fourth limitation stemmed from the Evaluation Coefficient Analysis (ECO) and the associated vocabulary lists, which posed a question of objectivity with regard to the selection of terms. Although all of the Eurocentric terms were taken from one source, *The New Dictionary of Cultural Literacy* (2002), the terms for the multicultural list were selected from a variety of sources including current research and scholarship within the scope of multicultural science education. Indigenous knowledge concepts do not easily translate into equivalent phrases, terms and vocabularies understood from the lens of Western Modern Science. Selection of appropriate terms to match indigenous knowledge concepts for science and the natural world posed a challenge as often no word or translation existed for the concepts held by indigenous thought. The subsets themselves, due to necessity, were crafted with terms aligned with Western Modern Science (WMS), and the researcher has been schooled from WMS perspectives. In addition, several of the key indigenous terms related to abstract concepts, and an attempt to secure a pure vocabulary word or phrase proved difficult.

A fifth limitation stemmed from the restriction of two of the measures used in the study to the units *introduction to biology* and *ecology*. Although the basis for this decision aligned with the purpose of the study and was supported by current research, the tallies indicated indigenous knowledge representations in other units including high frequencies for *plants*, which was not selected for the Evaluation Coefficient Analysis (ECO) or the visuals and illustrations segment of this study. As the ECO and the tally of the illustrations did not include analysis of all of the units in each textbook in the sample, there remained the possibility that multicultural vocabulary and indigenous depictions could have been incorporated in other parts of the text besides *introduction to biology* and *ecology* and, as such, were not recorded.

Lastly, one researcher conducted this study. Although the assistance of additional coders allowed for establishment of interrater reliabilities, the fact that one researcher conducted the primary research effort and served as the sole reporter of the results of the findings posed the possibility for recording error and the potential for bias. Every effort was made on the part of the researcher to ensure that the investigation represented the academic quality in its research, methodology, and reporting indicative of the expectations of the Graduate School.

Discussion of Findings

Indigenous Knowledge Tally

In general, indigenous knowledge representations in all four sets for student and teacher editions appeared with the highest averages in *plants* and *ecology* compared to the other units with the exception of teacher editions in Set 2, which also had high representations in *microbial world* and *vertebrates*. The high frequency of inclusion of indigenous content for *plants* and *ecology* was expected since current literature paralleled these two, couched in the broader category of Western Modern Science (WMS), with the knowledge base generated in indigenous ways of knowing the natural world (Snively and Corsiglia, 2002).

Since the number of texts varied for each set, calculations of averages served to facilitate the discussion of findings for comparisons across all four sets. For example, if one considered the average number of units that contained indigenous content for each set for both the student and teacher editions, there was an increase in representations among the sets, which occurred from Set 1 to Set 3, with a slight decrease in Set 4 for student editions and a larger decrease in Set 4 for teacher editions. In other words, the indigenous knowledge content, on average, increased until the final adoption cycle where the amount of indigenous knowledge content decreased.

If the same averages were considered again, with the exception of the texts in Set 1, the teacher editions had much more indigenous content compared to the to the student edition counterparts. As example, teacher editions for Set 4, from the consideration average number of recorded units with frequencies of content, had almost twice the content compared to the student editions. Set 3 teacher editions, on average, had more than double the content. Set 2 teacher editions, on average, had two-fifths more content than the student edition counter parts.

Since none of the textbooks appeared on all four adoption sets, comparisons of individual texts across all four cycles, as previously noted in the limitations of the study, were not possible and identifiable trends at this level were limited. However, there were several texts that appeared on three of the set lists that permitted noteworthy observations for discussion. Oram, as example, authored a series of texts for Glencoe called *Biology Living Systems*, and the text appeared as the 6th, 7th, and 8th editions for 1989 (Set 1), 1994 (Set 2), and 1998 (Set 3), respectively. The 6th edition was designated for general *Biology I* and the 7th and 8th editions moved to *Biology I Honors*. The 6th edition had very little indigenous content, but the 7th and 8th editions represented two of the texts in the sample, both student and teacher editions, that contained some of the highest recorded frequencies of indigenous content in the inclusive sample. Frequencies for Oram 2-5 and Oram 3-10 were the same number occurring in the same units indicating no change in content. The major changes between the 7th and 8th editions occurred not in the frequencies or kinds of representations but in the labeling for the multicultural content as well as the incorporation of multimedia instructional tools in Oram 3-10. Although the content was the same, Oram 2-5 used the phrase *multicultural connection* and Oram 3-10 used the phrase *cultural diversity* as labels for the textboxes that included multicultural content.

Florida adopted three versions of the BSCS series that appeared in the inclusive sample of texts, and *An Ecological Approach* Green Version appeared in the first three sets as the 6th, 7th and 8th editions for 1987, 1992, and 1998, respectively. *A Molecular Approach* (1990) and *A Human Approach* (1997) version appeared in Set 1 and Set 3, respectively. *An Ecological Approach* appeared as an honors level text for Set 1 and Set 2 but not for Set 3. Since *An Ecological Approach* appeared in three of the sets defined for this study, the findings for this text across the sets are reviewed here. The text had limited frequencies of indigenous content across the three sets for both the student and the teacher editions, with representations in *microbial world*, *plants* and *ecology* for all three sets and the addition of *vertebrates*. *Microbial world* for the student and teacher editions dropped in frequency by two-thirds from Set 1 to Sets 2 and 3; the frequency for *plants* for the student and teacher editions remained the same for all three sets. *Ecology* dropped in frequency by almost half from Set 1 to Set 2 and remained the same in Set 3 for the student edition; *ecology* decreased in frequency by one-third from Set 1 to Set 2 and then increased by one-third in Set 3.

Miller and Levine authored a series of texts for Prentice Hall called *Biology*, and the text appeared as the 2nd, 4th, and Florida 1st editions for 1993, 1998, and 2006, respectively. The 2nd edition and the Florida 1st edition were designated for general *Biology I* and the 4th and edition moved to *Biology I Honors*. Miller and Levine's student editions had very little indigenous content across all four sets; the teacher editions increased from Set 2 to Set 3 and then decreased by Set 4. *Genetics*, *evolution* and *invertebrates* remained the units that did not have indigenous content for the Miller and Levine texts across all sets. This trend in decrease in indigenous content by Set 4, coupled with same type of trend found across the sets when averages were compared, suggested that the necessity to prepare for FCAT may have forced a reduction in multicultural content.

The emphasis on FCAT preparation remained the noteworthy change in the textbooks in Set 4, and Miller and Levine's *Biology* Florida 1st edition provided a standard example of the heavy emphasis on Florida Comprehensive Assessment Testing (FCAT). The authors addressed the teacher on the opening page of the text with the following:

> Our students, as citizens of the most powerful and scientifically advanced nation in the world, must have both the knowledge to master new technologies and the insight to use them wisely…The Sunshine State Standards were woven into our plans for each chapter, ensuring that your students will cover the materials they need to succeed. We've also examined the FCAT requirements closely, and we have incorporated aids for student success into the program (T2)

The teacher interleafs (found as pages FL T1 – FL T69) continued with a section devoted to Sunshine State Standards course progressions charts; links to language arts and mathematics standards; pacing guide with time range and benchmarks with annual benchmarks highlighted in blue; scope and sequence of benchmarks for the *Biology*

Florida 1st edition text; inquiry skills chart with pages numbers for the labs and activities as well as captions and assessment questions that support the skills; charts with the Sunshine State Standards and links to the types of questions found on the FCAT (multiple choice, gridded response, short response, or extended response) that are used to assess the specific benchmark; roadmap to FCAT success that further emphasized the types of questions found on the FCAT as well as how to use the textbook to support FCAT preparation.

Across all sets in the sample, the kinds of indigenous representations primarily occurred between two categories: technologies and cultural practices/social life. Although a wide variety of examples were provided among the texts, there emerged a pattern of the types of representations. The technologies that appeared consistently were the use of the toxins in the frog's skin for the creation of poison-arrow darts, which appeared most often in the section of text dedicated to amphibians in *vertebrates*; the medicinal value of plants, which appeared most often in any section or chapter of *plants*; and the use of horsetails (or scouring rush) as pot scrubbers, which also occurred in *plants* within the section dedicated to primitive vascular plants. The cultural practices that appeared most consistently were corn as sacred or symbolic to Native American tribes, which appeared primarily in *plants*; the use of feather or animals in rituals, which appeared most often in *vertebrates*; and peyote or any other hallucinogenic used in rituals or rites of passage, which appeared in *microbial world*, *plants* or *human biology*, depending on the text.

The fact that many of the textbooks did not have authors or content reviewers who were professionals trained in aspects of multicultural perspectives or had any kind of expertise in diversity issues may account for the lack of range in the types of indigenous representations. In addition, several of the examples of indigenous representations, recycled by the various publishers over the years, appeared among all of the sets within different textbooks. This practice of recycling commonly accepted representations may be a product of a textbook industry geared to focus on quantity rather than quality, and appropriating the commonly accepted images of various groups in society may hold as the path of least resistance, economically as well as politically, to get a textbook on an adoption list.

Teacher Editions

Although the teacher editions in the sample were more likely, on average across the sets, to increasingly include what was identified as multicultural components, from the perspective of the general format, only eight of the texts in the sample had over-arching program goals or objectives that supported multicultural content. In other words, multicultural content was identified in the teacher editions, but the content was neither linked to the general purpose, theme, philosophy or program goal(s) espoused by the author nor included in the pacing or planning guides identified in over 60% of the sample. The eight teacher editions found to incorporate multicultural perspectives or diversity within the program goals or themes were included in either Set 2 or Set 3, which were also the two sets with the highest proportions of multicultural components per teacher edition.

Only two of the teacher editions in Set 1 were identified as containing multicultural components. This finding along with identification of an extreme limit in the number of descriptors and associated multicultural content indicated that Set 1did not provide adequate multicultural and diversity content. This would be expected as none of the authors in Set 1 addressed multicultural perspectives as a program goal or theme, and there were no multicultural content reviewers for the limited content that did occur. In addition, most of the books in Set 1 had publication dates of the late 1980s, prior to the time that multicultural science education appeared as a primary focus in the science education literature base.

Set 1 findings may better serve as a baseline from which to compare the remaining sets. With the exception of Kaskel 2-2 and Miller 2-4, all of the other teacher editions in the sample were noted to have multicultural content included in each of the 10 units in the text. There appeared no trend or pattern in the distribution of multicultural content among the units in the teacher editions. However, the incorporation of multicultural content was found to occur in two main formats: as teacher interleafs placed as the beginning pages of the unit or as textboxes in the margins of the pages with the label *multicultural perspective* or *multicultural connection*. The content connection to the chapter, section, or unit purpose or objectives was rarely determined, and the purpose for the multicultural content was seldom expressed. These findings also supported the conclusions of Eide and Heikkinen (1998), who examined the extent of multicultural content and its relationship to the science content in the teacher editions in middle school science.

The change in the number of multicultural components found to support the science objectives identified for the chapter or section of text revealed a noteworthy trend. A revisit to Table 26 showed that 10% of the multicultural content identified in Set 2 was directly related to the science objectives, with a drop to 5% in Set 3, and then an increase to 23% in Set 4. This remained an interesting finding since Set 4 also represented the sets of textbooks with a heavy emphasis on standardized testing and FCAT preparation. There appeared to be an increase in quality as determined by the increase in percentage of high relation of content to the stated science objectives. This finding could represent an indication of an increased effort by the publishers to examine the quality of content as well as a subsequent reduction of curricular emphasis that did not lend itself to the purpose of the objectives written for the text. However, the prominent theme in Set 4 remained standardized test preparation. Findings in the Miller and Levine *Biology*, as the only text to represent inclusion in three consecutive sets ending with Set 4, suggested a reduction in multicultural content across adoption cycles. As example, Miller 2-4 had two components with one descriptor. By Set 3, this number had increased to 121 with three descriptors in Miller 3-11, and by Set 4, this number had decreased to 75 with one descriptor in Miller 4-4.

The findings in the Miller texts also led to an important to note with regard to the nature of the descriptors. English as a second language, the most frequent descriptor in the Miller and Levine texts and the second most frequent descriptor located in the inclusive sample, qualified as an identifier of multicultural content. There was no way of knowing the intent by the authors of this designation, and herein lay one of the challenges with multicultural science education: *What constitutes multicultural science education?*; *What is its purpose?*; *Whom will the content serve?* A revisit of Hodson (1999) suggested that multicultural science education: 1) represents a set of instructional strategies to help teachers address issues with diversity in the classroom; 2) stands as curriculum that targets ethnic minorities in an effort to raise self-esteem and to reduce feelings of alienation or exclusion from opportunities in science; 3) provides an approach for raising awareness of forms of discrimination within science and science education. To determine whether or not this content addition was meant to introduce opportunities in science to those traditionally disenfranchised or to serve more as an instructional strategy to help struggling learners (or even meet a mandate for more ESOL content) was not part of the scope of this study but warrants further investigation as researchers examine not only the purpose for inclusion of multicultural science content but also the importance textbook publishers and other stakeholders place on including content that supports culturally relevant learning aimed at reducing the achievement gap and preparing human capital for the demands of the scientific enterprise in the 21^{st} century.

Archaeology of Statements

Although notions of authenticity or traditionality rarely occurred in any of the textbooks in the sample, the representations of indigenous knowledge were increasingly found, on average, to use generalizations to identify groups across the sets until Set 4, when the number of homogenizing terminologies dropped by about 60%. This is drop was expected as the ECO mean coefficients, addressed in the results section of the study, showed a decrease by Set 4 in the *indigenous representations* subset. If there was less indigenous content, possibly driven by the need for FCAT preparations, then there remained less opportunity to homogenize the represented groups under designations such at Native Americans or aboriginals. There were also very limited instances of universalizing language due to the lack of depth of inclusion of content.

Examination of the textual features of the texts created a challenge for the researcher due to the lack of depth and detail pertaining to the indigenous content as well as its typical placement in the teacher editions. With regard to verb tense, many of the textbooks used present tense more often in reference to an extant technology or practice, but these occurrences were limited and, again, found primarily in the teacher editions. When the student editions presented significant amounts of text (as depicted on half a page or more) relating an indigenous knowledge, it was most often a short narrative describing a legend or myth in the past tense or a brief biography of a biologist or other science professional either living or deceased. Although one-fourth to one-third of the statements balanced the past indigenous knowledge with a contemporary counterpart, one half to one-third of the representations among the sets placed the indigenous knowledge representation in the past as a historical anecdote. As much of the content related indigenous knowledge as factual tidbits removed from the context of the material in the textbook, any effort at introducing indigenous knowledge representations may be perceived as a trivial pursuit approach to knowledge acquisition.

Although the lack of content posed an obstacle with regard to meaningful analyses of textual features, the more prominent challenge remained physical location of content in the textbooks. Almost all of the statements in the archaeology were taken from the sections of text found in textboxes, which isolated the representation contextually from the remaining content, or from the margins of the pages in the teacher manual, which again removed the content from context, in this case, of the information found in the student edition. Although Ninnes (2003) discussed the “status elevation or privileging of scientific knowledges at the expense of indigenous and minority knowledges” (p. 177) by the spatial arrangement of the text on the page, the challenge with the sample of texts in this study remained that often the location of indigenous content occurred in the margins of the teacher editions. Students would not have the opportunity to experience this knowledge as peripheral to the science content or as a curiosity or oddity. Rather, it would be the teacher who experienced these content additions as "oddities," and it may be of import as to how these perceptions would affect the teacher's inclusion or use of the content. In addition, by treating indigenous representations in the textual manners outlined by Ninnes (2003), that is, high use of generalizations, knowledge as historical anecdotes, and special relegation to a few sentences or in textboxes, the authors of these textbooks have served to reinforce the idea of token content and limited any opportunity for a critical examination of different ways of knowing. An important caveat here not yet addressed remained that *introduction to biology* represented one of the units with the least amount of indigenous content and with the most potential for a meaningful examination of alternative ways of knowing. Every introductory unit identified in the sample discussed the nature of biology or the nature of science in the subtext of a scientific method or science as a way of knowing the natural world. The absence of indigenous representations as alternative ways to knowing may have served to position Western science as the superior knowledge system.

Evaluation Coefficient Analysis (ECO)

Although the Evaluation Coefficient Analysis (ECO) showed no solid trend in favorable incorporation of terms deemed supportive of multicultural or indigenous content, some noteworthy findings pertained to comparisons of the three series of textbooks that appeared in at least three of the sets of texts in the sample. The coefficient in Oram's *Biology Living Systems* (Glencoe) increased in the subset *nature of science* and decreased in *ecology* for the student and teacher editions by about 20% and 8%, respectively, and decreased in *indigenous representations* for the student and teacher editions by about 35% and 38%, respectively. Coefficients in *nature of science* for the Milani et al., *An Ecological Approach*, increased from 0.00 for student and teacher edition in Set 1 to 30.00 for student and teacher edition in Set 3. *An Ecological Approach* added a new first author in Set 3, so the text designation appears as Cairney 3-5 but represented the same text as Set 1 and Set 2. For *ecology*, the coefficient more than doubled for student and teacher edition from Set 1 to Set 2 and then dropped by about 10% from Set 2 to Set 3. Coefficients for *indigenous representations* were the same for Set 1 and Set 2 for both student and teacher editions. By Set 3, the coefficients for *indigenous representations* had reduced to 0.00 for the student edition and reduced by almost half for the teacher edition. This marked reduction by Set 3 for *An Ecological Approach* series may have been the result of the addition of a new lead author, implying the possible influence of authors with regard to content.

The change in Miller and Levine *Biology* across the sets revealed an interesting trend. The coefficient for *nature of science* was 0.00 for Set 2 and Set 3 for both the student and teacher edition with an increase to 9.59 and 7.61 for student and teacher edition, respectively. *Ecology* and *indigenous representations* increased from Set 2 to Set 3 for both student and teacher editions; by Set 4, coefficients for both subsets were reduced for student and teacher editions with the most notable difference occurring with respect to *indigenous representations*. For the student edition, the vocabulary relating indigenous concepts was reduced by two-thirds. For the teacher editions, the vocabulary relating indigenous concepts was reduced by almost half. Again, Miller 4-4 represented a complete overhaul of content to realign with FCAT, a high-stakes test linked to NCLB mandates, and the researcher would suggest the influence of FCAT and its directive under NCLB as one possible reason for the reduction in indigenous content.

Although the results previously reported a reduction in the incorporation of indigenous vocabulary across the sets when the mean coefficients were examined, a noteworthy consideration here shifts emphasis to the *nature of science* word list. The texts produced from the BSCS series were more likely to report a coefficient in *nature of science* and were more likely to include the multicultural terms such as *value* and *respect*. Upon further examination of the types of words identified for use on the vocabulary lists, the resulting coefficients for *nature of science*, particularly in Set 4, were due to utilization of the term *qualitative* as it compared to *quantitative*. However, the inclusion of *qualitative* was less about the multicultural perspective it might add and more about a position of *quantitative* as the superior form of data. As example, Postlethwait 4-5 only incorporated *quantitative*; there was no mention of *qualitative*. For the other texts, a thorough discussion of *quantitative* occurred with mention of *qualitative* as a means for describing data. As example, Biggs 4-2 offered students the following with regard to qualitative information: "Observational data – that is, written descriptions of what scientists observe – are often just as important in the solution of a scientific problem as numerical data" (p. 20). A look at the words most represented on the Western science list in the subset of *nature of science* included high incorporation of *evidence*, *hypothesis, theory, models,* and *tools.* Although multicultural vocabularies with regard to the *nature of science* were notably absent, the heavy use of Western science terminologies framed among frequent presentations of scientific knowledge acquisition typified by forming hypotheses, performing experiments, and collecting evidence may further serve to privilege Western knowledge over alternative ways of knowing (Ninnes, 2003). Moreover, this absence of indigenous representations, as previously noted, removes the potential for critical examinations of knowledge systems inherent in the very nature of science.

Another important finding in relation to vocabulary related to the kinds of words which appeared in the subset *ecology* across the sets. Since the literature coupled Western science and indigenous knowledge by using key terms and phrases such as *sustainability* or *sustainable development*, *agroforestry*, *agriculture(al)*, *biodiversity*, and *ethnobotany*, these particular terms were selected as appropriate for inclusion on the ECO *ecology* subset (Carter, 2008; International Council for Science, 2002; Pierotti and Wildcat, 2000). *Agriculture*(al) appeared as one of the most commonly used terms from the multicultural subset *ecology*. *Sustainable* and *sustainability* did appear in various texts within each set, with increased inclusion by Set 3 and Set 4. However, the increase was from one or two words per text to eight or ten per text. This remained a noteworthy finding since issues with sustainability of natural resources, as example, provide one area in the biological sciences where Western Modern Science and indigenous knowledge find similarities, representing an important curricular link to the meaningful incorporation of indigenous knowledge representations. Environmental concerns of the 21st century open classroom learning to relevant and real world problems with a greater chance of creating opportunities for science for all. More importantly, the limited use of terminologies in textbooks that hold the most potential for this type of association may signify that textbook publishers do not understand who will be represented in the prime age workforce, that is, minorities and other underrepresented groups that historically have not had access to opportunities in science.

Visuals and Illustrations

Although the research question related to the visual/illustration segment of the study was established to determine the extent of indigenous representations in relation to Western ways of knowing, the findings were limited with regard to photographs or visuals that depicted alternative ways of knowing or indigenous groups involved in any type of activity. As such, the results remain more appropriately interpreted from the lens of Western Modern Science as dominated by white males. From this perspective, the textbook may serve to exacerbate the broader issues with regard to the achievement gap and minority access to science if the depictions of individuals who participate in the scientific enterprise remain predominantly white and male.

For the sample, most of the pictures were of adults (68%) with an average of 21% of the images depicted as children or youth, 6% classified as aerial, and 5% classified as appendages in the form of hands and arms. Of the adult images for the sample, 52% on average depicted whites, 29% depicted non-whites, and 19% were unidentifiable with regard to race. Of the images of children or youth, 39% depicted whites, 46% depicted non-whites, and 15% were unidentifiable with regard to race. Of the adult images for the sample, 57% on average depicted male figures, 34% depicted female figures, and 9% were unidentifiable with regard to gender. Of the images of children or youth, 38% depicted male figures, 45% depicted female figures, and 17% were unidentifiable with regard to gender. For this sample most of the pictures depicted adult white males and non-white, female children or youth. Many of the pictures of white males positioned these individuals in laboratories or at computers actively engaged in what could be called "doing science." These findings reflect similar results from the Powell and Garcia (1985) study on which this segment of the investigation was based.

Additional Findings

Although science-technology-society (STS) content was not specifically identified as a point of data collection for the study, there remained some interesting observations with regard to the inclusion of STS content worthy of mention. Twenty-seven out of the 34 books included various topics related to science-technology-society issues, and the examples of content found in each text were included in the results of the general format for the teacher editions. Upon application of Aikenhead's (1994) criteria, included in the literature review, for classifying categories of STS, the researcher determined that all of the STS content in the sample could be placed at level one – motivation by STS content. In this case, the content finds itself in "traditional school science [with] mention of STS content in order to make a lesson interesting…low status given to STS content explains why this category is not normally taken seriously as STS instruction [and] students are not assessed on the STS content" (Aikenhead, 1994, p. 55). Although there appeared an importance with regard to STS content exemplified by mention of the author's rationale for inclusion, level-one content, per Aikenhead's standards, would not promote the relevant science experiences, more specifically defined in terms of the border crossing addressed in much of literature. Most notably, this effort at inclusion implied the same token effort as suggested with regard to the multicultural content and supported the notion of superficial efforts to include multicultural content in science curricula.

Conclusions

Depending on the context of the study, the overall results pointed to an increase, or at least an effort at inclusion by the authors, in the infusion of multicultural content, including indigenous knowledge representations as one facet of diversity, with the most obvious infusion occurring in the quantity of multicultural components identified in the teacher editions. While this effort certainly produced a semblance of quantity of content for whatever purpose, that is, meeting mandates or supporting policy, its product remained lacking in quality when the content inclusion was considered from several perspectives supported in the results including spatial arrangement or content location in text, content connection to science objectives, and homogenizing language in reference to indigenous groups.

In revisiting the statement of the problem, which served to frame this investigation, the researcher was reminded of the call for improvement within the scope of science education as the creation of curricula and instructional materials that reflect a balanced consideration of all perspectives. Accordingly, this balance has not been accounted for in the findings, again calling into question the notion of quality versus quantity as a factor in the conclusions of the study. More importantly, the authentic sense of balance intended for this study related considerations of all scientific perspectives in terms of alternative viewpoints and ways of knowing the natural world. In this sense, an imbalance of what is valued also existed among the sample of textbooks, exemplified by the 1) types and nature of indigenous representations identified in the tally and archaeology of statements segments of the study, 2) low coefficients in the *nature of science* vocabulary subset within the ECO analysis, and 3) higher percentages of adult white males in the visuals and illustrations.

Although the textbooks in the sample introduced students and teachers to various indigenous knowledge representations, these were most often included as superficial one or two-sentence acknowledgements or as text relegated as a sidebar found in the margins of the pages. Inclusion at this level placed the indigenous content as tokens of multicultural perspectives that served to trivialize the alternative knowledge. Moreover, the authors in general made no attempt to address alternative ways of knowing indicative of indigenous knowledge, and indigenous knowledge content appeared to be included in the broader scope of addressing multicultural education rather than as a critical component to examining the nature of knowledge or nature of biology most often included in the introductory units of the texts.

Since the work of Ninnes (2001; 2003) served as the primary basis for this study, his findings with regard to the nature of representations of ways of knowing in texts would be most relevant to the conclusion of the study. Ninnes (2001) made very clear that these trivialized types of efforts at inclusion of indigenous representations work to subordinate other ways of knowing in a manner that privileges Western Modern Science and positions it as the authority or “correct” way of knowing and understanding the natural world. More importantly, he contended that the nature of the representations did not provide opportunity for students to question or challenge the authority of one way of knowing over another or to critically examine knowledge bases or assumptions made by either Western or indigenous claims. The overall findings in this study most certainly support this view.

The issue of quality versus quantity plays out in a different light when the results of the study are considered from the perspective of standardized testing, specifically the Florida Comprehensive Assessment Test (FCAT) for science, as well as the particulars of the textbook adoption process. Although the intent of this study was not to assess the influence of policy as exemplified by the Florida A+ Plan and *No Child Left Behind* or to determine the effect of procedures intertwined in adoption processes on content, the findings of this study suggested an interesting trend that caused this researcher to assert that standardized testing, under the broader directives of *No Child Left Behind*, may have trumped the inclusion of multicultural content as exemplified by the form and function of the textbooks found in Set 4.

Specifically, five of the six student and teacher texts in Set 4 had special Florida editions representing a shift in content, which was not observed in the first three sets of texts, to include heavy emphasis on standardized testing and test preparation. In addition, the one text in the study, *BSCS An Ecological Approach*, which appeared in the first three sets of textbooks, was no longer included in Set 4. Its thematic approach rather than generalized content organization for what is traditionally known as high school biology would not support the requirements of standardized test preparation necessitated by the push for coverage of content or breadth of study. Add to the mix the overall average reduction in multicultural content as well as the telling ECO coefficients previously discussed, with particular emphasis on Miller and Levine's *Biology*, and it may not remain too far off base to conclude that FCAT (Florida Comprehensive Assessment Test) trumped IK (Indigenous Knowledge).

An appreciation of date and time may also work to explain some of these findings. Citing the *A+ Plan* in conjunction with *No Child Left Behind* as means to hold students and teachers accountable for learning, the Florida Department of Education provided the following in regard to FCAT science testing:

> The A+ Plan for Education, passed by the Florida Legislature in 1999, required a science assessment for students in Grades 5, 8, and 10. In 2000, development of science test items began…In 2003, FCAT Science was operational for the first time for all students in Grades 5, 8, and 10. In 2005, FCAT Science was administered to Grade 11 students, rather than Grade 10 students, in response to requests by Florida science educators to allow an additional year for students to receive high school-level science instruction (FLDOE)

In 1999, Florida began the emphasis on testing in the subject of science as a component of its *A+ Plan*. *No Child Left Behind* entered the equation at the start of 2002 with a focus on math and reading with science added in 2003. Since the latest publication date in Set 3 was 1998, the textbooks in Set 4 held the most potential for influence by any policy and subsequent directive that concerned standardized testing and, as it would appear, the textbook publishers followed suit with the creation of designer books crafted especially for FCAT Florida. In addition, this emphasis on preparation for standardized testing, the measure that makes or breaks the achievement gap, shifted focus to the educational needs of a student population not only increasing in minority membership but also expected to represent the human capital necessary meet the labor demands of the scientific enterprise.

The National Science Teachers Association (NSTA) represented one of the many organizations with a vested interest in science education, including science curricula and instructional materials. In 2000, the NSTA Board of Directors issued a position statement on multicultural science education that included the importance of developing science curricular that addressed the “contributions of many cultures our knowledge of science” (NSTA, 2000). Yet for this study, the findings would not necessarily confirm NSTA’s position. Although there was a general trend in increase in the inclusion of multicultural content, this trend did not occur consecutively throughout the study, and by Set 4, the textbooks not only decreased in multicultural content but also shifted focus to standardized testing. An interesting exception to this finding occurred in the one textbook in Set 4, Parke 4-1, which did not represent a Florida FCAT edition. Parke 4-1 also had no emphasis on any kind of standardized testing and the highest number of multicultural components of any of the texts in Set 4.

The content analyses of Wartenberg (1997) and Hansen (2005) add an interesting perspective to the considerations of policy influence. Both of these researchers confirmed an overall attempt by authors and publishers to include multicultural content in a sample of textbooks representing the respective subject areas of history and language arts. More importantly, both of these researchers, in an attempt to determine the overall influence of public policy supporting multiculturalism on the content of textbooks, determined a limited influence by these policies on the quantity and quality of multicultural content found within their respective sample of textbooks. Superficial policies appear to bring superficial change, and the directives meant to promote transformation of content exist more likely as mere reflections of the very tokenism they perpetuate. Perhaps *NCLB* has had more influence on textbook content than NSTA and its position statement on multicultural science education or any other policy, mandate or directive meant to challenge and improve the multicultural content in textbooks.

Implications

The texts in this study fall short of any attempt to approach the topic of alternative ways of knowing, an observation supported by the extremely low coefficients in the ECO analysis within the *nature of science* subset, which measured the inclusion of vocabulary related to indigenous perceptions of the natural world. The contrast in the use of *quantitative* and *qualitative* as previously described provides an appropriate example in support of this conclusion. Indeed, part of the challenge, which may have influenced the ability of the ECO multicultural word list to accurately reflect indigenous terminologies that relate to the natural world, remained an issue of translation, that is, indigenous concepts are difficult to capture in words or phrases that would make sense to someone versed in science from the Western perspective. In fact, it has been suggested that there is no word in the language base of indigenous peoples that can translate to mean *science* understood from Western perspectives (Cajete, 1986). In an effort to align the two perspectives, the implications for meaningful translation of indigenous knowledge concepts into Western terminologies may force more of an appropriation of a concept into one perspective rather than creation of an opportunity to critically examine similarities and differences between the two.

Lost in translation or not, the very nature of indigenous knowledge may also serve as its own worst enemy from the standpoint of important discoveries in the life sciences with in the last 150 years. Hirsch made clear the two events that influenced his selection of the terms to be included in the life sciences section of his *New Dictionary of Cultural*

Literacy (2002): the publication of Darwin's *Origin of Species* and the discoveries in genetics that included unlocking the structure of DNA and completion of the Human Genome Project. These events represented an important shift from "studying organisms as a whole to studying the complex chemical processes inside the cell" (Hirsch, 2002, p. 523). Indigenous knowledge remains rooted in an aspect of the whole, yet most of the high school biology textbooks in the sample framed the content from the cellular and genetic contexts outlined by Hirsch (2002). In addition, much of what appeared as STS content in the sample incorporated topics relating to cellular biology, and a survey of these indicated that for every one STS topic with an ecological concept, there occurred at least three that focused on biological issues at the cellular or genetic level.

Several implications arise here. In order to meet the needs of teachers and students, instructional materials, specifically the textbooks, may warrant an overhaul in the approach to the presentation of science content – one that moves away from the standard system of unit division which paints biology as a series of subsets of discrete content areas in cells, genetics, microbes, fungi, plants, animals, and humans. Students whose views of the natural world align more closely with holistic perspectives will need textbooks with content that frames the study of biology from the whole organism. These students will also need rigorous science experiences of the quality provided by science-technology-society (STS) teaching that create a relevance indicative of their worldviews. More importantly, if the STS content identified in the sample continues to represent level-one efforts by Aikenhead's standards, then the science experiences provided to students may serve as mere instructional strategies that help teachers address diversity issues in the classroom. Although this may represent a worthy goal, Hodson (1999) has suggested, as previously outlined in the background of this study, that this particular purpose for multicultural science education represents educational practices that align with an assimilationist approach to learning science.

For quality of content, there must be quality of input. Most of the textbooks in this study had no content reviewers with expertise or training in multicultural or diversity issues. Yet to effectively include indigenous content, there remain broader implications that stem again from the nature of the knowledge itself as well as the intent by authors or publishers to include indigenous knowledge in textbook content. Ninnes (2000) pointed out that within specific indigenous societies, “only certain people have the right to know particular pieces of knowledge” (p. 613). Critical to the development of quality indigenous knowledge content includes the contributions that come directly from members of indigenous societies, which also creates challenges to the traditional means of developing textbook content. Indigenous peoples recognize that their knowledge systems evolve and change constantly. Any textbook designed to incorporate these knowledge bases would need to be revisited and redesigned with a regularity that runs counter to “quantity imperative” (Whitman, 2004. p.33) of current textbook adoption processes.

A plethora of conceptions and misconceptions exist in the literature with regard to multicultural science education, including a specific aspect of that education known broadly as indigenous knowledge. There seems to be a desire to link indigenous knowledge with pseudoscience, and it remains possible that part of the misconception stems from spirituality, a notion that holds implication for effectively incorporating quality indigenous content into science curricula. Spirituality represents a key value in indigenous knowledge; it is integrated into the social and cultural practices of indigenous peoples (Cajete, 1986). Notions of spirituality, tribal religions and shamans make indigenous knowledge an easy target for the pseudoscientific designations most deserving of creationism and intelligent design. Indigenous knowledge is not a pseudoscience, and clear definitions of all three concepts – indigenous knowledge, Western science, pseudoscience – remain significant in order for indigenous representations to find an appropriate place in a science curricula expected to produce students who can meet the workforce demands of a scientific and technologically based world.

Recommendations to Publishers

Tyack and Cuban (1995) have noted that "laws, institutional custom, and cultural beliefs [have] worked together to hold the grammar of schooling in place" (p. 85), and those same laws, institutional customs, and cultural beliefs work to hold together a textbook publishing industry faced with the challenges of trying to please all of the people all of the time. Although the textbook ideally represents just one facet of a student's experience in school, researchers suggest the textbook will remain as the central instructional resource in the nation's classroom, and the ability of science textbooks to be all things to all teachers remains questionable, especially in consideration of quality materials developed to enhance multicultural science education. The process of textbook creation, however, has become the "quantity imperative" (Whitman, 2004, p. 33) with its associated economic rewards for those who meet the content mark. One recommendation to publishers and other involved in adoption processes falls in line with Whitman's (2004) findings: focus on quality of content. An imperative in the ability of teachers to facilitate culturally relevant science experiences depends on the development of textbooks that illustrate the contributions and ways of knowing indicative of non-Western cultures. Partnerships with individuals versed in multicultural science education scholarship as well as individuals directly linked to the content, that is, those who have membership in indigenous societies, should not only be developed but also maintained in a manner that promotes continual evaluation, dialogue regarding, and update of included content. Quality of content could also be increased with a curricular focus that underscores one specific indigenous group, giving that group an identity in contemporary society and moving away from the homogeneity and authenticity often linked to portrayals of indigenous groups. Again, an important caveat to developing this identity in a meaningful way includes collaborative efforts that involve indigenous peoples, acknowledging that in "some indigenous societies only certain people have the right to know particular pieces of knowledge" (Ninnes, 2000, p. 613). In this case, sensitivity for the need to secure proper permissions to obtain and share that knowledge would circumvent charges of appropriating that knowledge to suit the economic or other intents of the publishers and the overarching textbook industry (Ninnes, 2000).

If the textbook is indeed the primary instructional tool used in the classroom, then adoption policies, if currently set up in a manner that prevents major overhaul of content, need to be amended to allow the teachers or schools to add textbooks to any state-approved list. A set of approved books from which to choose assumes that a teacher can identify one ideal textbook to meet all of his or her classroom needs and forces a cookie-cutter approach to students and learning. Teachers should have access to a plethora of sources for use in the classroom and should be able to add a text to the list of approved resources when appropriate.

If the economic and political forces at work in the publishing industry prevent a major overhaul of the textbooks, then straightforward directions for the teacher as to how to effectively relate the included multicultural content to the science objectives would facilitate meaningful learning for all students. In addition, the removal any content found to show no relation to the stated science objectives or intent for the chapter or section would work to remove the stigma of indigenous representations as token content. When a pacing or planning guide is provided for the teacher, the multicultural content should be included and appear as part of the instructional map for the unit or chapter. The *ecology* unit, most likely to support indigenous content and most often found at the back of the book, should be moved toward the front of the text. Units that find themselves relegated to the back of the text face greater likelihood of not being covered in the school year due to time constraints.

Recommendation to Researchers

As the nation's classrooms will certainly continue to evolve in terms of cultural diversity, the question as to *how science curricula should respond to the presence of those students who represent the "non-Western, Indigenous, and minority group learners"* (Hines, 2003, p. 167) frames several directions for additional research, which address three key areas: multicultural science education, indigenous knowledge, and scientific literacy. Over the last two and half decades, the *how* piece of the puzzle has evolved into a variety of strategies, models, and practices, couched within the broad scope of multicultural education, meant to address the overall need for cultural approaches to science education. Efforts at content coverage, exemplified by indigenous knowledge representations, indentified as part of this study represent a component of this endeavor to create opportunities as science for *all*.

While much of the dialogue among the research focuses on the appropriate philosophy for science education, a consensus on how we define science within the broader scope of multicultural science education is missing. Without a clear definition of science in this capacity, the role of cultural approaches in classroom learning remains vague and plays out in the production of instructional materials limited in their capacity to support opportunities for meaningful science learning. One question for further exploration seeks the development of clearly defined parameters for a framework of multicultural science education and what it means to "do science" from that perspective. If the textbook serves as a possible support for this framework, how does the added multicultural content support learning science? Should this added content appear as instructional strategies to support inclusion of underrepresented groups or curricular content designed to promote critical examination of ways of knowing?

Although not a content component of the research questions planned for this study, science-technology-society (STS) was present in many of the textbooks in the sample. STS has also been identified in the body of knowledge regarding multicultural science education as a curriculum that supports culturally relevant learning and serves as the type of content that assists teachers in the border crossings needed as students negotiate the subculture of science. In this sense, STS may actually serve as a descriptor of quality multicultural content if the content, using Aikenhead's (1994) levels, can be classified at a four or higher. An avenue of research could include a reexamination of the STS content in the sample with emphasis on how the content could be moved to the higher levels designated by Aikenhead (1994). It may be useful to build on the work of Chiappetta, Fillman, and Sethna, who identified STS as theme of scientific literacy. The textbooks in this study could be examined from that theme, using the descriptors to identify STS content as a means to assess its ability to support multicultural science education.

Hodson (1998) has stated, with regard to different ways of knowing the world, that alternative knowledge bases are “not equal; they are different, and their value is that they provide alternative ways of understanding phenomena” (Hodson, 1998, p. 209). The findings in this investigation have shown that indigenous knowledge is indeed not equal – if equality is defined by the balance of inclusion of content. The findings have shown that indigenous knowledge is indeed different – so much so it warrants relegation as a sidebar. The findings have shown that indigenous knowledge has value – as a token pawn of multicultural education. Yet the report generated by the International Council for Science (2002) makes clear that “modern science does not constitute the only form of knowledge available to further the development of humankind” (p. 18). Research that investigates the history and philosophy of science as a means to highlight the contributions of indigenous peoples would represent one way to increase the content quality of appearing in textbooks. Again, a consensus of definition remains key and includes clear distinctions among indigenous knowledge, Western science and pseudoscience.

Perhaps one of the most critical research imperatives for understanding how science curricula should respond to the increasing presence of minority groups in contemporary classrooms stems from a comment that Hirsch (2002) relayed in the introduction to his

New Dictionary of Cultural Literacy:

> Scientific entries presented a special problem. Because there is little broad knowledge of science even among educated people, the criteria used to compile the lists for the humanities and the social sciences simply could not be used with the natural sciences. The gap between the essential basic knowledge of science and what the general reader can be expected to know has become too large (p. xi)

At the center of Hirsch's observation lay the concept of scientific literacy. The disparity in basic knowledge of science may manifest itself in tangible measures identified as the achievement gap, placing an important focus on the prime-age workforce, its racial makeup, and the number of potential workers qualified with the skills and competencies to meet the demands of science and technology in a global economy. How will the textbook and its content support the development of scientific literacy as an effort to reduce this gap? And are cultural approaches to learning science, including the incorporation of indigenous knowledge representations and alternative ways of knowing, the best way to address this gap?

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Appendices

Appendix A.
List of Textbooks

Set 1 (1990 – 1994)
Student Editions

Alexander, P., Bahret, M. J., Chaves, J., Courts, G., & D'Alessio, N. S. (1989). *Biology the living world*. Englewood Cliffs, NJ: Prentice Hall.

Goodman, H. D., Graham, L. E., Emmel, T. G., Slowiczek, F. M., Shecter, Y. (1989). *Biology*. Orlando: Harcourt, Brace, Jovanovich, Publishers.

McLaren, J. E., & Rotundo, L. (1989). *Heath Biology*. Lexington, MA: D.C. Heath and Company.

Milani, J. D., Erk. F.C., McInerney, J. D., McIver, P.D., Mayer, W. V., Slowiczek, F., et al. (1987). *Biological science: An ecological approach* (6th ed.). Dubuqu, IA: Kendall/Hunt Publishing Company.

Milani, J. P., Bradshaw, W. S., Storey, R. D., Swartzendruber, D., Taylor, M. R., Tolman, R. R., et al. (1990). *Biological science: A molecular approach* (6th ed.). Lexington, MA: D. C. Heath and Company.

Oram, R. F. (1989). *Biology living systems*. Columbus, OH: Merrill Publishing Company.

Schraer, W. D., & Stoltze, H. J. (1991). *Biology the study of life* (4th ed.). Englewood Cliffs, NJ: Prentice Hall.

Towle, A. (1989). *Modern biology*. Austin, TX: Holt, Rinehart, and Winston.

Appendix A. continued
List of Textbooks

Set 1 (1990 – 1994)
Teacher Editions

Alexander, P., Bahret, M. J., Chaves, J., Courts, G., & D'Alessio, N. S. (1989). *Annotated teacher's edition: Biology the living world*. Englewood Cliffs, NJ: Prentice Hall.

Goodman, H. D., Graham, L. E., Emmel, T. G., Slowiczek, F. M., Shecter, Y. (1989). *Annotated teacher's edition: Biology*. Orlando: Harcourt, Brace, Jovanovich, Publishers.

McLaren, J. E., & Rotundo, L. (1989). *Teacher's annotated edition: Heath Biology*. Lexington, MA: D.C. Heath and Company.

Milani, J. D., Erk. F.C., McInerney, J. D., McIver, P.D., Mayer, W. V., Slowiczek, F., et al. (1987).*Teacher's edition biological science: An ecological approach* (6th ed.). Dubuqu, IA: Kendall/Hunt Publishing Company.

Milani, J. P., Bradshaw, W. S., Storey, R. D., Swartzendruber, D., Taylor, M. R., Tolman, R. R., et al. (1990). *Teacher's edition biological science: A molecular approach* (6th ed.). Lexington, MA: D. C. Heath and Company.

Oram, R. F. (1989). *Teacher annotated edition biology living systems*. Columbus, OH: Merrill Publishing Company.

Schraer, W. D., & Stoltze, H. J. (1991). *Annotated teacher's edition biology the study of life* (4th ed.). Englewood Cliffs, NJ: Prentice Hall.

Towle, A. (1989). *Teacher's edition modern biology*. Austin, TX: Holt, Rinehart, and Winston.

Appendix A. continued
List of Textbooks

Set 2 (1994 – 1998)
Student Editions

Essenfeld, B., Gontang, C., & Moore, R. (1994). *Addison-Wesley biology*. Menlo, CA: Addison-Wesley Publishing Company.

Gottfried, S. S. (1993). *Biology today*. St. Louis: Mosby.

Johnson, G.B. (1994). *Holt biology visualizing life*. Washington, D. C.: National Academy Press.

Kaskel, A., Hummer, Jr., P. J., & Daniel, L. (1992). *Merrill biology an everyday experience*. Lake Forest, IL: Glencoe Macmillan/McGraw-Hill.

Milani, J. P., Leonard, W. H., Manney, T. R., Rainis, K. G., Uno, G. E., & Winternitz, K. A. (1992). *Biological science: An ecological approach* (7th ed.).

Miller, K. R., & Levine, J. (1994). *Biology*. Englewood Cliffs, NJ: Prentice Hall.

Oram, R. F. (1994). *Biology living systems*. New York: Macmillan/McGraw-Hill.

Schraer, W. D., & Stoltze, H. J. (1993). *Biology the study of life* (5th ed.). Needham, MA, Prentice Hall.

Towle, A. (1993). *Modern biology*. Austin, TX: Holt, Rinehart and Winston.

Appendix A. continued
List of Textbooks

Set 2 (1994 – 1998)
Teacher Editions

Essenfeld, B., Gontang, C., & Moore, R. (1994). *Teacher's edition Addison-Wesley biology*. Menlo, CA:Addison-Wesley Publishing Company.

Johnson, G.B. (1994). *Annotated teacher's edition Holt biology visualizing life*. Washington, D. C.: National Academy Press.

Kaskel, A., Hummer, Jr., P. J., & Daniel, L. (1992). *Teacher wraparound edition Merrill biology an everyday experience*. Lake Forest, IL: Glencoe Macmillan/McGraw-Hill.

Lumsden, A. S. (1993). *Teaching biology today*. St. Louis, MO: Mosby.

Milani, J. P., Leonard, W. H., Manney, T. R., Rainis, K. G., Uno, G. E., & Winternitz, K. A. (1992). *Teacher edition iological science: An ecological approach* (7th ed.).

Miller, K. R., & Levine, J. (1994). *Annotated teacher's edition biology*. Englewood Cliffs, NJ: Prentice Hall.

Oram, R. F. (1994). *Teacher wraparound edition biology living systems*. New York:

Macmillan/McGraw-Hill. *Annotated teacher's edition biology the study of life* (5th ed.). Needham, MA, Prentice Hall.

Towle, A. (1993). *Annotated teacher's edition modern biology*. Austin, TX: Holt, Rinehart and Winston.

Appendix A. continued
List of Textbooks

Set 3 (1998 – 2004)
Student Editions

Biggs, A., Blaustein, D., Kapicka, C., Kaskel, A., & Lundgren, L. (1998). *Biology the dynamics of life*. New York: Glencoe/McGraw-Hill.

Bybee, R.W., M. J. Dougherty, M. J., Powell, J. C., & Uno, G. E. (1997). *Biology human approach student edition* (1st ed.). Colorado Springs, CO: Kendall/Hunt Publishing.

Cairney, W. J., Cassel, J. F., Cully, P., Girard, J. C., Rainis, K. G., Uno, G. E., et al. *BSCS biology an ecological approach* (8th ed.). Dubuque, IA: Kendall/Hunt .

Johnson, G. B. (1998). *Holt biology visualizing life*. Orlando, FL: Holt, Rinehart, and Winston.

Johnson, G. B., & Raven, P. H. (1998). *Biology principles and explorations*. Orlando, FL: Holt, Rinehart, and Winston.

Leonard, W. H., & Penick, J. E. (1998). *Biology a community context*. Cincinnati, OH: South-Western Educational Publishing.

Miller, K. R., & Levine, K. R. (1998). *Prentice Hall biology the living science*. Upper Saddle, NJ: Prentice Hall.

Miller, K. R., & Levine, J. (1998). *Biology*. Englewood Cliffs, NJ: Prentice Hall.

Oram, R. F. (1998). *Glencoe biology living systems*. Westerville, OH: Glencoe/McGraw-Hill.

Pignatiello, J., Siggens, Jr., Di Chiappari, F., & Madama, J. (1998). *Essentials of biology concepts and communication*. Austin, TX: Holt, Rinehart, and Winston.

Appendix A. continued
List of Textbooks

Strauss, E., & Lisowski, M. (1998). *Biology the web of life*. Reading, MA: Scott Foresman Addison Wesley.

Appendix A.
List of Textbooks

Set 3 (1998 – 2004)
Teacher Editions

Biggs, A., Blaustein, D., Kapicka, C., Kaskel, A., & Lundgren, L. (1998). *Teacher wraparound edition biology the dynamics of life*. New York: Glencoe/McGraw-Hill.

Bybee, R. W., Dougherty, M. J., Powell, J. C., & Uno, G. E. (1997). *Teacher's resource book BSCS a human approach*. Dubuque, IA: Kendall/Hunt Publishing Company.

Cairney, W. J., Cassel, J. F., Cully, P., Girard, J. C., Rainis, K. G., Uno, G. E., et al. *Teacher's edition BSCS biology an ecological approach teacher's edition* (8th ed.). Dubuque, IA: Kendall/Hunt .

Johnson, G. B. (1998). *Annotated teacher's edition Holt biology visualizing life*. Orlando, FL: Holt, Rinehart, and Winston.

Johnson, G. B., & Raven, P. H. (1998). *Annotated teacher's edition iology principles and explorations*. Orlando, FL: Holt, Rinehart, and Winston.

Leonard, W. H., & Penick, J. E. (1998). *Teacher's guide biology a community context*. Cincinnati, OH: South-Western Educational Publishing.

Miller, K. R., & Levine, K. R. (1998). *Teacher's edition Prentice Hall biology the living science*. Upper Saddle, NJ: Prentice Hall.

Miller, K. R., & Levine, J. (1998). *Annotated teacher's edition biology*. Englewood Cliffs, NJ: Prentice Hall.

Appendix A. continued
List of Textbooks

Oram, R. F. (1998). *Teacher wraparound edition Glencoe biology living systems*. Westerville, OH: Glencoe/McGraw-Hill.

Pignatiello, J., Siggens, Jr., Di Chiappari, F., & Madama, J. (1998). *Teacher's edition essentials of biology concepts and communication*. Austin, TX: Holt, Rinehart, and Winston.

Strauss, E., & Lisowski, M. (1998). *Teacher's edition biology the web of life*. Reading, MA: Scott Foresman Addison Wesley.

Appendix A. continued
List of Textbooks

Set 4 (2005 – 2006)
Student Editions

Biggs, A., Hagins, W. C., Kapicka, C., Lundgren, L., Rillero, P., Tallman, K.G., & et al. (2006). *Florida biology the dynamics of life*. New York: Glencoe/McGraw-Hill.

Campbell, N. A., Williamson, B., & Heyden, R. J. (2006). *Florida biology exploring life*. Boston, MA: Pearson, Prentice Hall.

Johnson, G., & Raven, P. (2006). *Florida Holt biology*. (2006). Orlando, FL: Holt, Rinehart and Winston.

Miller, K.R., & Levine, J. (2006). *Prentice Hall biology Florida edition*. Boston, MA: Pearson Prentice Hall.

Parke, H. M, & Enderle, P. (2006). *Biology cycles of life*. Circle Pines, MN: AGS Publishing.

Postlethwait, J. H., & Hopson, J. L. (2006). *Florida edition modern biology*. Orlando, FL: Holt, Rinehart and Winston.

Appendix A. continued
List of Textbooks

Set 4 (2005 – 2006)
Teacher Editions

Biggs, A., Hagins, W. C., Kapicka, C., Lundgren, L., Rillero, P., Tallman, K.G., & et al. (2006). *Florida teacher wraparound edition biology the dynamics of life*. New York: Glencoe/McGraw-Hill.

Campbell, N. A., Williamson, B., & Heyden, R. J. (2006). *Florida teacher's edition biology exploring life*. Boston, MA: Pearson Prentice Hall.

Johnson, G., & Raven, P. (2006). *Florida Holt biology teacher's edition*. (2006). Orlando, FL: Holt, Rinehart and Winston.

Miller, K.R., & Levine, J. (2006). *Florida's teacher edition Prentice Hall biology Florida edition*. Boston, MA: Pearson Prentice Hall.

Parke, H. M, & Enderle, P. (2006). *Teacher's edition biology cycles of life*. Circle Pines, MN: AGS Publishing.

Postlethwait, J. H., & Hopson, J. L. (2006). *Florida edition modern biology teacher edition*. Orlando, FL: Holt, Rinehart and Winston.

WP = word phrase
S = sentence
¶ = paragraph
BT = box of text
P = page

Appendix B.
Indigenous Knowledge Tally Worksheet

Name of Textbook: ____ Group: _______

Chapter Number	Page Number	Unit Name	Topic	Type of Discrete Text

Appendix C.
List of Terms to Identify Indigenous Knowledge

Adapted from:

Knapp, S. (1992). *The contemporary thesaurus of social science terms and synonyms: A guide for natural language computer searching.* Phoenix, AZ: The Oryx Press.

Knapp, S. (2000). *The contemporary thesaurus of search terms and synonyms: A guide for natural language computer searching.* Phoenix, AZ: The Oryx Press.

Central American native cultural groups.
Central American Indian(s)
Central Amerind(s)
Middle American Indian(s)
Indian(s)
Mestizo(s)
Native American(s)
Chorotega
Chibcha
Olmec
Teotihuacan
Toltec
Mixtec
Zapotec
Aztec
Quiche
Maya
Arawak
Carib
San blas
Mosquitia
Lacandones
Huastec
Tarascan
Yaqui
Tarahumara
Cuna
Quekchi
Mayan
Cakchiquel
Guaymi

North American native cultural groups.
North American Indian(s)
Indian(s) of North America
Canadian Indian(s)
Amerindians
Native American(s)
Plains Indian(s)
Natchez
Choctaw
Navajo
Pima
Tlaxcaltecan
Zuni
Apache
Salish
Mohawk
Iroquois
Hopi
Papago
Seminoles
Chippewa
Araphaho
Cheyennes
Mohave
Ojibwa
Multnomah
Algonquin
Sioux
Comanche
Kiowa
Algonquian
Abenaki
Native American(s)
Canad(a,ian) native(s)
Alaska(n) native(s)
Abnaki
Manitou
Manibozho
Manabaus
Mandan
Muskogean
Nadene
Reservation Indian(s)
Kwakiutl
Haida
Tsimshian
Nootka
Arikara
Hidatsa
Mandam
Spokan
Paiute
Nez Perce
Shoshone
Cherokee
Creek
Pomo
Eskimos
Blackfoot
Aleuts
Athapascan
Athabascan
Inuits
Mestizos
Chipewyan
Spokane
Cree

Pre Columbian empires.
Andean
Mesoamerican
Aztec(s,an)
Inca(s,an)
Maya(a,an)
Olmec(s)
Zapotoc(s,an)

Appendix C. continued
List of Terms to Identify Indigenous Knowledge

Oceanic cultural groups.
Oceanic
Pacific islander(s)
Australia(an)
Australasia
New Guinea(n)
Melanesia(n)
Micronesia(n)
Polynesia(n)
Abelam
Ambae
Ambulas
Anuta
Aranda
Asmat
Banaro
Bau
Belau
Bikini
Boazi
Chambri
Chamorros
Chimbo
Choiseul Island
Cook Islands
Dani
Daribi
Dieri
Dobu
Easter Island
Eipo
Enga
Foi
Fore
Futana
Gahuku
Gama
Gainji
Garia
Gebusi
Gnau
Gogodala
Goodenough Island
Guadalcanal
Gururumba
Hawaiians
Iatmul
Kaluli
Kamilaroi
Kapauku
Kapingamarangi
Karadjeri
Kariera
Keraki
Kewa
Kilenge
Kiribati
Kiwai
Koiari
Kosrae
Kurtatchi
Kwoma
Lak
Lakalai
Lau
Lesu
Loyalty Islands
Mae
Mafulu
Mailu
Maisin
Malaita
Malekula
Manam
Mandak
Mangareva
Manihiki
Manus
Maori
Mardudjara
Marindanim
Maring
Marquessas Islands
Marshall Islands
Mejbrat
Mekeo
Melpa
Mendi
Mimika
Miyamin
Motu
Mountain Arapesh
Mundugumor
Murik
Murngin
Muyu
Namau
Nasioi
Nauru
New Georgia
Ngatatjara
Nguna
Ningerum
Nissan
Niue
Nomoi
Ontong Java
Orokaiva
Orokolo
Pentecost
Pintupi
Pitjendra
Pukapuka
Rapa
Raroia
Rennell Island
Rossel Island
Rotuma
Sambia
Samoa
San Cristobal
Santa Cruz
Selepet
Sengseng
Siane
Sio
Siwai
Tahiti
Tairora

Appendix C. continued
List of Terms to Identify Indigenous Knowledge

Oceanic cultural groups continued.
Tanga
Tanna
Tasmanians
Tauade
Telefomin
Tikopia
Tiwi
Tokelau
Tolai
Tonga
Tongareva
Tor
Torres Straight Islanders
Trobriand Islands
Truk
Tuvalu
Ulithi
Usino
Uvea
Wamira
Wantoat
Wape
Warlpiri
Waropen
Wik Mungkan
Wogeo
Woleai
Wongaibon
Wovan
Yangoru
Yangoru Boiken
Yap
Yir Yoront
Yungar

South American Native cultural groups.
South American Indian(s)
South American Amerind(s)
Alacaluf
Arawak
Aymara
Araucanian
Baniwa
Carib
Cayapo
Chibcha
Chimu
Colorado
Guarani
Incas
Jivaro
Kanamari
Kraho
Makiritare
Mapuche
Mochica
Motilones
Nazca
Ona
Panoa
Piaroa
Paracana
Pauo
Puelches
Quechua
Shirishana
Tehuelches
Ticuna
Terena
Trio
Tupi guarani
Waorani
Warao
Xavante
Yahgan
Yanomama

African cultural groups.
Berber(s)
Copt(s)
Murle(s)
Nubian(s)
Jerbian(s)
Saharan tribes
Acoli
Akans
Ambo
Amharas
Anang
Anuaks
Arusha
Ashntis
Atuot
Azande
Baganda
Bakongo
Bakwiri
Bangwa
Bantus
Banyang
Banyankore
Barundi
Basuto
Bayak
Budja
Bushmen
Chaga
Ewe
Fan
Fon
Fulahs
Ga
Gabra
Gallas
Gbaya
Hausas
Higi
Hottentots
Ibibios
Igbo
Isoka
Kalanga
Kamba
Kapsiki
Kikuyu
Korekore
Kpelle
Kumu
Kuria
Lala
Lebou

Appendix C. continued
List of Terms to Identify Indigenous Knowledge

African cultural groups continued.
Lozi
Lugbara
Luo
Mandingo
Mang'anja
Manzes
Mashona
Mongo
Mpongwe
Nama Hottentots
Ndebele
Ndembu
Nguni
Nilo-Hamitic
Nilotic tribes
Nuba
Nuer
Nupe
Nyakyusa
Nzakara
Padola
Pare
Rukuba
Sarakolle
Shiluks
Sisala
Suks
Taita
Thonga
Tswana
Turkana
Vasu
Venda
Wahehe
Wambulu
Wapangwa
Wolofs
Xosa
Yorubas
Zamaro
Zulus

Indian (India) cultural groups.
Indian
Agris
Aryans
Asurs
Badagas
Baigas
Balahis
Baltis
Bargundas
Basors
Bathuria
Bengali
Bhantus
Bhils
Bhiriguids
Bhuiyas
Bhumiyas
Birhors
Bondos
Brahuis
Bumij
Burushos
Chaks
Changs
Chenchoos
Dards
Dharuas
Doms
Dravidians
Gadabas
Gaddis
Garhwali
Garos
Gonds
Hindus
Hos
Irulas
Juangs
Kacharis
Kadars
Kandhs
Kanets
Kanikars
Kasubas
Katkaris
Kaws
Khasis
Kherias
Kinnar
Kijahs
Kilarians
Kolis
Kondhs
Konkani
Konyaks
Korwas
Kotas
Kukis
Kunnuvans
Kurmi-Mahtos
Kurmis
Kurumbas
Ladakhi
Lepchas
Luchai
Maitais
Malabars
Malaiali
Malas
Malers
Malpaharians
Malsers
Mannans
Marias
Maroongs
Marvars
Meenas
Meithis
Mikirs
Moghias
Mookwas
Moduvans
Mundas
Muria

Appendix C. continued
List of Terms to Identify Indigenous Knowledge

Indian (India) cultural groups continued.
Musurs
Nagas
Nahals
Nairs
Noatia
Oraons
Paharia
Paliyans
Pandarams
Paniyans
Parsis
Pondans
Porojas
Prabhus
Rajbansis
Rajis
Rajputs
Rawalttas
Reddis
Riang
Sabakhais
Samuls
Sangtams
Santals
Sathiyas
Savaras
Shokas
Sikhs
Sindhis
Sugalis
Swalgiri
Tamarias
Tamils
Telegu
Todas
Uralia
Varlis
Weddid
Yenadis

Indonesian cultural groups.
Alor
Ambon
Aru
Atjehnese
Babar
Badui
Bahau
Bajau
Bali
Banda
Batak
Batjan
Buru
Ceram
Ceramlaut
Damar
Enggano
Flores
Gayo Alas
Goram
Gorontalo
Halmahera
Iban
Javanese
Kayan
Kei
Kenya
Kisar
Klamantan
Kubu
Land Dyak
Leti
Loinan
Lombok
Madura
Makassar
Mentawei
Minangkabau
Mori Laki
Ngadju
Nias
Nila
Obi
Orang Laut
Punan
Redjang-Lampong
Roti
Sadang
Salon
Sangirese
Savu
Sea Gypsies
Sermata
Sula
Sumba
Sumbawa
Sundanese
Tanimbar
Tenggerese
Ternate
Timor
Toala
Toradja
Watubela
Wetar

Philippine Islands cultural groups.
Aeta
Apayos
Bagodos
Bisayas
Gaddang
Hanunoo
Ifugoas
Igorots
Ilokos
Ilongot
Isinay
Kalinga

Appendix C. continued
List of Terms to Identify Indigenous Knowledge

Philippine Islands
Cultural groups continued.
Mangyans
Quianganes
Subamos
Sulu
Tagalog
Tinguianws
Tirurayes
Yakan
Yogads

Generic terms.
Traditional society(ies)
Primitive
Tribal(ism)
Hunter-gatherer
Indigenous
Native
Peasant
Folk
Simple
Archaic
Nomad(ic,s)
- Lapp(s)
- Kirghiz
- Gypsies

Aborigines(al)
Clan

Appendix D.
Teacher's Edition Worksheet – General Format

Textbook____ Group _____

Program Goals/Objectives/Philosophies/Rationale

<u>NOTES</u>:

Relationship of multicultural content to the overall science content/purpose:

1) There is support for multicultural diversity content as part of the overall program goals and objectives.
<u>NOTES</u>:

2) These is some support for multicultural diversity; the support is limited or not clearly defined for the teacher.
<u>NOTES</u>:

3) There is support or link to multicultural and diversity content as part of the stated program goals and objectives.
<u>NOTES</u>:

<u>Authors/reviewers expertise/degrees outside of science or education</u>: YES NO

<u>Emphasis on FCAT and/or other standardized testing</u>: YES NO

<u>Emphasis on Reading</u>: YES NO

<u>Pacing Guide</u>: YES NO

<u>Multicultural/Diversity support</u>: YES NO

<u>Student needs</u>: YES NO Example of needs:
____

<u>STS content</u>: YES NO

COMMENTS:

Appendix E.
Teacher's Edition Worksheet – Multicultural Content

Textbook Code: ____________________________

Descriptor	Instructional Strategy	Curricular Content	Unit	Page	Comments

Appendix F.
Directions for Coding Multicultural Components

Descriptor Codes:

Bilingual: **BIL**
Cross-cultural: **C-C**
Cross-cultural studies: **C-CS**
Cultural: **CULT**
Culture: **CULTR**
Cultural activities: **CULT AC**
Cultural awareness: **CULT AW**
Cultural differences: **CULT DIF**
Cultural education: **CULT ED**
Cultural enrichment: **CULT EN**
Cultural heritage: **CULT HER**
Cultural pluralism: **CULT PL**
Culturally relevant education: **CRE**
Diversity: **DIV**
English (Second Language): **ESL**
Ethnic groups: **ETH GR**
Ethnicity: **ETH**
Global education: **GE**
Interdisciplinary Approach: **INTE**
Limited English Speaking: **LES**
Minority: **MINOR**
Minority groups: **MINOR GR**
Multicultural: **MULTI**
Multiculturalism: **MULTISM**
Multicultural education: **ME**
Social studies: **SS**

Appendix F. continued
Directions for Coding Multicultural Components

Directions for Coding

Background Information to Coder:

Coders will be working with teacher editions of high school biology textbooks. For this study, 31 of 34 teacher editions are annotated versions of the student edition. Three of the teacher editions occur as separate manuals. The teacher edition will include any information for the teacher as interleafs usually found at the beginning of each unit or chapter and as annotations listed in the margins or embedded within what would appear as the student pages.

The task for the coder is to identify a multicultural component and then record the relationship of that component to the science objectives for that particular page or section of text. A multicultural component is defined as a discrete section of text that contains one of the descriptors listed above. A discrete section of text for the purposes of coding is 1) an annotation in the teacher edition, which may be located in the margins or directly on what would appear in the student edition as the student page or 2) a sentence, paragraph, page or textbox that appears in the interleafs or margins of the teacher edition.

Content for coding occurs as a chapter in the textbook. Each chapter belongs to one of ten units: 1) intro to biology; 2) cells; 3) genetics; 4) evolution; 5) microbial world; 6) plants, 7) invertebrates; 8) vertebrates; 9) human biology; 10) ecology.

Once a coder is comfortable with the background information, the coder will:

1. Record unit name for chapter to be coded on the Multicultural Content Worksheet (column 4).
2. Scan each page of the assigned unit for discrete sections of text that utilize the descriptors from the list of Descriptor Codes.
3. Upon location of descriptor, record descriptor code (column 1) and page number (column 5).
4. Check column 2 if the multicultural component is considered an instructional strategy. An instructional strategy will include a task-oriented strategy. As example, the teacher may ask the students to research a topic, discuss a scenario, or create a concept map using the vocabulary. Check column 3 if the multicultural component only relates content, facts or general information about a topic. As example, there may be short biography of a scientist or a story regarding a legend of a particular cultural group.

Appendix F. continued

Directions for Coding Multicultural Components

5. Once the multicultural component has been identified and labeled as instructional or curricular in content, the coder should determine the degree to which the multicultural component supports the goal, purpose or objective of the chapter or unit section.
6. The coder should locate the objectives/goals/purpose as identified by the author. These are usually located at the start of the chapter section.
7. If the multicultural component should be coded in column 6 as a 1, 2 or 3 based on the degree to which the component supports the objectives:

   (1) highly related (the multicultural component directly supports the goals and objectives; pay attention to what the goals require of the student – does the information or task in the multicultural component allow the student to perform or meet that objective.

   (2) somewhat related (the multicultural component somewhat supports the stated goals and objectives; the information or task is associated with the task but not directly related to the assigned objective.

   (3) not related (no connection between the multicultural component and the stated goals and objectives); there seems to be no relation between the information or task to the assigned objective for that section of task; the component seems out of place or appears as an add-on.

Appendix G.
Archaeology of Statements Worksheet

Textbook: *Biology Living Systems* **Number: 1** **Set: 1**

Statement # 1	**Unit: Intro**	**p. 24**
Early scientists did not know how to solve their problems. Often they did not study a problem carefully. Many times they did not know for what they were looking. One of the most important factors in good science is asking the right questions. Many discoveries made in the last few hundred years are valid because the scientists who made then were good detectives.		
	Comments: nature of knowledge	

Statement # 2	**Unit: Intro**	**p. 24**
The methods of science are unique. A scientist is a detective who must solve problems by asking questions and putting the answer together in a meaningful way. Intelligent guessing is important to the scientist. But guessing alone is not enough. The guesses must be supported or rejected by evidence.		
	Comments: nature of knowledge	

Statement # 3	**Unit: Intro**	**p. 24**
Science is a process that produces a body of knowledge about natures. Areas of study such as art, music, or history are no less scholarly than science because all of them involve creativity. But, the manner in which science studies nature makes it different from other subjects.		
	Comments:	

Statement # 4	**Unit:**	**p. 523**
A Mohawk Indian raised by her Quaker grandparents, Rosa Minoka-Hill made up her mind early in life to help needy Indians. On a primitive farm in the Oneida Indian Reservation in Wisconsin, Dr. Minoka-Hill carried out that decision. Rosa Minoka-Hill delivered babies, treated diseases, and ran a “kitchen clinic” stocked with herbals (plants used for medical treatment) and medicines provided by the doctors in Green Bay for the people of the reservation.		
	Comments: People in Biology	

Appendix G. continued
Archaeology of Statements Worksheet

Textbook: *HBJ Biology* **Number: 2 Set: 1**

Statement # 1		**Unit: Intro**	**p. 25**
The goal of science is to establish principles and thereby to acquire knowledge about the natural world. Scientists establish principles through a logical, organized method of study called a scientific method. Many different procedures, performed in varying order, are part of a scientific method, but all of them draw on the following series of logical steps.			
	Comments: nature of knowledge		

Statement # 2		**Unit: Intro**	**p. 24**
Today the word science is used to describe both the body of knowledge that exists about the world and the method of study used to arrive at that knowledge.			
	Comments: nature of knowledge		

Statement # 3		**Unit: Plants**	**p. 434**
In addition to improving existing crops, scientists are seeking new sources of food. One promising discovery is grain amaranth, once a staple food of the Aztec empire. Amaranth outranks other common grains in protein content and contains important amino acids that most grains lack.			
	Comments:		

Statement # 4		**Unit: Plants**	**p. 436**
Long before the age of modern medicine, people used plants to cure illness and soothe discomfort. Some medicinal plants are still in use. Dried foxglove leaves yield a substance called digitalis, which is used to treat heart disease. Extracts from the opium poppy are used in the powerful pain relievers morphine and codeine. The bark of the cinchona tree contains quinine, a drug used to treat malaria.			
	Comments:		

Appendix G. continued
Archaeology of Statements Worksheet

Statement # 5		**Unit: Human Biology**	**p. 680**
Studies of people who live at high altitudes provide information on the long-range effects of conditions in which levels of oxygen are low. For example, the Quechua Indians of the Andes, who live above 3,600 m (more than mi.), have developed very large chest and lung capacities. These people also differ in blood composition; they have a higher concentration of red blood cells and hemoglobin than do people who normally live at sea level.			
	Comments: Thinking About Biology: Effects of High Altitude		

Statement # 6		**Unit: Ecology**	**p. 827**
The Amazon Indians have lived in the rain forest for centuries.			
	Comments:		

Statement # 7		**Unit: Ecology**	**p. 830**
Terrace farming has been employed in some parts of the world for hundreds of years. The Incas of Peru built extensive terraces over 400 years ago to grow corn and other crops in their mountainous areas.			
	Comments: TE		

Appendix G. continued
Archaeology of Statements Worksheet

Textbook: *Heath Biology* **Number: 3 Set: 1**

Statement # 1		**Unit: Intro**	**p. 3**
Science is a way of knowing about the physical world. Anyone can be a scientist. No laboratory or advanced college degree is needed. As soon as you ask questions about the things you observe, and begin to look for answers, you are doing science.			
	Comments: nature of knowledge		

Statement # 2		**Unit: Intro**	**p. 5**
An important characteristic of science is using an organized approach to solve problems. You can learn the methods scientists use and later put them to use in your own studies.			
	Comments: nature of knowledge		

Statement # 3		**Unit: Intro**	**p. 7**
You have been reading about a general procedure, called the research method. This method is frequently use dot answer scientific questions. The steps of the research method are usually listed as 1. observing; 2. defining the problem or question; 3. forming a hypothesis; 4. testing the hypothesis with a controlled experiment; 5. observing and recording results; 6. forming conclusions by confirming or modifying the hypothesis; 7. reporting results.			
	Comments: nature of knowledge		

Statement # 4		**Unit: Plants**	**p. 355**
Conifers produce many useful products. They are a major source of lumber, paper, and turpentine. The seed of some pines, called pine nuts, are used in Middle Eastern and other Mediterranean cooking. They are also eaten by the Indians of the Southwest.			
	Comments:		

Appendix G. continued
Archaeology of Statements Worksheet

Statement # 5		**Unit Ecology**	**p. 825**
At one time, humans depended completely on wild plants and animals for food and clothing. Today, wildlife still represents an important natural resource. Wildlife provides food, hides, and other products. Wildlife also has recreational and artistic value.			
	Comments:		

Appendix G. continued
Archaeology of Statements Worksheet

Textbook: *HRW Modern Biology* **Number: 4 Set: 1**

Statement # 1		**Unit Intro**	**p. 17**
Science is a body of knowledge. Science is also a way of learning about the natural world.			
	Comments: nature of knowledge		

Statement # 2		**Unit Intro**	**p. 825**
Science does not prescribe one single method for asking and seeking answers to questions. Scientists combine some or all the processes you have read about in a logical way to devise a scientific method best suited for a particular research project.			
	Comments: nature of knowledge		

Statement # 3		**Unit Plants**	**p. 372**
Native Americans and early settlers used horsetails as pot scrubbers.			
	Comments:		

Statement # 4		**Unit: Plants**	**p. 356**
When early peoples began cultivating plants, they usually selected the most robust plants for food and seed. This selection process led to hardier crops with better yields. Unfortunately, it also led to decreased genetic variation. Furthermore, because only certain traits were selected for, many “wild” plans with potentially beneficial traits were not cultivated. Scientists are now rediscovering some of these wild varieties.			
	Comments:		

Appendix G. continued
Archaeology of Statements Worksheet

Textbook: ***PH Biology The Living World*** **Number: 5 Set: 1**

Statement # 1		**Unit Intro**	**p. 3**
Science is a method of obtaining knowledge about nature. Science involves the examination of nature to understand and describe aspects of it. Science seeks to answer certain kinds of questions about nature.			
	Comments: nature of knowledge		

Statement # 2		**Unit Intro**	**p. 3**
The scientific method is a means of gathering information and testing ideas. It is the way a scientist tries to find answers to questions about nature. Although the procedures can vary, the scientific method consists of these steps: making observations, forming hypotheses, testing explanations, and drawing conclusions. It is the use of the scientific method that separates science from other fields of study.			
	Comments: nature of knowledge		

Statement # 3		**Unit: Evolution**	**p. 186**
Figure 9-17 A map showing the frequency of blood group A. The frequency of this blood group is high among the Blackfoot Indians of North America.			
	Comments: Figure 9-17		

Appendix G. continued
Archaeology of Statements

Textbook: *BSCS A Molecular Approach* **Number: 6** **Set: 1**

Statement # 1		**Unit Intro**	**p. 6**
You use many scientific methods to solve problems every day, probably without realizing it. In science, problem solving is based on the interpretation of data, which is information gained through observation, measurement, or experimentation.			
	Comments: nature of knowledge		

Statement # 2		**Unit Intro**	**p.**
Science is one way of explaining the world, and the characteristics of science serve as a basis for establishing what qualifies as science. Several characteristics generally define science. Science is a human enterprise and can be influenced in some ways by personal bias and by politics.			
	Comments: nature of knowledge		

Appendix G. continued
Archaeology of Statements

Textbook: ***BSCS An Ecological Approach*** **Number: 7 Set: 1**

Statement # 1	**Unit Intro**	**p. 22**
Science is one way of obtaining knowledge about the world around us. The method of obtaining scientific knowledge involves a series of steps that begins with an observation of the living world.		
	Comments: nature of knowledge	

Statement # 2	**Unit Microbial**	**p. 371**
Primitive people thought that disease came from an evil spirit that entered the body. The cure for the illness was to frighten or coax the spirit out of the body. That became the function of a medicine man, or shaman, who may have used masks, rattles, and charms. Today, your dentist might say your toothache was caused by a buildup in the population of tooth-decaying bacteria. Your dentist would not give you coca leaves for your pain, but he or she might inject cocaine to numb your mouth.		
	Comments: nature of knowledge	

Statement # 3	**Unit Microbial**	**p. 372**
Figure 11.20 Navaho medicine man, administering chant to mother and baby for better health.		
	Comments:	

Statement # 4	**Unit: Microbial**	**p. 432**
In the Arctic, reindeer mosses accumulated radioactive materials that drifted there from aboveground atomic bomb testing. The reindeer and caribou that are the lichens took in the radioactive materials and passed them on to the Eskimos who ate those animals. That is another example of how unexpected materials are passed along a food chain to a consumer at the top of the chain.		
	Comments:	

Appendix G. continued
Archaeology of Statements Worksheet

Statement # 5	**Unit: Plants**	**p. 456**
Horsetails are harsh to the touch; their tissues contain silica, a compound present in sand. American Indians and the pioneers scrubbed pots and pans with them, thus their common name of scouring rushes.		
	Comments:	

Statement # 6	**Unit: Ecology**	**p. 896**
Probably humans already were gathering and using the wild wheat; now they could have wheat fields near their settlements. Hunters and gatherers can get by with working three or four days out of each week. But without any way to store food they must sometimes go hungry. Around AD 160, Indians in northern New England were hunters and gatherers. The Indian farmers used common village grounds for their farms. Use of common areas for grazing and farming tends to lead to what biologist Garrett Hardin has called the "tragedy of the commons:" eventually one of the users tried to use more than his share of the common resource. Early hunters domesticated dogs before the agricultural revolution, but the domestication of other animals apparently came later.		
	Comments:	

Statement # 7	**Unit: Ecology**	**p. 54**
Compare the so-called primitive way of getting food with the so-called modern way. There are only a few hunting-gathering tribes left in the world today. Those people hunt and fish and gather berries, nuts, leaves, roots, and insect larvae.		
	Comments: Figure 2.27	

Appendix G. continued
Archaeology of Statements Worksheet

Statement # 8	Unit: Ecology	p. 57
Among these population crashes would be: the Inca and Maya of South and Central America, Caster Island, Anasazi Indians of US Southwest, and tribes of the Sahara. Reference books available to students would be helpful.		
	Comments: TE	

Statement # 9	Unit: Ecology	p. 900
Indians in what is now Alabama obtained copper from the Lake Superior regions. Thus, building settlements helped them to bring about travel and trade.		
	Comments:	

Statement # 10	Unit: Ecology	p. 911
The Indians who settled in that area must have done some farming, but it probably affected the natural ecosystem very little. The people hunted deer, wild turkey, and other animals, and they gathered hackberries and nuts.		
	Comments:	

Appendix G. continued
Archaeology of Statements

Textbook: ***Biology The Study of Life*** **Number: 8 Set: 1**

Statement # 1		**Unit: Intro**	**p. 13**
Broadly speaking, science is an attempt to understand the world we live in. By this, we mean that science goes beyond the simple observation and description of objects and events. It tries to find general principles to explain why things are as they are and why things happen as they do.			
	Comments: nature of knowledge		

Statement # 2		**Unit: Intro**	**p. 13**
Within each of theses fields, there are numerous subdivisions. Even so, scientists in all fields approach their problems in the same way. When a scientist announces a finding or proposes a new idea, other scientists may repeat the work or test its conclusions. This universal approach to scientific problems is called the scientific method. Its main features are the same in all areas of science.			
	Comments: nature of knowledge		

Appendix G.
Archaeology of Statements Worksheet

Textbook: *Addison-Wesley Biology* **Number: 1** **Set: 2**

Statement # 1		**Unit: Intro**	**p. 17**
What do scientists do? What skills do they have? But the real activity of science, the interpretation of observations and data, takes place in the minds of scientists. You will understand biology best if you learn how scientists investigate nature. Science is much more than a body of knowledge. It is a way of learning and thinking about the natural world.			
	Comments: nature of knowledge		

Statement # 2		**Unit: Intro**	**p. 19**
There is not just one particular process all scientists use in performing experiments. Their strategies are as individual as the scientists themselves. Questions, hypotheses, and ideas pop up at different times, and one experiment may lead to another. Science is a continuous, self-generating process that leads scientists through a lifetime of learning.			
	Comments: nature of knowledge		

Statement # 3		**Unit: Intro**	**p. 6**
Native Americans living in the plains regions of the United States once used buffalo hides in the construction of their tepees. Native Americans living in the southwestern parts of the United States, where temperatures are fairly mild all year, used thatch roofs.			
	Comments: TE Multicultural Perspective		

Statement # 4		**Unit: Genetics**	**p. 127**
Many modern food crops are descendants of wild plants. Native Americans selected and bred many varieties of corn from a wild plant similar to the teosinte. The picture on the right shows both corn and teosinte seeds.			
	Comments: Figure 8.1		

Appendix G. continued
Archaeology of Statements Worksheet

Statement # 5		**Unit: Genetics**	**p. 127**
Native Americans developed more than 300 varieties of corn from a type of wild plant called teosinte. The native people of Peru probably developed potatoes by selecting and breeding certain wild plants that formed starchy, nutritious underground stems. Such developments occurred long before people understood the process of inheritance.			
	Comments:		

Statement # 6		**Unit: Genetics**	**p. 189**
As you learned in chapter 8, ancient native peoples of North and South America used controlled breeding to develop corn and potatoes form wild plants. In controlling the breeding of cattle and other living things, our ancestors were practicing biotechnology. In modern times, farmers and breeders still use controlled breeding to develop new crops and new breeds of animals to feed a hungry world.			
	Comments:		

Statement # 7		**Unit: Microbial**	**p. 299**
In some cultures, all things in the world are considered alive, including rocks, soil, and water. All things are considered to be a part of a whole. This viewpoint is gaining popularity among some Western scientists. According to the Gaia hypothesis, Earth is analogous to an organism in its ability to correct imbalances and to maintain homeostasis. Because Earth is viewed as a whole, the Gaia hypothesis incorporates components that have been considered nonliving in the traditional European viewpoint.			
	Comments: TE Multicultural Perspective		

Appendix G. continued
Archaeology of Statements Worksheet

Statement # 8		**Unit: Plants**	**p. 365**
The agriculture of Native Americans was and is different in many ways from modern agriculture, and is in some cases superior. Early in the development of their culture, Native Americans learned to honor Earth, which together with the sun is considered to be the source of all life. Native Americans base their farming practices and whole life pattern on a "oneness" with nature and a great respect for all living things. Scientists who study the dynamics of life on Earth are beginning to recognize the value of the practices and beliefs of Native Americans. Early Native American agriculture developed some very effective and sophisticated methods that are used in farming today. Selective breeding enabled Native Americans to develop a wild grass, called Teosinte, into more than 300 varieties of corn. But early Native American agriculture contributed more than just food and farming techniques to modern society. By extracting and processing the sap of rubber trees, Native Americans invented waterproofing substances for clothing. Native Americans also used and still use herbs and other plant products for medicines. These medicines include aspirin, digitalis, and quinine. Many Native Americans are true environmentalists. They understand the dangers of pollution and wasteful habits. As modern society becomes more aware of the need to conserve resources and save the environment, the ways of Native Americans are becoming more valuable.			
	Comments: Historical Notebook **What can be learned about agriculture from Native Americans?**		

Statement # 9		**Unit: Plants**	**p. 365**
During the 1500s, several Native American groups, who are collectively called the Aztecs, cultivated a wide variety of crops. In the higher-altitude inland regions of Mexico, the Aztec people grew maize (corn), beans, squashes, and chilies (peppers). These crops served as the staple foods for the inhabitants of the region.			
	Comments: TE Multicultural Perspective		

Archaeology of Statements Worksheet

Statement # 10	**Unit: Plants**	**p. 375**
Some peoples, for instance, some Native Americans, express the concept that plants and animals share the same life breath. This interdependence of plants and animals can be expressed another way. In 1771, an English clergyman and chemist named Joseph Priestly made a discovery. He found that a mouse could live in a container of air that had been spoiled by a burning candle as long as plants were in the container.		
	Comments:	

Statement # 11	**Unit: Plants**	**p. 377**
The chemicals in plants can also help keep humans healthy. For many years, practitioners of folk medicine have used plant extracts to cure diseases. For example, Native Americans chewed willow bark to relieve pain.		
	Comments:	

Statement # 12	**Unit: Plants**	**p. 407**
Not all drugs are used for their healing effects. Native Americans have long used the hallucinogenic drug peyote, which is derived from the peyote cactus button, as part of their religious ceremonies. Because of the hallucinogenic effects of peyote, Native American often call the peyote cactus "the plant that shows the way," or "the plant that gives sleep."		
	Comments: TE Multicultural Perspective	

Statement # 13	**Unit: Plants**	**p. 411**
Maple syrup production is carried out today much as it was by the Native Americans of the Great Lakes region who originated the process hundreds of years ago. The Native Americans who invented the process used wooden spiles and containers. Also, they knew about the timing of the sap flow and invented ways to boil the sap.		
	Comments: Everyday Biology	

Appendix G. continued
Archaeology of Statements Worksheet

Statement # 14		Unit: Plants	p. 405
Before the 1500s, more than 200 kinds of potatoes were grown by Native American people for food.			
	Comments:		

Statement # 15		Unit: Invertebrates	p. 479
One tribe of Native Americans living in the Amazon regions add sponge spicules to their pottery clay. The spicules serve to strengthen their ceramic pots.			
	Comments:		

Statement # 16		Unit: Invertebrates	p. 506
The shells of mollusks classified as Scaphopoda were used by Native Americans who lived on the Pacific coast of North America as wampum, a form of currency. The mollusks in this group have small shells that resemble tusks.			
	Comments: TE Multicultural Perspective		

Statement # 17		Unit: Invertebrates	p. 529
The Tainos, an extinct aboriginal tribe from the Greater Antilles and the Bahamas, used maggots as a source of food. To obtain the maggots, the Tainos placed the pulp of a poisonous plant called the zamia out in the sun. The pulp drew flies which laid eggs on the pulp. The eggs developed into maggots that drew the poison out of the plant as they fed. The plant pulp and maggots were then made into a burgerlike food and eaten.			
	Comments: TE Multicultural Perspective		

Statement # 18		Unit: Vertebrates	p. 578
The use of frog toxins by humans is not new. People in the Amazon rain forest use chemicals form frog skin to make poison-tipped arrows. People in small villages in Argentina take advantage of the antibiotic effect of frog skins. These people place the frogs on wounds to speed healing.			
	Comments: Frontiers of Medicine		

Appendix G. continued
Archaeology of Statements Worksheet

Statement # 19		**Unit:**	**p. 578**
In the rainforest regions of many South American countries, certain cultures live much as their ancestors did centuries ago. They follow the same tribal customs and mores, and use their understanding of a seemingly hostile environment to their advantage. As one example, natives use poisons secreted by glands of certain frog species for a variety of purposes. Chief among the uses is to make poison-tipped arrows and darts that stun or kill animals the people hunt for food and clothing.			
	Comments: TE Multicultural Perspective		

Statement # 20		**Unit: Vertebrates**	**p. 598**
Snakes are widely distributed in nature. Certain cultures of North America, Africa, India, and Asia hold ceremonies and activities involving snakes.			
	Comments: TE Multicultural Perspective		

Statement # 21		**Unit: Vertebrates**	**p. 628**
The Inuit peoples living in the Arctic regions of North America have long used aquatic mammals as their primary source of food and clothing. Pinnapeds, such as walruses and seals, and whales are part of the Inuit diet. The skins of these animals are used to make clothing. The blubber, or fat, of the sea animals is used as a cooking fat and a fuel source.			
	Comments: TE Multicultural Perspective		

Statement # 22		**Unit: Human Biology**	**p. 803**
In addition to using mescaline in religious ceremonies, some Native American cultures use mescaline as part of a "rite of passage." In this ritual, a young man is given mescaline and sent off into the desert for several days. The young man may not return until he has experienced certain types of visions and survived the solitary experience. Upon his return, the youth is considered a man.			
	Comments: TE Multicultural Perspective		

Appendix G. continued
Archaeology of Statements Worksheet

Statement # 23		Unit: Human Biology	p. 803
Hallucinogens were used by people thousands of years ago. A hallucinogen called mescaline comes from peyote, a spineless cactus plant shown in Figure 44.5. Some Native American cultures use mescaline in their religious ceremonies. Figure 44.5 The hallucinogen mescaline is derived from the peyote cactus. This drug has played an important role in certain religious ceremonies, both ancient and modern.			
	Comments: Figure 44.5		

Statement # 24		Unit: Ecology	p. 829
Prior to the settlement of the midwestern United States by Europeans, buffalo were a dominant species in grassland regions. The buffalo were killed in small numbers by Native Americans who used the animals for food, clothing, and even to build shelters. As Europeans settled in grassland regions, buffalo hunting became a popular sport. AS a result of this practice, buffalo were almost hunted to extinction.			
	Comments: TE Multicultural Perspective		

Statement # 25		Unit: Ecology	p. 875
Native Americans have long thought of the environment as a living being. In this view, people, plants and animals each represent different nations. Each nation is said to have its own language, laws, and society. According to these Native American beliefs, humans, or “two-leggeds,” make up only one of the many communities on Earth. The idea of the Earth as a living being is not unique to Native Americans. James Lovelock, an English scientist, developed a similar view. Lovelock class his idea the Gaia hypothesis, names for Gaia, the Greek goddess of the Earth. The Gaia hypothesis is based on Lovelock’s belief that the interactions among the biotic and abiotic factors of the environment have a natural balance.			
	Comments:		

Appendix G. continued
Archaeology of Statements Worksheet

Statement # 26		**Unit: Human Biology**	**p. 786**
For 2000 years, smallpox conducted a reign of terror over all humanity. The disease killed great numbers of people around the world. The course of history was often changed as smallpox killed huge numbers of Native Americans.			
	Comments: Historical Notebook Smallpox: Horror with a Happy Ending		

Statement # 27		**Unit: Human Biology**	**p. 786**
After American was settled by Europeans, Native Americans became vulnerable to many diseases they had never before encountered. These diseases were introduced to Native Americans through contact with the Europeans. For example, most historians agree that smallpox was the main force behind the fall of the Aztec civilization, not Cortez and his small band of soldiers.			
	Comments: TE Social Studies Connection		

Appendix G.
Archaeology of Statements Worksheet

Textbook: *Biology An Everyday Experience* **Number: 2 Set: 2**

Statement # 1		**Unit: Intro**	**p. 15**
Much of the work of biology is to solve problems. Problems are not solved by flipping a coin or taking a guess as to the outcome. Scientists use a series of steps called a scientific method to solve problems. The following steps are often used: recognizing the problem, researching the problem, forming hypothesis, testing the hypothesis, and drawing conclusions.			
	Comments: nature of knowledge		

Statement # 2		**Unit: Plants**	**p. 425**
Several centuries ago, explorers brought plants form the tropical forests of the New World back to Europe. The explorers had discovered that these plants were being used for medicines by native peoples. For example, quinine was found to be used as a cure for malaria. The natives of South America had made an extract of quinine by soaking the bark of the Cinchona tree in water.			
	Comments:		

Appendix G.
Archaeology of Statements Worksheet

Textbook: *Holt Biology Visualizing Life* **Number: 3** **Set: 2**

Statement # 1		**Unit: Intro**	**p. 5**
Science is a way of investigating the world, observing nature in order to form general rules about what causes things to happen.			
	Comments: nature of knowledge		

Statement # 2		**Unit: Intro**	**p. 15**
It was once fashionable to claim that scientific progress was the result of applying a series of steps called "the scientific method." In this view, science is a sequence of logical "either/or" steps, each step rejecting one of two incompatible alternatives. Trial-and-error testing could inevitably lead one through a maze of uncertainty. If this view were true, a computer could be programmed to be a good scientist. But science is not done this way. If you ask successful scientists how they do their work, you will find that they design experiments with a good idea of how their experiments are going to come out. Not just any hypothesis is tested but rather a hunch or educated guess based on all the scientist knows and that allows his or her imagination full play. Because insight and imagination are so important in scientific progress, some scientists are better than others.			
	Comments: nature of knowledge		

Statement # 3		**Unit: Intro**	**p. 9**
An old saying that is attributed to many different sources, from Native Americans to Amish farmers, states that "we do not inherit the world from our parents; we borrow it from out children."			
	Comments:		

Appendix G. continued
Archaeology of Statements Worksheet

Statement # 4		Unit: Ecology	p. 259
In India, the neem tree provides so many useful products that is has been called "the village pharmacy." Its leaves are used to make medicinal teas and insect repellents. Juice from the tree is used to treat skin problems, and the twigs are used to clean teeth.			
	Comments: TE Cultural Perspective		

Statement # 5		Unit: Ecology	p. 315
1450 AD Native Americans develop advanced systems of agriculture. Native American farmers, in various parts of the Americas, are producing crops such as corn, peanuts, peppers, cocoa, beans, squash, rubber trees, tobacco, and tomatoes. Europeans first learn of these crops from Native Americans.			
	Comments: Discoveries in Science – timeline		

Statement # 6		Unit: Intro	p. 11
The native people of South America called the cinchona tree the "bark of barks" because it holds cures for human illnesses. With the help of natives, scientists discovered that bark of the cinchona tree contains the drug quinine, the cure for malaria. Peruvian Native Americans also knew of the properties of the cinchona tree before AD 1500. This was documented when Native Americans offered the "fever tree" to Juan Lopez, a Jesuit missionary.			
	Comments: TE Cultural Perspective		

Appendix G. continued
Archaeology of Statements Worksheet

Statement # 6		**Unit: Microbial**	**p. 325**
Are species natural units that are recognized by different cultures? Or are they artificial distinctions imposed on nature by Western scientists? It appears that the first is true. In 1928 Ernst Mayr, then a young ornithologist, traveled to New Guinea to collect bird specimens. Mayr found that the local Arfak people recognized 136 kinds of birds, just one less than he did. Moreover, Mayr and the Arfak recognized the same species expect for two very similar species that the Arfak did not distinguish.			
	Comments: TE Cultural Perspective		

Statement # 7		**Unit: Microbial**	**p. 351**
The Egyptians and ancient Chinese used mold from bread and cereal to treat wounds and infections. Thus, it is evident that the Egyptians and Chinese were aware of the healing properties of some molds long before penicillin was discovered.			
	Comments: TE Cultural Perspective		

Statement # 8		**Unit: Plants**	**p. 409**
The indigenous people taught me about their medicines and the plants from which they are derived.			
	Comments:		

Statement # 9		**Unit: Plants**	**p. 417**
Kola nuts are cultivated in the West Indies, West Africa, and South Africa. They are the fruits of several types of evergreen trees. People who live in African countries call the nuts *guru* or *goora* nuts and chew them like gum. Kola nuts are also used to make coal soft drinks and medicines. .			
	Comments: TE Multicultural Perspective		

Appendix G. continued
Archaeology of Statements Worksheet

Statement # 10	**Unit: Plants**	**p. 430**
The selective breeding of corn began more than 7,000 years ago in Mexico. Native American farmers selected for an increase in the number of rows of grains in the "ear," which evolved form the teosinte spike. Corn was cultivated y the Aztecs of central America, the Mayas of southern Mexico and northern Central America, and the Incas of western South America.		
	Comments: Journeys – History of Corn – timeline	

Statement # 11	**Unit: Plants**	**p. 438**
People have always used plants to relieve pain and cure ailments or disease. Some people still use plants to cure ailments and many doctors, such as the one in Figure 20.8, are studying the cures these plants provide. Today plants produce many substances used in medicinal drugs. Fro instance, sweet potatoes provide an extract used in producing steroid hormones for birth control pills and cortisone. The May apple was used by Cherokees to kill parasitic worms. In the middle of the seventeenth century, Jesuit missionary a remedy for malaria made by boiling cinchona bark in water. The Native Americans called the tree bark "quina." The medicine isolated from its bark was called quinine. Today quinine e is made synthetically. It is still widely used to prevent malaria.		
	Comments: Figure 20.8	

Statement # 12	**Unit: Plants**	**p. 438**
The Native American doctor (left) is teaching the Western doctor (right) how to use plants native to the Amazonian rain forest to treat some illnesses.		
	Comments: Figure 20.8	

Statement # 13	**Unit: Plants**	**p. 439**
However, drug companies searching for and finding valuable botanicals throughout developing countries refuse to pay people for their knowledge or products.		
	Comments: Social Studies Connection	

Appendix G. continued
Archaeology of Statements Worksheet

Statement # 14	Unit: Plants	p. 440
Native Americans of Central and South America made rubber balls and waterproof shoes from latex.		
	Comments:	

Statement # 15	Unit: Plants	p. 443
The Chinese have been using the Quighao plant, *Artemisia annua*, in traditional medicine for more than 2,000 years to treat chills and fever associated with malaria.		
	Comments: TE Cultural Perspective	

Statement # 16	Unit: Vertebrates	p. 586
Through the ages, birds and their feathers have been a part of many cultures. The Indians of North and South America have used bird symbols in their rituals, and bird feathers, beaks, and talons in their costumes. Costa Rica uses a bird on its currency. Birds have been important in mythology, as icons in certain religions, and as pets around the world.		
	Comments: TE Cultural Perspective	

Statement # 17	Unit: Human Biology	p. 699
The word tobacco is a Spanish adaptation of the term the natives of the Caribbean used for cigar. Tobacco was chewed of smoked for ceremonies surrounding was, peace, puberty, the harvest, or death. Most uses suggested the notion of sacrificial offerings.		
	Comments: TE Cultural Perspective	

Appendix G. continued
Archaeology of Statements Worksheet

Statement # 18		Unit: Human Biology	p. 702
Before the people of the Americas had contact with Europeans, many with highly developed agricultural societies made and used alcoholic beverages. The intake of alcohol for the Papagos and Pima Indians of the Southeast was used as part of the ceremony to bring rain. Among the Aztecs, intoxication served to induce medication and prophecy.			
	Comments: TE Cultural Perspective		

Statement # 19		Unit: Human Biology	p. 703
Peyote, the fruit of the *Lophophora williamsii* cactus that grows in northern Mexico and along the Rio Grande Valley, is another hallucinogen used by Mexican tribes and the Apache for both sacred and secular purposes. The Mexicans and Apaches learned to cut off the rounded top of the plant, dry it, and brew it into a tea. Peyote was also used as an appetite and thirst suppressant.			
	Comments: TE Cultural Perspective		

Statement # 20		Unit: Ecology	p. 291C
For many Native Americans and tribal people on other continents, the rain forest is their home. The Cofan Indians of Ecuador, who formerly relied upon these sources for drinking water, now depend on rainwater.			
	Comments: TE Multicultural Lesson Plan		

Statement # 21		Unit: Plants	p. 438
At one time, members of the Crow tribe chewed willow bard to relieve headaches. Scientists have discovered that the bark of the weeping willow tree contains a chemical that turns into salicylic acid in the human body. Today we call this acid aspirin.			
	Comments: TE History Connection		

Appendix G.
Archaeology of Statements Worksheet

Textbook: *Prentice Hall Biology* **Number: 4 Set: 2**

<table>
<tr><td colspan="2">Statement # 1</td><td>Unit: Intro</td><td>p. 5</td></tr>
<tr><td colspan="4">Asking questions about the world around us is part of human nature. How did life begin? Where did plants and animals come from? Why do animals behave as they do? Every culture in the world has tried to answer these questions – often through myths and legends.

The Pitjendara tribe of central Australia, for example, finds answers to questions about nature on an enormous mound of stone called Ayer’s Rock.

According to the Pitjendara, the images etch on Ayer’s rock tell stories that depict the adventures, the loves, and the battles of ten enormous creatures. The rock contains the likenesses of two snakes, Liru and Kunia. Through these and other stories, the Pitjendara explain the formation of the world and the processes of birth, life and death.

The stories of the rock also detail the connections between the tribe and animals important in their everyday lives: snakes, desert lizards, and kangaroos. The stories even explain the origins of dreams. We might say that the rock provides the Pitjendara with answers that other societies seek through a process known as science.

People like the Pitjendara live their entire lives in a single culture. Thus, they often find it difficult to imagine that their particular stories about the world might be in error. Today, however, we can visit and read about many cultures. And when we assemble stories form around the globe, it becomes obvious that all these stories cannot be true.

Is there some other way to explain the world around us? One way is to assume that all events in nature have natural causes. We can then try to arrange a series of observations or test to learn what those causes are. Science is the word that we apply to this process. The goal of science is to understand the world around us. There are, however, many important fields of human endeavor that study the world around us but are not considered sciences. Such fields include language, history, art, music, and philosophy. The character that distinguishes science from nonscience is an approach knows as the scientific method.</td></tr>
<tr><td></td><td colspan="3">Comments: Figure 1-1
Nature of knowledge</td></tr>
</table>

Appendix G. continued
Archaeology of Statements Worksheet

Statement # 2		**Unit: Intro**	**p. 7**
The simplest definition of the scientific method was offered by biologist Claude Villee. He called it "Organized common sense." That is exactly what science should be. In practice, the scientific method consists of several steps… To the true scientist, however, the scientific method is more a frame of mind – a frame of mind that involves curiosity. Another important characteristic of the scientific spirit is the refusal to accept an explanation without evidence or proof. This "prove it!" attitude encourages scientists to investigate phenomena and to develop new explanations and ideas.			
	Comments: nature of knowledge		

Statement # 3		**Unit: Intro**	**p. 15**
As knowledge grows, facts can change. This print depicts a Hindu legend that tells that the Earth is supported by three elephants resting on the back of a giant tortoise.			
	Comments: Figure 1 -12 **nature of knowledge**		

Statement # 4		**Unit: Intro**	**p. 11**
Science works best when scientists everywhere read each other's papers, check each other's experiments, and argue about what those experiments mean.			
	Comments: nature of knowledge		

Statement # 5		**Unit: Plants**	**p. 461**
At one time, mosses were ground up and used by Native Americans to treat burns and bruises.			
	Comments:		

Appendix G. continued
Archaeology of Statements Worksheet

Statement # 6		**Unit: Vertebrates**	**p. 701**
Some tropical tree frogs make a poison so powerful that it can kill humans and other large animals. Native tribes in the tropics often poison their arrow tips by rubbing them on these frogs. For this reason, these brightly colored amphibians are called poison arrow frogs.			
	Comments:		

Statement # 7		**Unit: Ecology**	**p. 1068**
Although a few whales are hunted in traditional ways by native people, most of the whales killed today are taken by massive factory skips that process the whales while at sea.			
	Comments:		

Statement # 8		**Unit: Cells**	**p. 171**
Or students may want to learn about Native Americans' use of herbs for healing, an art that is practiced in Chine even today.			
	Comments: TE		

Statement # 9		**Unit: Ecology**	**p. 900**
Because of this property, it was used ritualistically in ancient societies in Central America, Russia, and India.			
	Comments: TE Tie-in Medicine		

Appendix G.
Archaeology of Statements Worksheet

Textbook: ***Biology Living Systems*** **Number: 5** **Set: 2**

Statement # 1		**Unit: Intro**	**p. 33**
Science is a process that produces a body of knowledge about nature.			
	Comments: nature of knowledge		

Statement # 2		**Unit: Intro**	**p. 33**
The methods of science have been practiced by many cultures for thousands of years. No one knows who first discovered fire, invented agriculture, or explained sexual reproduction. The Egyptians knew about physiology and use surgery as early as 3000 BC. The Aztecs, Incas, and Mayas of Central and South America used accurate calendars based on the movements of celestial bodies. The Incas of Ecuador discovered the equator before the Egyptians. All cultures today share scientific methods to make new discoveries.			
	Comments: TE Multicultural Connection		

Statement # 3		**Unit: Intro**	**p. 32**
What brought up these discoveries? It was a new way of learning about nature. One of the most important factors in good science is asking the right question. Many discoveries in the last 100 years are still valid because the scientists who made them were good detectives.			
	Comments:		

Statement # 4		**Unit: Intro**	**p. 33**
Remember that scientists note effects and attempts to explain the causes of those effects. There is no fixed way to do this; scientists arrive at explanations in many ways. Each situation is different. Several factors play a role in learning about natures. Among them are careful and thorough observations, interpretation of what is observed, explaining what is observed and testing to see if those explanations are "on the right track." These steps do no always follow a precise order, and a scientist may go back and forth many times between many steps to solve a puzzle.			
	Comments:		

Appendix G. continued
Archaeology of Statements Worksheet

Statement # 5		**Unit: Cells**	**p. 60**
Corn is an excellent source of starch in our diets. What we know as hominy is actually made from corn. Native Americans discovered that soaking corn in a solution made from the ashes of a wood fire (a lye solution) would change the grains into an expanded, lighter-textured material with a unique flavor. This changed corn was then baked into custard-like puddings or fried with meats and wild greens. If the hominy is dried and pounded into a fine texture, hominy grits are formed.			
	Comments: TE Multicultural Connection		

Statement # 6		**Unit: Cells**	**p. 98**
Water is vital to most biological processes. If you remove most of the water from in and around fish cells, microorganisms can't grow – at least not well. The seafaring people of Northern Scandinavia are old master of the art of drying fish. So are the Eskimos. But perhaps the most dramatic example of preservation by drying comes from the Native Americans of pre-Columbian Peru. Living in the Andes Mountains, they would freeze fish in the frigid night air and dry it in the hot daytime sun. In the daytime hear, the low atmospheric pressure of the high mountains allowed much of the fish meat's water, frozen during the night, to turn directly from ice to vapor. This was freeze-drying, a technique we consider very modern.			
	Comments: Global Connection		

Statement # 7		**Unit: Genetics**	**p. 210**
Animals were important in the cultural of American Indians. They were used for food and clothing, and the hides were used for shelter. The traits of animals have been an important part of the folklore and culture. Some of their tales describe how they got their phenotypic traits. For instance, one tale tells that the owl got its large eyes and short neck because it was always stretching its neck to see what was going on around its roost and got its big eyes so it could see at night. The names of tribal members were basically animal names that described the phenotypic traits that the person "acquired" from the animal. For instance, the name Silent Eagle was given to a person who was swift and who hunted quietly and with great accuracy.			
	Comments: TE Multicultural Connection		

Archaeology of Statements Worksheet

Statement # 8		Unit: Evolution	p. 308
Samoans, in the South Pacific, believed that their island came from an egg that had been broken into pieces and thrown into the water. The Maoris, from New Zealand, believed that a bird dropped an egg that burst open in the sea. This egg contained the people and animals that found their way to New Zealand. Ask students to make up a myth that explains how Earth and its in habitants first formed.			
	Comments: TE Multicultural Connection		

Statement # 9		Unit: Evolution	p. 314
Six thousand years ago, pre-Incan Indians in South America were cultivating the common white potato. When they cultivated this plant, they practiced selective breeding to improve the quality of the potato form one generation to the next.			
	Comments: TE Multicultural Connection		

Statement # 10		Unit: Evolution	p. 350
According to Good White Buffalo of the Brule Sioux nation, crows were once white. They were also friends of the buffalo, and warned them when Native American hunters approached the herd, much to the resentment of plains Indians who depended on buffalo for food. A young brave captured the leader of the crows and hurled him into the fire. He was singed black, and ever since, all crows have been black. Folklore includes a variety of stories passed orally from person to person and generation to generation within a given culture. Many pre-scientific explanations for the origins and conditions of the world appear in folklore as myths. The myths of a given culture center on what that culture considers important. “How the Crow Came to Be Black” illustrates the importance of buffalo to the plains tribes. Biologists today know color has evolved through natural selection and species adaptation. In many species, color serves important survival functions. Although evolution may provide us with many a tale of origins of weird and wonderful life forms, probably none would be as simple, or simplistic, as the myths and legends passed on from generation to generation in folk tales.			
	Comments: Literature Connection		

Appendix G. continued
Archaeology of Statements Worksheet

Statement # 11		Unit: Plants	p. 438
Corn was so important to these early farmers that their culture was built around it, and they worshiped a god of corn. Largely as a result of their development of corn and other agricultural practices, the Aztecs developed a great empire. By the time Columbus came to America in 1492, Native Americans of both North and South America were growing many kinds of corn. Flint corn, which has a very hard, smooth kernel, was the kind most widely grown. Flour corn was grown by the Aztecs and Incas. Because corn was an easy crop to grow and it was plentiful, it has a symbolic place in the culture of many Native American tribes. In the Tewa Tribe of New Mexico, for instance, summer is the time of the Blue Corn Chief, while winter is the time of the White Corn Chief. Many Native American tribes consider corn a sacred plant. Much rain is needed for corn to grow well. Before the Hopi and Zuni tribes developed the practice of irrigation, corn dances were part of a ritual to bring rain, and other dances were performed to thank the gods for a bountiful harvest. The early English colonists were taught to plant corn by Native Americans who lived in northeastern North America. The colonists and the Spanish explorers not only used it as a food source, they exported it to Europe and beyond. From these beginnings sprang a plant that is now grown all over the world and is a major food source for both humans and their livestock.			
	Comments: Global Connection		

Statement # 12		Unit: Plants	p. 440
Tell students about amaranth, once the Aztecs' most widely cultivated crop. It produces huge numbers of seeds that are high in the amino acid lysine. When Cortez arrived in 1519, he banned the growing of amaranth because the Aztecs also use the red dye of the flowers for religious ceremonies.			
	Comments: TE Multicultural Connection		

Appendix G. continued
Archaeology of Statements Worksheet

Statement # 13		**Unit: Plants**	**p. 441**
The Chinese have controlled insect pests by biological means for 1700 years, a method introduced to the West only in this century. The Chinese use of yellow, citrus-killer ants to protect mandarin trees is still in use today. Bridges of bamboo are stretched between trees to allow the ants to move easily from tress to tree. The ants hunt and eat the pests that would consume the oranges			
	Comments: TE Multicultural Connection		

Statement # 14		**Unit: Vertebrates**	**p. 460**
There is no one people called "Native Americans" or "American Indians." There are hundreds of different Native American peoples, all with differing beliefs and cultures. So there is no single Native American way of considering animals. There are, however, some broad, underlying ideas that various Native Americans hold in common, though they may express them differently. Native American beliefs generally include a strong tie between people and the land. In such a world view, it's only natural that animals have an important place. Rather than seeing animals as lower creatures fit only for work or food, Native American traditions often portray animals as beings as important or even more important than humans. Often, animals were depicted as the descendants of great animal spirits responsible for the creation of the world or for the origination of social customs. The roles they play in Native American myths and legends not only illustrate how certain natural things came to be, but also communicate cultural values. An Iroquois legend, for example, tells about how the owl made the Creator angry by greedily demanding too much and arrogantly sticking his beak in where it didn't belong. Rather than giving the owl what he asked for, the Creator gave him a short neck so he wouldn't be able to crane his neck to look where he shouldn't and big ears so that he could better hear what he was told. A Papago myth tells of the Creator being saddened by the thought that the beautiful children, the lovely leaves, and the colorful flowers would all grow old and die. Much Northwestern Native American lore deals with Coyote – an anthropomorphic hero and ancestor of the animal that shares his name. One story form the Nez Perce tells how Coyote tricked and killed a monster who was eating all his fellow animals.			
	Comments: Global Connection		

Appendix G. continued
Archaeology of Statements Worksheet

Statement # 15		Unit: Vertebrates	p. 470
Birds were important in the arts and crafts of the Incas of Peru in the 11th century. The Inca bird was different from the birds used in arts and crafts of Native Americans. The Zuni, one of the Pueblo tribes of Native Americans, used a geometrically shaped “rain bird” on their pottery. The Hopi also used geometric shapes in creating the birds on their pottery.			
	Comments: TE Multicultural Connection		

Statement #16		Unit: Vertebrates	p. 502
Columbus started the confusion. Thinking he had discovered a new trade route to India, he called the people living in the Americas “Indians.” More confusion arose when the European settlers tried to learn the personal names of the Native Americans they encountered. The Europeans discovered that the original inhabitants of the land often changed their names as they grew older. A childhood name might be exchanged for a new one at adolescence, or after a first battle or an important dream. The Native American tradition of naming babies is a practice that survives today among many tribes. A baby might be called simply “boy” or “girl” until he or she is several months old. Buy that time, the baby has developed some personality. A tribe elder observing the baby will then know enough about his or her personal traits to suggest a name that seems fit. That name might be one given to honor a dead ancestor, or it might come from a dream of the baby’s mother or father. Even after a Native American child grows up, his or her name can change. In some tribes, names are considered a personal possession that can be loaned, pawned, given away, or even thrown away. Because of misunderstandings, many Native American names have been fun of. For instance, the name “Stinking Blanket” may have caused snickers among Europeans. However, attitudes about that name changed significantly after hearing an explanation of its source: An Indian brave fought so long and hard against his enemies that he never had time to stop and change his horse’s saddle blanket. Today, many Native Americans have two personal names. One name might be an ordinary one used for convenience. The other and more important name is the tribal name, which established membership in the tribe.			
	Comments: Literature Connection		

Appendix G. continued
Archaeology of Statements Worksheet

Statement # 17		Unit: Human Biology	p. 530
The menstrual period has always been surrounded by myth. The word taboo may come from the Polynesian word for menstruation. Not all the myths are negative, however. A girl's first period is greeted with celebration in some areas, for it means that she can now have children. Canada's Naskapi, for example, create elaborate caribou veils for women during their firs menses. Apache girls kneel on sacred deerskin during a four-day celebration of their first menstrual period.			
	Comments: TE Multicultural Connection		

Statement # 18		Unit: Human Biology	p. 560
Salt also played an important part in religious life. In many early societies along the Mediterranean, offerings of salt were made to the gods. On the North American continent, the Aztecs honored a salt goddess, the Navajos prayed to Salt Woman, and the Hopis' war god was Salt Man.			
	Comments: Global Connection		

Statement # 19		Unit: Ecology	p. 796
Fossil evidence indicates that the fruit of the prickly pear cactus was part of the diet of the native Indians of this region as long as 9000 years ago. The Aztecs prized the prickly pear for the red dye that was extracted from the bodies of an insect that lived on the plant.			
	Comments: Art Connection		

Statement # 20		Unit: Ecology	p. 807
For the Lapps, or Sami as they prefer to be called, semi-nomadic herders who live on the tundra of Scandinavia, the reindeer are the basis of their economy. Each Sami eats an average of eight to ten reindeer a year. They also make their coats, shoes, and tents from reindeer hides, use the antlers to make knife handles and glue, and sell reindeer meat to markets in the southern cities. Following the migration of reindeer herds has been their way of life for more than 10000 years.			
	Comments: Biology, Technology, and Society [STS content]		

Appendix G. continued
Archaeology of Statements Worksheet

Statement # 21		**Unit: Ecology**	**p. 825**
Explain to students how different cultures are dependent upon the biomes in which they live. For example, Laplanders depend on the reindeer that are the dominant large animals where they live in the taiga.			
	Comments: TE Multicultural Connection		

Statement # 22		**Unit: Ecology**	**p. 829**
There are often parallels between cultures that share the same type of environment even though the cultures are continents apart. Ask students to compare and contrast the cultures inhabiting the grasslands of North America (farmers), South America (gauchos), and Africa (Masai herders of Kenya).			
	Comments: TE Multicultural Connection		

Statement # 23		**Unit: Ecology**	**p. 867**
The Chipko Movement began in India in 1730 when the Maharajah of Jodphur sent his wood cutters to cut down the few trees left in the area. The Bishnois, a religious sect for whom the protection of trees and wildlife was a sacred duty, prevented this action. Bishnois women rushed in and put their arms around the trees to protect them. In 1973, a sports company was to come in to an area of Himalayan forest to cut trees for making racquet sports equipment. A community leader urged the people of the area to "chipko" or hold fast to the trees in their forest. When the tree cutters arrived, the women of the village rushed in and threw their arms around the threes.			
	Comments: TE Multicultural Connection		

Statement # 24		**Unit: Human Biology**	**p. 568**
Dr. Minoka-Hill (1876-1952) was a Native American born on a Mohawk reservation in New York state. After her mother's death, she stayed on the reservation with her maternal relatives until she was old enough to go to school. She also spent much of her time teaching the Oneida people about nutrition and good eating habits in an effort to relieve their constant problem of malnutrition.			
	Comments: History Connection **Lillie Rosa Minoka-Hill**		

Appendix G. continued
Archaeology of Statements Worksheet

Statement # 25		**Unit: Human Biology**	**p. 621**
People who live at high altitudes are adapted to the lower air pressure. For example, the native Aymara and Quechua Indians that live in the Andes mountains have barrel-shaped chests, strong diaphragms, and large lungs that have a greater capacity than the lungs of people who live at lower altitudes. The Aymara and Quechua also have more capillaries around their aveoli, larger hearts, and more red blood cells.			
	Comments: Global Connection **How high can they live?**		

Statement # 26		**Unit: Plants**	**p. 439**
Give each group an anthology of Native American poetry. Ask them to find poems that refer to plants. Ask them to explain how or why the poet used that specific plant in the poem.			
	Comments: TE Literature Connection		

Appendix G. continued
Archaeology of Statements Worksheet

Textbook: ***Modern Biology*** **Number: 6 Set: 2**

Statement # 1	**Unit:**	**p. 17**
Science is a body of knowledge. Science is also a way of learning about the natural world.		
	Comments: nature of knowledge	

Statement # 2	**Unit:**	**p.**
Science does not prescribe one single method for asking and seeking answers to questions. Scientists combine some or all of the processes you have read about in a logical way to devise a scientific method best suited for a particular research project.		
	Comments: nature of knowledge	

Statement # 3	**Unit: Plants**	**p. 373**
Native Americans and early settlers used horsetails as pot scrubbers. This practice led to another common name for the genus, scouring rushes.		
	Comments:	

Statement # 4	**Unit: Vertebrates**	**p. 590**
Have students use library resources to research the uses and significance of feathers within Native American cultures. This could include uses in clothing and art, ceremonial significance, indications of status within the tribe, or the significance of the species of birds from which the feathers are obtained. Suggest that students obtain information about historical tribes or about pre-Columbian civilizations, such as the Peruvian Inca.		
	Comments: Interdisciplinary Activity – Social Studies	

Appendix G. continued
Archaeology of Statements Worksheet

Textbook: ***BSCS Ecological Approach*** **Number: 7 Set: 2**

Statement # 1	**Unit: Intro**	**p. 19**
Biology is concerned with data – observations that do not differ from one person to another. Biologist collect and organize data about organisms. They use the data in various ways to gain more information. Science, however, is more than just the collection of data. It is a systematic way of looking as the world, of obtaining data, and of interpreting it. It is a continuous process of inquiry, the product of which is a body of knowledge. This body of knowledge is subject to change and revision as we acquire new information. Above all science is a human endeavor because people are involved in the process of inquiry.		
	Comments: nature of knowledge	

Statement # 2	**Unit: Intro**	**p. 20**
The methods of obtaining scientific knowledge involve a series of steps that begin with observations of the living world.		
	Comments: nature of knowledge	

Statement # 3	**Unit: Microbial**	**p. 327**
Some reindeer moss has accumulated radioactive materials from aboveground atomic bomb testing in the Artic. Reindeer and caribou that have eaten the lichens have taken in the radioactive materials. When Eskimos have eaten these animals, they also have absorbed the radioactive materials. Thus materials may be passed along unexpectedly through a food chain to a consumer at the top of the chain.		
	Comments:	

Statement # 4	**Unit: Plants**	**p. 345**
Horsetails are harsh to the touch; their tissues contain silica, a compound present in sand. Because American Indians and the pioneers scrubbed pots and pans with them, they are commonly called scouring rushes.		
	Comments:	

Appendix G. continued
Archaeology of Statements Worksheet

Statement # 5	**Unit: Vertebrates**	**p. 360**
Frequently, bright colors on animals are warnings to potential predators. What might the bright colors on this frog signal? From what you know about how frogs have sometimes been used by natives of Central and South America, suggest a name for this frog.		
	Comments: Figure *Atelopus varius*	

Statement #6	**Unit: Ecology**	**p. 671**
Animal-powered agriculture.		
	Comments: Figure 24.5	

Statement # 7	**Unit: Ecology**	**p. 670**
Llamas were used extensively in South America; dogs (travois and sled) in North America. Otherwise, American Indians fully domesticated only turkeys and guinea pigs.		
	Comments: TE	

Appendix G. continued
Archaeology of Statements Worksheet

Textbook: *Biology Today* **Number: 8** **Set: 2**

Statement # 1	**Unit: Intro**	**p. 3**
Science often seems a mysterious process to the nonscientist. White-coated men working in the sterile laboratories and engaging in difficult-to-understand processes embody the stereotype of the typical scientist and *his* work. However, as you can see in the opener photos, scientists are men *and* women, and are a culturally and ethnically diverse group. In addition, not all scientists work in laboratories. In fact, science takes place just about anywhere!		
	Comments: nature of knowledge	

Statement # 2	**Unit: Intro**	**p. 3**
Although scientists and "their" science may differ in their focuses all scientists – biologists, chemists, physicists, and so forth – study the natural world and go about their work in a similar way. This similar way is referred to as the scientific method. The scientific method is a process, or series of steps, scientists use to answer the questions they ask. In addition, all scientists ask questions that can be investigated by means of experimentation.		
	Comments:	

Statement # 3	**Unit: Plants**	**p. 537**
Grain amaranths were important grain crops of the Latin American highlands in the days of the Incas and Aztecs, but are little used now. Their use was suppressed because they played a role in pagan ceremonies of which the Spanish conquerors disapproved.		
	Comments:	

Statement # 4	**Unit: Ecology**	**p. 632**
These workers are using a primitive method to thresh sorghum in southern India.		
	Comments: Figure 36-7	

Appendix G. continued
Archaeology of Statements Worksheet

Statement # 5		**Unit: Ecology**	**p. 647**
The tiny tropical tree frog is so poisonous that Indians in western Colombia use their venom to poison their blow darts..			
	Comments:		

Statement # 6		**Unit: Ecology**	**p. 699**
These farmers live near the Andasibe reserve in Madagascar.			
	Comments: Figure 40-4.		

Appendix G. continued
Archaeology of Statements Worksheet

Textbook: ***Biology The Study of Life*** **Number: 9 Set: 2**

Statement # 1		**Unit: Intro**	**p. 13**
Broadly speaking, science is an attempt to understand the world we live in. By this, we mean that science goes beyond the simple observation and description of objects and events. It tries to find general principles to explain why things are as they are and why things happen as they do.			
	Comments: nature of knowledge		

Statement # 2		**Unit: Intro**	**p. 13**
Within each of theses fields, there are numerous subdivisions. Even so, scientists in all fields approach their problems in the same way. When a scientist announces a finding or proposes a new idea, other scientists may repeat the work or test its conclusions. This universal approach to scientific problems is called the scientific method. Its main features are the same in all areas of science.			
	Comments: nature of knowledge		

Appendix G.
Archaeology of Statements Worksheet

Textbook: *Biology The Dynamics of Life* **Number: 1** **Set: 3**

Statement # 1	**Unit: Intro**	**p. 6**
For humans who share this planet with an amazing diversity of living things, the natural world often poses questions that arouse our curiosity. More often than not, such questions have simple explanations, but sometimes nature defies common sense. Whether nature's puzzles are simple or complex, many may be explained with the concepts and principles of biological science.		
	Comments: nature of knowledge	

Statement # 2	**Unit: Intro**	**p. 9**
Figure 1.4 Biology will teach you about how humans function and fit in with the rest of the natural world. It will also equip you with the knowledge needed to handle any future biological problems of Earth.		
	Comments: nature of knowledge	

Statement # 3	**Unit: Intro**	**p. 21**
Biology, like all sciences, is a continuous process that seeks to discover facts about the natural world.		
	Comments: nature of knowledge	

Statement # 4	**Unit: Intro**	**p. 25**
How do biologists know these things? They've acquired this knowledge using well-established methods of study.		
	Comments: nature of knowledge	

Statement # 5	**Unit: Intro**	**p. 42**
Observational data – that is, written descriptions of what scientists observe – are often just as important in the solution of a scientific problem as numerical data.		
	Comments: nature of knowledge	

Appendix G. continued
Archaeology of Statements Worksheet

Statement # 6	**Unit: Intro**	**p. 43**
Some questions are simply not in the realm of science. Many of these involve questions of good versus evil, ugly versus beautiful, or similar judgments. If a question is not testable using scientific methods, the question is not science. However, this does not mean the question in unimportant.		
	Comments: nature of knowledge	

Statement # 7	**Unit: Evolution**	**p. 474**
Humans reached North America by at least 12,000 years ago, and by 8000 to 10000 years ago, cultural innovations such as animal domestication, agriculture, and the development of permanent settlements by Native Americans had begun.		
	Comments:	

Statement # 8	**Unit: Evolution**	**p. 474**
Permanent settlements in the Americas, such as this one in the Betatakin Navajo National Monument of Arizona, have been dated to 11000 years ago.		
	Comments: Figure 19.14	

Statement # 9	**Unit: Ecology**	**p. 73**
Cultural adaptations to the Environment For example, the Inuit of North America created housing using their most available resources: snow and ice. People of the southwestern United States often built their houses into mountainsides using a mud-clay mixture called adobe.		
	Comments:	

Statement # 10	**Unit: Cells**	**p. 226**
People in early agricultural societies observed that dried or salted meats resisted decay.		
	Comments: TE History Connection – Agricultural Lifestyles	

Appendix G. continued
Archaeology of Statements Worksheet

Statement # 11		**Unit: Plants**	**p. 589**
Introduce students to the growing field of ethnobotany, the study of how native cultures use plants. Ethnobotany has become increasingly important to the development of new drugs by pharmaceutical companies. One firm, Shaman Pharmaceuticals in California, sends researchers into South America, Asian, and African tropical forests to ask healers about the medications they drive from plants.			
	Comments: TE Cultural Diversity		

Statement # 12		**Unit: Plants**	**p. 631**
Corn was one of the earliest crops to be domesticated, and has been a major food source for Native Americans of both North and South America for about 7000 years. In addition to its importance as a food source, corn also occupies a symbolic place in the culture of many Native American tribes.			
	Comments: TE Cultural Diversity		

Statement # 13		**Unit: Plants**	**p. 632**
Lima beans spread from Central America to North America, where Native Americans combined them with corn to make succotash.			
	Comments: Social Studies Beans of the World		

Statement # 14		**Unit: Plants**	**p.**
Because of its seeds, cocao was domesticated by the Mayas and Aztecs who turned the seeds into a rich brown drink called chocolate.			
	Comments: TE Cultural Diversity		

Statement # 15		**Unit: Plants**	**p.**
Animals in Cross-cultural Perspective For example, Native American traditions often portray animals as important as or even more important than humans.			
	Comments: TE Cultural Diversity		

Appendix G. continued
Archaeology of Statements Worksheet

Statement # 16		Unit: Vertebrates	p. 830
The poison secreted by these frogs is used by native peoples to coat the tips of the darts they use in their blow guns for hunting.			
	Comments: Chemistry – Killer Frogs		

Statement # 17		Unit: Human Biology	p. 1010
The Chinese have used acupuncture as complete system of medicine for many years. Acupuncture has been slow to gain acceptance in Western medical practices.			
	Comments: TE Different Viewpoints in Biology – Acupuncture		

Statement # 18		Unit: Human Biology	p. 1054
Rites of Passage In many cultures and religions, traditional celebrations mark the transition from childhood to adulthood. For example, in Mexican tradition, a girl celebrates her transition from childhood to adulthood on her fifteenth birthday in a celebration known as quinceanera.			
	Comments: TE Cultural Diversity		

Appendix G. continued
Archaeology of Statements Worksheet

Textbook: *Biology Principles & Explorations* **Number: 2** **Set: 3**

Statement # 1		**Unit: Intro**	**p. 8**
Although there is no single scientific method, all scientific investigations can be said to have six stages: collecting observations, forming hypotheses, making predictions, verifying predictions, performing control experiments, and forming a theory.			
	Comments:		

Statement # 2		**Unit: Intro**	**p. 5**
A frog is an important character in a story about the first Kwakiutl totem pole, told by the Haida Indians of the American Northwest coast. This special frog led the Haida chieftain to a spectacular totem pole – the first of the tribe. The frog called it the sky-supporting pole.			
	Comments: TE Multicultural Perspective		

Statement # 3		**Unit: Intro**	**p. 16**
Using the scientific method, medical researchers in the 1970s began to prove the validity of medicinal plants known to other cultures for thousands of years. The onslaught of scientific interest in traditional medicine has both positive and negative consequences.			
	Comments: TE Historical Note		

Statement # 4		**Unit: Cells**	**p. 58**
Different cultures throughout the world have used water and mineral salts to purify their bodies. Some Native American tribes use sweat lodges or community steam baths for physical and spiritual purification.			
	Comments: TE Multicultural Perspective		

Appendix G. continued
Archaeology of Statements Worksheet

Statement # 5		**Unit: Cells**	**p. 75**
The Hindu word om represents the sound of universal energy from which all things are created. Many non-Hindu Americans and Europeans have begun to use Eastern meditation practices such as the chanting of om in order to regulate body metabolism, control chronic pain, or remedy health problems, such as heart and respiratory disease.			
	Comments: TE Multicultural Perspective		

Statement # 6		**Unit: Cells**	**p. 123**
While most Europeans form the Middle Ages through the nineteenth century believed that genetic defects reflected inner corruption, many other cultures, including both the Celtic people of Europe and Native Americans, considered such people to have a special gift of insight and a closer connection with nature. These unique members of the community were given responsibility as tribal leaders or healers.			
	Comments: TE Multicultural Perspective		

Statement # 7		**Unit: Genetics**	**p. 154**
A survey to determine the frequency of albinism in Native American communities in Arizona and New Mexico showed the numbers to range from very rare to nonexistent. However, in a Hopi tribe in Arizona, the frequency of albinos was determined to be 1 out of every 277 people. Emphasize that Hopi people have always had a high regard for albinos, and clan leaders have taken special care to protect them from the harsh desert sun.			
	Comments: TE Demonstration – Cultural Selection		

Statement # 8		**Unit: Evolution**	**p. 226**
A Hopi proverb states, “Earth gives life and seeks the man who walks gently upon it.”			
	Comments: TE Multicultural Perspective		

Appendix G. continued
Archaeology of Statements Worksheet

Statement # 9		**Unit: Evolution**	**p. 303**
Ask students to think of ways that rocks may be used as tools, and how they might show evidence of use. If they have trouble thinking of rocks as tools, suggest thinking of ways Native Americans use rocks. (arrowheads, axes, grinding stones, hammers)			
	Comments: TE Teaching Tips *Handy Man*		

Statement # 10		**Unit: Ecology**	**p. 338**
Isolated indigenous peoples often have more intimate and complete knowledge of their local plants and animals than do Western biologists. In the 1920s, Ernst Mayr, who would later propose the biological species concept, visited a remote area of New Guinea to collect birds. HE hired hunters of the Arfak tribe to bring in specimens and noted the local name for each species. With one exception, Mayr and the local Arfak tribe recognized the same species of birds. The Arfak people hunted birds for food and feathers, and knowledge of appearance and habits of their prey was necessary to ensure successful hunting.			
	Comments: TE Multicultural Perspective		

Statement # 11		**Unit: Plants**	**p. 532**
Native Americans used gymnosperms in several ways. Using pine needles, they made a tea that was rich in vitamin C and help them prevent scurvy. They also chewed resin from spruce trees as a type of chewing gum.			
	Comments: TE Multicultural Perspective		

Statement # 12		**Unit: Plants**	**p. 557**
Native Americans once ate the young stems of cattails, which taste very much like the asparagus we eat today.			
	Comments: TE Multicultural Perspectives		

Appendix G. continued
Archaeology of Statements Worksheet

Statement # 13	Unit: Plants	p. 590
Native Americans developed all of the types of corn known today, such as popcorn and sweet corn, before the time of Columbus. They also developed the processes of popping and grinding corn.		
	Comments: TE Opening Demonstration	

Statement # 14	Unit: Plants	p. 594
American colonists of the 1600s and 1700s first learned how to grow corn form Native Americans. In the southeastern United States, corn was more widely grown than wheat, which does not grow as well in hot climates.		
	Comments:	

Statement # 15	Unit: Plants	p. 594
A Hopi legend tells of a mockingbird that placed different kinds of corn in front of the different Indian tribes. Each tribe selected a different ear of corn. Some of those chosen included yellow by the Navajo, red by the Havasupai, white by the Sioux, flint by the Ute, and the longest ear by the Apache. The last ear, which was blue, was selected by the Hopi. To the Hopi Indians of Arizona, blue corn is sacred and predicts a hard but long life.		
	Comments: TE Multicultural Perspective	

Statement # 16	Unit: Plants	p. 594
Early native farmers in Mexico are thought to have selected seeds from the largest flower spikes of teostinte, a wild annual grass. Selective breeding by humans eventually produced plants that had flowed spikes with many parallel rows of grain, resembling an ear of corn. Corn was later cultivated by the Aztecs of central Mexico, the Mayas of central Mexico and northern Central America, and the Incas of western South America. The cultivation of corn also spread among many other native North American cultures.		
	Comments:	

Appendix G. continued
Archaeology of Statements Worksheet

Statement # 17		**Unit: Plants**	**p. 601**
Rural and primitive cultures around the world still depend on native plants to ease pain and cure illnesses. By studying the plants traditionally used to treat human ailments, researchers have developed many “modern” medicines. For example, solutions made by soaking the bark of willow trees, Salix, were a traditional cure for aches and pains.			
	Comments:		

Statement # 18		**Unit: Plants**	**p. 603**
Rubber was first obtained from plants. Native Americans of Central and South America made rubber balls and water-proof shoes from latex, the milky white sap of tropical trees of the genus *Hevea*.			
	Comments:		

Statement # 19		**Unit: Invertebrates**	**p. 627**
The Cochiti of the South-western United States have incorporated the beetle’s behavior into one of their creation stories. The story states that long ago the beetle was told to place the stars in the sky. But the beetle became careless and dropped the stars, causing them to scatter. As a result, the Milky Way was formed. To this day, the beetle is so ashamed of the mishap, it lowers its head in disgrace whenever someone approaches.			
	Comments: TE Multicultural Perspective		

Statement # 20		**Unit: Invertebrates**	**p. 666**
Mollusk shells have served many different functions in various cultures, especially in making jewelry and crafts. In addition to their usefulness as decorations, these shells have been used for several practical purposes. Phoenicians and Romans used Murex sea snails to make a purple dye for coloring fabric. Native North Americans carved large clam shells into wampum beads and used other shells as money. Filipinos cut thin Placuna oyster shells to fit into wooden frames as window panes.			
	Comments: TE Multicultural Perspective		

Appendix G. continued
Archaeology of Statements Worksheet

Statement # 21		**Unit: Vertebrates**	**p. 780**
The snake is one of the deadliest reptiles and is also one of the most fascinating to the people of India. In a tradition that goes back at least 2,000 years, the Indians compare areas of energy located throughout the human body, collectively termed kundalini (“coiled one”), to a cobra. The Indians teach that this energy, like its cobra counterpart, must be treated with great respect. A very popular yoga position is called “the cobra.”			
	Comments: TE Multicultural Perspective		

Statement # 22		**Unit: Vertebrates**	**p. 796**
The only people in North America who can legally own an eagle feather are Native Americans. The eagle is so highly valued by tribes throughout the United States that its feathers must be earned through personal sacrifice and then used only in special ceremonies. For instance, if a Winnebago pow-wow dancer accidentally drops an eagle feather during a performance, the dance is stopped until the feather is purified by an elder and then reclaimed by the dancer, who si not allowed to dance again for a year.			
	Comments: TE Multicultural Perspective		

Statement # 23		**Unit: Human Biology**	**p. 955**
The majority of the people in South America used the term before Columbus arrived in the Americas. Tobacco was chewed or smoked for centuries to mark events such as war, peace, puberty, the harvest, or death.			
	Comments: TE Multicultural Perspective		

Statement # 24		**Unit: Microbial**	**p. 419**
Dr. Chuck Haines is a microbiologist. He is also an ethnobotanist. Combining his love of science with his fascination of the medicinal plants of indigenous people, Dr. Haines wrote his doctoral dissertation on the medicinal properties of cinnamon. He teaches biology, ethnobotany, and microbiology at Haskell Indian Nations University in Lawrence, Kansas – the only school in the United States that brings together Native American students from over 160 tribes.			
	Comments: TE Multicultural Perspective		

Appendix G. continued
Archaeology of Statements Worksheet

<table>
<tr><td colspan="2">Statement # 25</td><td>Unit: Microbial</td><td>p. 457</td></tr>
<tr><td colspan="4">On the Navajo reservation in the “four corners” regions of Colorado, New Mexico, Utah and Arizona, a viral infection previously unknown to Americans killed 16 people within six months in 1993. This pulmonary syndrome, which is spread by deer mice, is caused by a hantavirus, names after the Hanteen River in Korea, where US military researchers first encountered it. The American hantavirus variant primarily attacks the lungs, unlike Asian and European strains, which cause fever and kidney disease.</td></tr>
<tr><td></td><td colspan="3">Comments: TE Multicultural Perspective</td></tr>
</table>

<table>
<tr><td colspan="2">Statement # 26</td><td>Unit: Microbial</td><td>p. 470</td></tr>
<tr><td colspan="4">Isolated communities are at particular risk of epidemics when outsiders visit. In the northern Quebec community of Ungava Bay, 99% of the native people were afflicted with measles in 1952. Measles also killed a high number of native Brazilian people in Xingu National Park in 1952. Today, the Yanomamo tribe of Brazil and Venezuela is dying rapidly because of the onslaught of malaria, influenza, measles, and chickenpox brought by miners in search of gold.</td></tr>
<tr><td></td><td colspan="3">Comments: TE Multicultural Perspective</td></tr>
</table>

<table>
<tr><td colspan="2">Statement # 27</td><td>Unit: Plants</td><td>p. 578</td></tr>
<tr><td colspan="4">Have students research the concept of intellectual property rights and then debate whether businesses should have the right to use valuable plants for the economic gain without compensation to the people of the countries in which the plants are collected.</td></tr>
<tr><td></td><td colspan="3">Comments: TE Instructional Strategies</td></tr>
</table>

Appendix G. continued
Archaeology of Statements Worksheet

Textbook: ***Essentials of Biology Concepts and Communication*** **Number: 3 Set: 3**

Statement # 1		**Unit: Intro**	**p. 6**
Recall that we said biology is a science. Science is the study of how the natural world works. Scientists study the world. They observe nature. Nature is everything that is not made or change by people.			
	Comments: nature of knowledge		

Statement # 2		**Unit: Intro**	**p. 6**
Scientists study many different things, but they have common processes for their studies. These processes are called scientific methods. Scientific methods are ways of asking and answering questions about the world. We will take about the usual scientific methods that scientists often use. You use scientific methods every day to answer questions that come up in your life.			
	Comments: nature of knowledge		

Appendix G. continued
Archaeology of Statements Worksheet

Textbook: ***Holt Biology Visualizing Life*** **Number: 4** **Set: 3**

Statement # 1		**Unit: Intro**	**p.**
Science is a way of investigating the world in order to form general rules about what causes things to happen. Science has changed the world rapidly in modern times, and new and important scientific discoveries, like the one shown in Figure 1-1, continue to be made			
	Comments: nature of knowledge		

Statement # 2		**Unit: Intro**	**p. 15**
It was once fashionable to claim that scientific progress was the result of applying a series of steps called "the scientific method." In this view, science is a sequence of logical "either/or" steps, each step rejecting one of two incompatible alternatives. Trial-and-error testing could inevitably lead one through a maze of uncertainty. If this view were true, a computer could be programmed to be a good scientist. But science is not done this way. If you ask successful scientists how they do their work, you will find that they design experiments with a good idea of the results they will get. Not just any hypothesis is tested – only a hunch or educated guess that is based on all the scientist knows and that allows his or her imagination full play. Because insight and imagination are so important in scientific progress, some scientists are better than others.			
	Comments: nature of knowledge		

Statement # 3		**Unit: Intro**	**p. 9**
An old saying that is attributed to many different sources, from Native Americans to Amish farmers, states that "we do not inherit the world from our parents; we borrow it from out children."			
	Comments:		

Appendix G. continued
Archaeology of Statements Worksheet

Statement # 4	**Unit: Intro**	**p. 13**
Legends of the Navajo, Chippewa, and Sioux Native Americans have told of bears teaching people to use herbs and roots for medicine. Scientists are now giving serious attention to these legends. Some tribes observed and described bears digging for roots and bulbs to eat. The Native Americans found that some of these roots could be used to treat certain ailments and fight infections and parasites. In some tribes, strong medicine is still called "bear medicine." Throughout the world, scientists are seeking the wisdom of indigenous peoples and observing the eating habits of animals to learn which plants hold medicinal value.		
	Comments: TE Multicultural Perspective	

Statement # 5	**Unit: Ecology**	**p. 265**
In India, the neem tree provides so many useful products that is has been called "the village pharmacy." Its leaves are used to make medicinal teas and insect repellents. Juice from the tree is used to treat skin problems, and the twigs are used to clean teeth.		
	Comments: TE Multicultural Perspective	

Statement # 6	**Unit: Microbial**	**p. 319**
Are species natural units that are recognized by different cultures? Or are they artificial distinctions imposed on nature by Western scientists? It appears that the first is true. In 1928 Ernst Mayr, then a young ornithologist, traveled to New Guinea to collect bird specimens. Mayr found that the local Arfak people recognized 136 kinds of birds, just one less than he did. Moreover, Mayr and the Arfak recognized the same species expect for two very similar species that the Arfak did not distinguish.		
	Comments: TE Multicultural Perspective	

Statement # 7	**Unit: Plants**	**p. 404**
Kola nuts are cultivated in the West Indies, West Africa, and South Africa. They are the fruits of several types of evergreen trees. People who live in African countries call the nuts *guru* or *goora* nuts and chew them like gum. Kola nuts are also used to make coal soft drinks and medicines.		
	Comments: TE Multicultural Perspective	

Appendix G. continued
Archaeology of Statements Worksheet

Statement # 8		**Unit: Plants**	**p. 413**
Rice plays an important part in the customs of many cultures. For example, Japanese people place a *shimenawa*, a rice-straw rope, over an entrance to ward off evil.			
	Comments: TE Multicultural Perspective		

Statement # 9		**Unit: Plants**	**p. 414**
Corn was cultivated by the Aztecs of Mexico, the Mayas of Yucatan and Central America, and the Incas of South America. American Indian framers selected plants that produced "ears" with tender grains that could be eaten more easily than the hard teosinte grains. They also selected plants that produced ears with more rows of grains.			
	Comments:		

Statement # 10		**Unit: Plants**	**p. 419**
People have always used plants to treat diseases and other ailments. Botany (the study of plants) was considered to be a branch of medicine until the mid-1800s. Doctors, such as the ones in Figure 22-10, continue to search for plants that may provide new treatments or cures for diseases such as cancer. Many familiar medicines, their original plant sources, and their uses are listed in table 22-2.			
	Comments:		

Statement # 11		**Unit: Plants**	**p. 418**
An American Indian doctor (left) is teaching a Western doctor (right) about native Amazonian rain-forest plants that can be used to treat disease.			
	Comments: Figure 22-10		

Statement # 12		**Unit: Plants**	**p. 419**
American Indians of South America made rubber balls and waterproof shoes from latex, which is shown in Figure 22-12.			
	Comments:		

Appendix G. continued
Archaeology of Statements Worksheet

Statement # 13	**Unit: Vertebrates**	**p. 488**
Mollusk shells have served many different functions in various cultures, especially as ornaments in jewelry and crafts. In addition to their usefulness as decorations, these shells have been used for several practical purposes. Phoenicians and Romans used murex sea snails to make a purple dye for coloring fabric. Native Americans carved large clamshells into wampum beads and used other shells as money. Filipinos cut thin placuna oyster shells to fit into wooden frames as window panes.		
	Comments: TE Multicultural Perspective	

Statement # 14	**Unit: Vertebrates**	**p. 542**
A female green turtle will lay her eggs on the same beach where she hatched, but it is not known how she finds the correct beach.		
	Comments: TE Matter of Fact	

Statement # 15	**Unit: Vertebrates**	**p. 565**
Indigenous people in Brazil wear jewelry made of animals bones, claws, teeth and feathers. Jaguar claws, for example, are used in necklaces. The brightly colored feathers of the toucan are used in earrings.		
	Comments: TE Multicultural Perspective	

Statement # 16	**Unit: Vertebrates**	**p. 235**
To the early European colonists of Australia, the technology of the Aborigines indicated a very primitive people. The Aborigines could produce only a limited variety of tools because they did not know how to mine, smelt or work metal. They had to rely on hunting and gathering because they did not practice agriculture. However, as the Europeans soon learned, the Aborigines compensated for the technological “deficiencies” with a deep and detailed knowledge of their environment, which allowed them to survive in areas where Europeans explorers and settlers perished. In particular, Aborigines were experts on the behavior of animals, and they used this knowledge to capture game and to find water in dry areas.		
	Comments: TE Multicultural Perspective	

Appendix G. continued
Archaeology of Statements Worksheet

Statement # 17		**Unit: Microbial**	**p. 349**
The early struggles between Europeans and Native Americans may well have been decided by disease. Spanish conqueror Hernan Cortes was aided in his conquest of the Aztecs by a smallpox epidemic that struck the Aztecs – smallpox had been unknown in the New World prior to the Europeans' arrival. Smallpox killed millions of Native Americans. Spanish chronicler Toribio Motolinia wrote that so many had died that they could not be buried – "They pulled down the houses over them in order to check the stench that rose from the dead bodies." Native Americans also died in great numbers in the northeastern United States, allowing Europeans to more easily establish their presence there.			
	Comments: TE Multicultural Perspective		

Appendix G. continued
Archaeology of Statements Worksheet

Textbook: ***BSCS Ecological Approach*** **Number: 5 Set: 3**

Statement # 1		**Unit: Intro**	**p. 15**
Biology is concerned with data – observations that do not differ from one person to another. Biologist collect and organize data about organisms. They use the data in various ways to gain more information. Science, however, is more than just the collection of data. It is a systematic way of looking as the world, of obtaining data, and of interpreting it. It is a continuous process of inquiry, the product of which is a body of knowledge. This body of knowledge is subject to change and revision as we acquire new information. Above all science is a human endeavor because people are involved in the process of inquiry.			
	Comments: nature of knowledge		

Statement # 2		**Unit: Intro**	**p. 16**
The methods of obtaining scientific knowledge involve a series of steps that begin with observations of the living world.			
	Comments: nature of knowledge		

Statement # 3		**Unit: Microbial**	**p. 303**
Some reindeer moss has accumulated radioactive materials form aboveground atomic bomb testing in the Arctic. Reindeer and caribou that have eaten the lichens have taken in the radioactive materials. When Eskimos have eaten these animals, they also have absorbed the radioactive materials. Thus materials may be passed along unexpectedly through a food chain to a consumer at the top of the chain.			
	Comments:		

Statement # 4		**Unit: Plants**	**p. 322**
Horsetails are harsh to the touch; their tissues contain silica, a compound present in sand. Because American Indians and the pioneers scrubbed pots and pans with them, they are commonly called scouring rushes.			
	Comments:		

Appendix G. continued
Archaeology of Statements Worksheet

Textbook: *BSCS Human Approach* **Number: 6 Set: 3**

Statement # 1	**Unit: Evolution**	**p. 3**
The biology program you are just beginning focuses on science as one of the ways human understand and explain their world. The activities throughout the program encourage you to think as a scientists thinks.		
	Comments: nature of knowledge	

Statement # 2	**Unit: Evolution**	**p. 10**
Imagine yourself doing one or more of the following: • Understanding the choices a doctor offers; • Deciphering nutritional information on a food package label; • Voting on an issue involving science and technology; • Serving on a jury that has to listen to an expert describe DNA evidence or; • Deciding whether or not to support the construction of a new dam. Will you be one of the people acting with information because you have learned to think scientifically? Or will you be one of the people who acts and hopes for the best, despite a lack of information and understanding? By participating in this biology program you are taking a big step toward joining the first group of people.		
	Comments: nature of knowledge	

Statement # 3	**Unit: Evolution**	**p. 71**
An important characteristic of scientific knowledge is this openness to change and modification. Scientific knowledge is not static because scientists continuously discover new information and test and reevaluate existing understandings. Usually, changes in scientific knowledge are not so great that we must discard all of our previous explanations in favor of new ideas		
	Comments: nature of knowledge	

Appendix G. continued
Archaeology of Statements Worksheet

Statement # 4		**Unit: Genetics**	**p. 255**
During World War II, the United States Marine Corps used this language, Navajo, to code and transfer secret information. They chose Navajo because it is a complex language that is not widely known. Consequently, if a message were intercepted by people outside the United States, it was unlikely that they would be able to make sense of it.			
	Comments:		

Statement # 5		**Unit: Human Biology**	**p. E129**
The earliest Anasazi Indians. The year is 950 A.D. To plant, they use a stick to make holes in the ground, drop kernels of corn into each hole, and then cover them with soil. The Anasazi families will not only eat the fruit and seed of the yucca, but they will use the roots for soap and shampoo, and the strong, sturdy fibers from the leaves for making intricate baskets, sandals, aprons, mats and cradle boards. In addition to preparing and eating the meat, the Anasazi make clothing for the winter months form the pelts of rabbits and tools and utensils such as needles from the bones.			
	Comments:		

Statement # 6		**Unit: Human Biology**	**E153**
In a tribe in the Amazon forest, adolescent boys undergo an initiation rite that marks them as young men. Two older men make incisions in the boys' skin and fill the wounds with hot, liquid tar. The tar prevents infection and leaves a pattern of scars on their bodies. Although the ritual is painful, the boys are proud to be entering puberty. Similar scarification techniques are used by Aborigines of Australia's Northern Territory and by the Abelam of Papua New Guinea. Among the Abelam, a female's first menstruation is a time of great celebration. At this time other women cut designs in the skin of the breasts, stomach and upper arms of the girl and shave her head. Such rituals are conducted with great celebration.			
	Comments:		

Appendix G. continued
Archaeology of Statements Worksheet

Statement # 7		**Unit: Human Biology**	**E227**
In general, traditional societies are societies that have not been influenced by the modern or Western cultures around them. Because we live in an extremely mobile world, most traditional cultures have had contact with modern cultures, but the timing and the extent of this contact have varied.			
	Comments:		

Appendix G. continued
Archaeology of Statements Worksheet

Textbook: ***Biology The Living Science*** **Number: 7 Set: 3**

Statement # 1	**Unit: Intro**	**p. 4**
Thanks to human curiosity and intelligence, we have developed a remarkable process of thinking and learning about the world around us. This process is called science. As you know, there are many fields of science, each of which tries to explain one aspect of our world. Biology, the science of life, is the subject of this textbook.		
	Comments: nature of knowledge	

Statement # 2	**Unit: Intro**	**p. 11**
People often answer their questions about life by thinking about their everyday experiences. However, science demands that questions be answered by the use of a precise method. In this section, you'll discover just what that method is. The precise method used by scientists is called the scientific method, and it separates from other ways of studying and learning.		
	Comments: nature of knowledge	

Statement # 3	**Unit: Intro**	**p. 11**
The scientific method is a system of asking questions, developing explanations, and testing those explanations against the reality of the natural world. Other fields – such as art, music, history, and philosophy – all have a great deal to tell us about the world. But although each is important and deserving of careful study, none of them uses the scientific method, which means that none of them is a field of science.		
	Comments:	

Appendix G. continued
Archaeology of Statements Worksheet

Statement # 4		**Unit: Genetics**	**p. 197**
Native Americans living in what is now central or southern Mexico selectively bred corn from wild plants to make it a more useful food crop. Encourage student to learn more about how advances in farming techniques change the customs and lifestyles of Native Americans, such as the Pueblo people. Have students consider why it was important for Native Americans to improve the wild plants and animals around them to help them to survive. Challenge students to compare these Native Americans to present-day breeders.			
	Comments: TE Managing Classroom Diversity – Multicultural Strategy		

Statement # 5		**Unit: Genetics**	**p. 197**
Over a span of 200 years, both the Palouse and Nez Perce had acquired horses and learned how to train and breed them. From Spanish horses of mixed color and temperament, the two tribes produced the appaloosa – the first recognized breed of horses in North America and still a favorite among horse owners today.			
	Comments: Figure 9-1		

Statement # 6		**Unit: Genetics**	**p. 197**
Spanish explorers tried either to convert Native Americans to the Spanish way of life or conquer them. Native Americans were resistant to giving up their customs and their land.			
	Comments: TE Integrating Social Studies		

Statement # 7		**Unit: Evolution**	**p. 250**
Darwin made his voyage during one of the most exciting periods in Western science. Many explorers were traveling the world, expanding the horizons of knowledge. Great thinkers in several fields of science had begun to challenge established views about the natural world.			
	Comments:		

Appendix G. continued
Archaeology of Statements Worksheet

Statement # 8		Unit: Ecology	p. 341
The indigenous peoples of the present Untied States, including Alaska and Hawaii, have inhabited all major biomes, adapting to and making use of the biotic and abiotic factors in their environment.			
	Comments: Managing Classroom Diversity – Multicultural Strategy		

Statement # 9		Unit: Ecology	p. 359
The Anasazi were the direct ancestors of modern Pueblo Indians, the Hopi and Zuni. For more than 1000 years, the Anasazi flourished across the American Southwest where the present states of Utah, Colorado, Arizona, and New Mexico meet. These ancient people first settled the area in about AD 100. By AD 1200 they numbered well into the tens of thousands.			
	Comments: TE Managing Classroom Diversity – Multicultural Strategy		

Statement # 10		Unit: Ecology	p. 359
The Anasazi civilization built elaborate cities and created beautiful objects but did not survive a long period of drought. Perhaps these cultures offer important lessons as we look to the future.			
	Comments: Figure 16-1		

Statement # 11		Unit: Ecology	p. 359
In a far different environment, the Anasazi, which in Navajo means “ancient people,” built great cities in the canyons of the American Southwest. AS their population grew, however, the Anasazi required more form the desert than the ecosystem could supply.			
	Comments:		

Appendix G. continued
Archaeology of Statements Worksheet

Statement # 12		**Unit: Plants**	**p. 565**
Have students investigate the many uses of ferns and fern fronds in cultures around the world. Some students could concentrate on the uses of ferns in folk medicine; others could investigate the use of fern fronds in the construction of thatch houses in Asia and the South Pacific.			
	Comments:		

Statement # 13		**Unit: Vertebrates**	**p. 715**
Native American cultures of the northwestern United States and Canada have many myths that involve Raven as the central figure, including creation myths.			
	Comments: TE Managing Classroom Diversity – Multicultural Strategy		

Statement # 14		**Unit: Evolution**	**p. 250**
Encourage students to choose a small population of people, such as aborigines form New Zealand, native Hawaiians, or American Eskimos, and learn about their culture and their environment. Challenge students to make inferences about why these small populations of people are diverse from other populations of people.			
	Comments: TE Multicultural Strategy		

Statement # 15		**Unit: Microbial**	**p. 502**
The Spanish conquistador Hernando Cortes landed on the Mexican coast in 1519, and within two years he and a small army had conquered the powerful Aztec empire. Part of the reason was the introduction of smallpox and other diseases, which both killed many Aztecs and demoralized their society. Over the next decades, epidemics ravaged the native populations of the Americas; one historian has estimated that the Mexican population was reduced by 90 percent over the next 120 years. The intentional introduction of disease among Native Americans is infamous. For example, in 1763, the commander of British forces in North America ordered blankets inoculated with smallpox to be distributed among the Pontiac people. The resulting epidemic spread across the continent, devastating native people as far away as California.			
	Comments: TE Historical Perspective		

Appendix G. continued
Archaeology of Statements Worksheet

Statement # 16		Unit: Microbial	p. 502
In 1519, Spanish conquistador Hernando Cortes arrived in Mexico with about 600 soldiers, some guns and a few dozen horses. The great Aztec empire he encountered was home to between 25 and 30 million people. Yet the tiny band of Spaniards managed to topple the enormous and powerful Aztec empire. Francisco Pizarro had similar results in subduing the Incas in Peru. How was this possible? Besides old Native American legends and the alliances between the Spaniards and the discontented people who hated their Aztec overlords, there was disease.			

Statement # 17		Unit: Microbial	p. 521
The smallpox virus was the cause of many terrible epidemics throughout human history in Europe and Asia, and as recently as 1967 it caused 2 million deaths worldwide. The introduction of the virus into the Americas by Europeans caused particularly savage epidemics among Native Americans because none had immunity to the infection.			
	Comments: TE Historical Perspective		

Appendix G. continued
Archaeology of Statements Worksheet

Textbook: Biology The Web of Life **Number: 8** **Set: 3**

Statement # 1		**Unit: Intro**	**p. 19**
The work of science, and of any other discipline, involves the careful observation of events. Scientists make meaningful connections between their observations and past observations made by themselves and others. Mastering science is like mastering any other discipline, such as law, art, and philosophy. In science and in other disciplines, researchers build upon the historical record and follow logical paths to reach new conclusions about their field of expertise.			
	Comments: nature of knowledge		

Statement # 2		**Unit: Intro**	**p. 20**
Although the exact sequence of these steps can vary depending upon the nature of a question, the characteristic steps in a scientific inquiry are commonly called the scientific method.			
	Comments:		

Statement # 3		**Unit: Intro**	**p. 17**
Wood has been used for the construction of shelter for many years. However, wood is not the only living thing form which shelters are made. Native Americans living in the plains regions of the United States used buffalo hides to construct their tepees. Native Americans living in the southwestern part of the United States use thatch for the roofs of their shelters.			
	Comments: TE Multicultural Perspective		

Statement # 4		**Unit: Genetics**	**p. 132**
Although they may not have defined or explained patterns of inheritance, many early civilizations experimented with genetics by breeding plants and animals for certain traits. Native Americans developed more than 300 varieties of corn from a wild plant called teosine. Native people of Peru probably developed potatoes by selecting and breeding certain wild plants that formed starchy, nutritious underground stems.			
	Comments: TE Multicultural Perspective		

Appendix G. continued
Archaeology of Statements Worksheet

Statement # 5		**Unit: Genetics**	**p. 206**
For example, ancient peoples native to North and South America used selective breeding to develop corn and potatoes form wild plants.			
	Comments:		

Statement # 6		**Unit: Evolution**	**p. 235**
Indians of South America who predated the Incas of 6000 years ago cultivated the white potato as a food crop. These peoples made use of selective breeding to create a potato that improved in quality from generation to generation.			
	Comments: TE Multicultural Perspective		

Statement # 7		**Unit: Plants**	**p. 406**
In the Aztec civilization that flourished in Mexico during the fifteenth century, farmers cultivated a wide variety of crops. In the high-altitude inland regions, Aztecs grew maize (corn), beans, squashes, avocados, and chilies (peppers).			
	Comments: TE Multicultural Perspective		

Statement # 8		**Unit: Plants**	**p. 407**
Ginseng is a herbaceous plant native to Manchuria and Korea and eastern North America. Native Americans may have used the roots to relieve pain and prolong life.			
	Comments: TE Multicultural Perspective		

Statement # 9		**Unit: Plants**	**p. 407**
For example, Native Americans chewed willow bark to relieve pain. In the 1800s, chemists discovered that willow bark contained substances that could be used to make aspirin.			
	Comments:		

Appendix G. continued
Archaeology of Statements Worksheet

Statement # 10		**Unit: Plants**	**p. 484**
For many years pine nuts were part of a system of trade among Native Americans in the western United States.			
	Comments:		

Statement # 11		**Unit: Plants**	**p. 488**
Cacao tress had been cultivated in Central America for centuries before Spanish explorers arrived in the 1400s. The explorers, impressed with the drink that Native Americans made from cacao seeds, took the beans and the recipe back to Spain.			
	Comments: TE Multicultural Perspective		

Statement # 12		**Unit: Invertebrates**	**p. 517**
Native Americans living in the Amazon region often use sponge spicules to make clay pottery. Other unusual uses for sponges existed more than 3000 years ago among the inhabitants of Crete, a Greek island. The Cretans used sponges to make masks to filter out particles in foul air to prevent disease. The Cretans also burned sponges as a way to fumigate and sterilize the air in close rooms.			
	Comments: TE Multicultural Perspective		

Statement # 13		**Unit: Invertebrates**	**p. 518**
Members of a South American tribe that inhabits the Amazon region add sponge spicules to the clay they use for making pottery.			
	Comments:		

Statement # 14		**Unit: Vertebrates**	**p. 601**
Fish is a mainstay in the diets of many Native American Inuits, who live in the Artic. Although they eat many fatty meats, they rarely develop heart disease.			
	Comments: TE Multicultural Perspective		

Appendix G. continued
Archaeology of Statements Worksheet

Statement # 15		**Unit: Vertebrates**	**p. 613**
In the South American rain forest some cultures live as their ancestors did centuries ago, using their understanding of a seemingly hostile environment to heir advantage. For example, they use poisons secreted by the glands of certain frog species for a variety of purposes. Chief among these uses is making poison-tipped arrows and darts that stun or kill animals hunted for food.			
	Comments: TE Multicultural Perspective		

Statement # 16		**Unit: Vertebrates**	**p. 657**
The Inuit people living in the Arctic regions of North America have long used aquatic mammals as their primary source of food and clothing. Pinnapeds, such as walruses and seals, and whales are part of the Inuit diet. Inuits use the blubber or fat from these animals in cooking and as a fuel source and the skins to make clothing.			
	Comments: TE Multicultural Perspective		

Statement # 17		**Unit: Ecology**	**p. 863**
Several Native American groups have settled in dry biomes. The Hopi live in northeastern Arizona where they farm and herd sheep. The Apache live on reservations in Arizona and New Mexico. The Zuni, known for their jewelry craft, live in villages in New Mexico.			
	Comments:		

Statement # 18		**Unit: Ecology**	**p. 908**
Native Americans taught early European settlers to bury pieces of fish with the seeds of the corn they planted. According to tradition, this practice would ensure a good harvest. The practice worked because the fish acts as a fertilizer for the corn. Decomposers break down nitrogen compounds in the fish and release ammonia that remains in the soil for use by nitrifying bacteria. The soil ammonia and nitrates released by the bacteria are absorbed by the corn roots and used by the plant.			
	Comments: TE Multicultural Perspective		

Appendix G. continued
Archaeology of Statements Worksheet

Statement # 19		**Unit: Ecology**	**p. 922**
Archaeologists have discovered that the ancient Maya (A.D. 1200) recycled broken pottery and grinding stones in building their temples. To reduce waste, they buried their dead with old, broken, and fake objects instead of using new pottery.			
	Comments: TE Multicultural Perspective		

Statement # 20		**Unit: Genetics**	**p. 150**
Anthropologic studies on the worldwide distribution of the blood-type B allele indicate that the greatest frequency (30%) appears in central Asia. The B allele is 5% in western Europeans and is absent among Native Americans. Ask: Why would the US have a different statistical trend than Asia or Europe?			
	Comments: TE Multicultural Perspective		

Appendix G. continued
Archaeology of Statements Worksheet

Textbook: *Biology A Community Context* **Number: 9** **Set: 3**

Statement # 1		**Unit: Glossary**	**p. 561**
Science: A process of inquiry and the knowledge that is gained through inquiry.			
	Comments:		

Statement # 2		**Unit: Glossary**	**p. 558**
Biology: The study of living systems.			
	Comments:		

Appendix G. continued
Archaeology of Statements Worksheet

Textbook: ***Biology Living Systems*** **Number: 10** **Set: 3**

Statement # 1		**Unit: Intro**	**p. 33**
Science is a process that produces a body of knowledge about nature.			
	Comments: nature of knowledge		

Statement # 2		**Unit: Intro**	**p. 33**
The methods of science have been practiced by many cultures for thousands of years. No one knows who first discovered fire, invented agriculture, or explained sexual reproduction. The Egyptians knew about physiology and use surgery as early as 3000 BC. The Aztecs, Incas, and Mayas of Central and South America used accurate calendars based on the movements of celestial bodies. The Incas of Ecuador discovered the equator before the Egyptians. All cultures today share scientific methods to make new discoveries.			
	Comments: TE Cultural Diversity		

Statement # 3		**Unit: Intro**	**p. 32**
What brought up these discoveries? It was a new way of learning about nature. One of the most important factors in good science is asking the right question. Many discoveries in the last 100 years are still valid because the scientists who made them were good detectives.			
	Comments:		

Statement # 4		**Unit: Intro**	**p. 33**
Remember that scientists note effects and attempts to explain the causes of those effects. There is no fixed way to do this; scientists arrive at explanations in many ways. Each situation is different. Several factors play a role in learning about natures. Among them are careful and thorough observations, interpretation of what is observed, explaining what is observed and testing to see if those explanations are "on the right track." These steps do no always follow a precise order, and a scientist may go back and forth many times between many steps to solve a puzzle.			
	Comments:		

Appendix G. continued
Archaeology of Statements Worksheet

Statement # 5		**Unit: Cells**	**p. 60**
Corn is an excellent source of starch in our diets. What we know as hominy is actually made from corn. Native Americans discovered that soaking corn in a solution made from the ashes of a wood fire (a lye solution) would change the grains into an expanded, lighter-textured material with a unique flavor. This changed corn was then baked into custard-like puddings or fried with meats and wild greens. If the hominy is dried and pounded into a fine texture, hominy grits are formed.			
	Comments: TE Cultural Diversity		

Statement # 6		**Unit: Cells**	**p. 98**
Water is vital to most biological processes. If you remove most of the water from in and around fish cells, microorganisms can't grow – at least not well. The seafaring people of Northern Scandinavia are old master of the art of drying fish. So are the Eskimos. But perhaps the most dramatic example of preservation by drying comes from the Native Americans of pre-Columbian Peru. Living in the Andes Mountains, they would freeze fish in the frigid night air and dry it in the hot daytime sun. In the daytime hear, the low atmospheric pressure of the high mountains allowed much of the fish meat's water, frozen during the night, to turn directly from ice to vapor. This was freeze-drying, a technique we consider very modern.			
	Comments: Global Connection		

Statement # 7		**Unit: Genetics**	**p. 210**
Animals were important in the cultural of American Indians. They were used for food and clothing, and the hides were used for shelter. The traits of animals have been an important part of the folklore and culture. Some of their tales describe how they got their phenotypic traits. For instance, one tale tells that the owl got its large eyes and short neck because it was always stretching its neck to see what was going on around its roost and got its big eyes so it could see at night. The names of tribal members were basically animals names that described the phenotypic traits that the person " acquired" from the animal. For instance, the name Silent Eagle was given to a person who was swift and who hunted quietly and with great accuracy.			
	Comments: TE Cultural Diversity		

Appendix G. continued
Archaeology of Statements Worksheet

Statement # 8		**Unit: Evolution**	**p. 308**
Samoans, in the South Pacific, believed that their island came from an egg that had been broken into pieces and thrown into the water. The Maoris, from New Zealand, believed that a bird dropped an egg that burst open in the sea. This egg contained the people and animals that found their way to New Zealand. Ask students to make up a myth that explains how Earth and its in habitants first formed.			
	Comments: TE Cultural Diversity		

Statement # 9		**Unit: Evolution**	**p. 314**
Six thousand years ago, pre-Incan Indians in South America were cultivating the common white potato. When they cultivated this plant, they practiced selective breeding to improve the quality of the potato form one generation to the next.			
	Comments: TE Cultural Diversity		

Statement # 10		**Unit: Evolution**	**p. 350**
According to Good White Buffalo of the Brule Sioux nation, crows were once white. They were also friends of the buffalo, and warned them when Native American hunters approached the herd, much to the resentment of plains Indians who depended on buffalo for food. A young brave captured the leader of the crows and hurled him into the fire. He was singed black, and ever since, all crows have been black. Folklore includes a variety of stories passed orally from person to person and generation to generation within a given culture. Many prescientific explanations for the origins and conditions of the world appear in folklore as myths. The myths of a given culture center on what that culture considers important. "How the Crow Came to Be Black" illustrates the importance of buffalo to the plains tribes. Biologists today know color has evolved through natural selection and species adaptation. In many species, color serves important survival functions. Although evolution may provide us with many a tale of origins of weird and wonderful life forms, probably none would be as simple, or simplistic, as the myths and legends passed on from generation to generation in folk tales.			
	Comments: Literature Connection		

Appendix G. continued
Archaeology of Statements Worksheet

Statement # 11		**Unit: Plants**	**p. 438**
Corn was so important to these early farmers that their culture was built around it, and they worshiped a god of corn. Largely as a result of their development of corn and other agricultural practices, the Aztecs developed a great empire. By the time Columbus came to America in 1492, Native Americans of both North and South America were growing many kinds of corn. Flint corn, which has a very hard, smooth kernel, was the kind most widely grown. Flour corn was grown by the Aztecs and Incas. Its soft kernels made it easy to grind into flour, the main ingredient in tortillas, a major part of the regional diet today. Because corn was an easy crop to grow and it was plentiful, it has a symbolic place in the culture of many Native American tribes. In the Tewa Tribe of New Mexico, for instance, summer is the time of the Blue Corn Chief, while winter is the time of the White Corn Chief. When a child is named, its mother offers two perfect ears of corn, one white and one blue, to the six scared directions, and prayers are said for good fortune. Many Native American tribes consider corn a sacred plant. Much rain is needed for corn to grow well. Before the Hopi and Zuni tribes developed the practice of irrigation, corn dances were part of a ritual to bring rain, and other dances were performed to thank the gods for a bountiful harvest. The early English colonists were taught to plant corn by Native Americans who lived in northeastern North America. The colonists and the Spanish explorers not only used it as a food source, they exported it to Europe and beyond. From these beginnings sprang a plant that is now grown all over the world and is a major food source for both humans and their livestock.			
	Comments: Global Connection		

Statement # 12		**Unit: Plants**	**p. 440**
Tell students about amaranth, once the Aztecs' most widely cultivated crop. It produces huge numbers of seeds that are high in the amino acid lysine. When Cortez arrived in 1519, he banned the growing of amaranth because the Aztecs also use the red dye of the flowers for religious ceremonies.			
	Comments: TE Cultural Diversity		

Appendix G. continued
Archaeology of Statements Worksheet

Statement # 13		**Unit: Plants**	**p. 441**
The Chinese have controlled insect pests by biological means for 1700 years, a method introduced to the West only in this century. The Chinese use of yellow, citrus-killer ants to protect mandarin trees is still in use today. Bridges of bamboo are stretched between trees to allow the ants to move easily from tress to tree. The ants hunt and eat the pests that would consume the oranges			
	Comments: TE Cultural Diversity		

Statement # 14		**Unit: Vertebrates**	**p. 460**
There is no one people called "Native Americans" or "American Indians." There are hundreds of different Native American peoples, all with differing beliefs and cultures. So there is no single Native American way of considering animals. There are, however, some broad, underlying ideas that various Native Americans hold in common, though they may express them differently. Native American beliefs generally include a strong tie between people and the land. They stress the unity of the entire natural world, including both animate and inanimate objects and such phenomena as the wind and the rain. In such a world view, it's only natural that animals have an important place. Rather than seeing animals as lower creatures fit only for work or food, Native American traditions often portray animals as beings as important or even more important than humans. An Iroquois legend, for example, tells about how the owl made the Creator angry by greedily demanding too much and arrogantly sticking his beak in where it didn't belong. Rather than giving the owl what he asked for, the Creator gave him a short neck so he wouldn't be able to crane his neck to look where he shouldn't and big ears so that he could better hear what he was told. A Papago myth tells of the Creator being saddened by the thought that the beautiful children, the lovely leaves, and the colorful flowers would all grow old and die. To preserve some of the beauty, he took the beautiful sights and sounds around him and created butterflies, only to be reproached by the birds. The birds were upset that the Creator had given butterflies the melodious songs that belonged to them. Much Northwestern Native American lore deals with Coyote – an anthropomorphic hero and ancestor of the animal that shares his name.			
	Comments: Global Connection		

Statement # 15		Unit: Vertebrates	p. 470
Birds were important in the arts and crafts of the Incas of Peru in the 11th century. The Inca bird was different from the birds used in arts and crafts of Native Americans. The Zuni, one of the Pueblo tribes of Native Americans, used a geometrically shaped “rain bird” on their pottery. The Hopi also used geometric shapes in creating the birds on their pottery.			
	Comments: TE Cultural Diversity		

Statement #16		Unit: Vertebrates	p. 502
Columbus started the confusion. Thinking he had discovered a new trade route to India, he called the people living in the Americas “Indians.” More confusion arose when the European settlers tried to learn the personal names of the Native Americans they encountered. The Europeans discovered that the original inhabitants of the land often changed their names as they grew older. A childhood name might be exchanged for a new one at adolescence, or after a first battle or an important dream. Another cultural mystery to Europeans was that some Native Americans considered their names so personal and sacred that only a bad-mannered person would address them directly by those names. The Native American tradition of naming babies is a practice that survives today among many tribes. A baby might be called simply “boy” or “girl” until he or she is several months old. Buy that time, the baby has developed some personality. A tribe elder observing the baby will then know enough about his or her personal traits to suggest a name that seems fit. That name might be one given to honor a dead ancestor, or it might come from a dream of the baby’s mother or father. Even after a Native American child grows up, his or her name can change. In some tribes, names are considered a personal possession that can be loaned, pawned, given away, or even thrown away. Because of misunderstandings, many Native American names have been fun of. For instance, the name “Stinking Blanket” may have caused snickers among Europeans. However, attitudes about that name changed significantly after hearing an explanation of its source: An Indian brave fought so long and hard against his enemies that he never had time to stop and change his horse’s saddle blanket. Similarly, the name “Crazy Horse” sounds different when the “crazy” is correctly translated as “recklessly brave.”			
	Comments: Literature Connection		

Appendix G. continued
Archaeology of Statements Worksheet

Statement #17		Unit: Human Biology	p. 530
The menstrual period has always been surrounded by myth. The word taboo may come from the Polynesian word for menstruation. Not all myths are negative, however. A girl's first period is greeted with celebration in some areas, for it means that she can now have children. Apache girls kneel on sacred deerskin during a four-day celebration of their first menstrual period.			
	Comments: TE Cultural Diversity		

Statement # 18		Unit: Human Biology	p. 560
Salt also played an important part in religious life. In many early societies along the Mediterranean, offerings of salt were made to the gods. On the North American continent, the Aztecs honored a salt goddess, the Navajos prayed to Salt Woman, and the Hopis' war god was Salt Man.			
	Comments: Global Connection		

Statement # 19		Unit: Ecology	p. 796
The prickly pear cactus has long played an important part in the life of Mexico and the southwest. Fossil evidence indicates that the fruit of the prickly pear cactus was part of the diet of the native Indians of this region as long as 9000 years ago. The Aztecs prized the prickly pear for the red dye that was extracted from the bodies of an insect that lived on the plant.			
	Comments: Art Connection		

Statement # 20		Unit: Ecology	p. 807
For the Lapps, or Sami as they prefer to be called, semi-nomadic herders who live on the tundra of Scandinavia, the reindeer are the basis of their economy. Each Sami eats an average of eight to ten reindeer a year. They also make their coats, shoes, and tents from reindeer hides, use the antlers to make knife handles and glue, and sell reindeer meat to markets in the southern cities. Following the migration of reindeer herds has been their way of life for more than 10000 years.			
	Comments: Biology, Technology, and Society [STS content]		

Appendix G. continued
Archaeology of Statements Worksheet

Statement # 21		Unit: Ecology	p. 825
Explain to students how different cultures are dependent upon the biomes in which they live. For example, Laplanders depend on the reindeer that are the dominant large animals where they live in the taiga.			
	Comments: TE Cultural Diversity		

Statement # 22		Unit: Ecology	p. 829
There are often parallels between cultures that share the same type of environment even though the cultures are continents apart. Ask students to compare and contrast the cultures inhabiting the grasslands of North America (farmers), South America (gauchos), and Africa (Masai herders of Kenya).			
	Comments: TE Cultural Diversity		

Statement # 23		Unit: Ecology	p. 867
The Chipko Movement began in India in 1730 when the Maharajah of Jodphur sent his wood cutters to cut down the few trees left in the area. The Bishnois, a religious sect for whom the protection of trees and wildlife was a sacred duty, prevented this action. Bishnois women rushed in and put their arms around the trees to protect them. In 1973, a sports company was to come in to an area of Himalayan forest to cut trees for making racquet sports equipment. A community leader urged the people of the area to "chipko" or hold fast to the trees in their forest. When the tree cutters arrived, the women of the village rushed in and threw their arms around the threes.			
	Comments: TE Cultural Diversity		

Statement # 24		Unit: Human Biology	p. 568
Dr. Minoka-Hill (1876-1952) was a Native American born on a Mohawk reservation in New York state. After her mother's death, she stayed on the reservation with her maternal relatives until she was old enough to go to school. She also spent much of her time teaching the Oneida people about nutrition and good eating habits in an effort to relieve their constant problem of malnutrition.			
	Comments: History Connection Lillie Rosa Minoka-Hill		

Appendix G. continued
Archaeology of Statements Worksheet

Statement # 25		**Unit: Human Biology**	**p. 621**
People who live at high altitudes are adapted to the lower air pressure. For example, the native Aymara and Quechua Indians that live in the Andes mountains have barrel-shaped chests, strong diaphragms, and large lungs that have a greater capacity than the lungs of people who live at lower altitudes. The Aymara and Quechua also have more capillaries around their aveoli, larger hearts, and more red blood cells.			
	Comments: Global Connection **How high can they live?**		

Appendix G. continued
Archaeology of Statements Worksheet

Textbook: ***Prentice Hall Biology*** **Number: 11 Set: 3**

Statement # 1	**Unit: Intro**	**p. 5**
Asking questions about the world around us is part of human nature. How did life begin? Where did plants and animals come from? Why do animals behave as they do? Every culture in the world has tried to answer these questions – often through myths and legends. The Pitjendara tribe of central Australia, for example, finds answers to questions about nature on an enormous mound of stone called Ayer's Rock. According to the Pitjendara, the images etch on Ayer's rock tell stories that depict the adventures, the loves, and the battles of ten enormous creatures. The rock contains the likenesses of two snakes, Liru and Kunia. The Pitjendara believe that the two snakes fought an epic battle that created many features on the southern face of Ayer's Rock. Elsewhere on the rock, a sand-lizard man left his mark digging for water. Through these and other stories, the Pitjendara explain the formation of the world and the processes of birth, life and death. We might say that the rock provides the Pitjendara with answers that other societies seek through a process known as science. People like the Pitjendara live their entire lives in a single culture. Thus, they often find it difficult to imagine that their particular stories about the world might be in error. Today, however, we can visit and read about many cultures. And when we assemble stories form around the globe, it becomes obvious that all these stories cannot be true. Is there some other way to explain the world around us? One way is to assume that all events in nature have natural causes. We can then try to arrange a series of observations or test to learn what those causes are. Science is the word that we apply to this process. The goal of science is to understand the world around us. There are, however, many important fields of human endeavor that study the world around us but are not considered sciences. Such fields include language, history, art, music, and philosophy. The character that distinguishes science from nonscience is an approach knows as the scientific method.		
	Comments: Figure 1-1 **Nature of knowledge**	

Appendix G. continued
Archaeology of Statements Worksheet

Statement # 2		**Unit: Intro**	**p. 7**
The simplest definition of the scientific method was offered by biologist Claude Villee. He called it "Organized common sense." That is exactly what science should be. In practice, the scientific method consists of several steps… To the true scientist, however, the scientific method is more a frame of mind – a frame of mind that involves curiosity. Another important characteristic of the scientific spirit is the refusal to accept an explanation without evidence or proof. This "prove it!" attitude encourages scientists to investigate phenomena and to develop new explanations and ideas.			
	Comments: nature of knowledge		

Statement # 3		**Unit: Intro**	**p. 15**
As knowledge grows, facts can change. This print depicts a Hindu legend that tells that the Earth is supported by three elephants resting on the back of a giant tortoise.			
	Comments: Figure 1 -12 **nature of knowledge**		

Statement # 4		**Unit: Microbial**	**p. 339**
Throughout history, various cultures have developed alternative explanations concerning the origin of life. Interested students may want to research these alternative theories, focusing particularly on the ideas arising in ancient Egypt and India as well as various concepts from Native Americans.			
	Comments: TE Multicultural Strategy		

Statement # 5		**Unit: Microbial**	**p. 342**
There is a Native American legend from the Lakota (Sioux) tribe called "Tunkashila," or "Grandfather Rock," that attempts to explain the origins of land. According to the legend, at one time all things existed as spirits. The spirits tried to live on the sun but it was too hot for them, so they came to the Earth. They couldn't find any land on the Earth because it was totally covered by water.			
	Comments: TE Multicultural Strategy		

Appendix G. continued
Archaeology of Statements Worksheet

Statement # 6	Unit: Plants	p. 494
A Native American myth from the Southwest tells how the first people climbed up into the world on the branches of a tree, Indian philosophers have noted that people are like leaves on a tree – although we may perceive ourselves as separate from one another, we all are connected and belong to something greater than ourselves.		
	Comments: TE Multicultural Strategy	

Statement # 7	Unit: Plants	p. 527
Have students investigate plants' symbolic importance in many cultural traditions and rituals. For example, in the Navaho culture, the corn plant symbolizes life, and in many cultures throughout history, the olive branch has been a symbol of peace.		
	Comments: TE Multicultural Strategy	

Statement # 8	Unit: Vertebrates	p. 701
Some tropical tree frogs make a poison so powerful that it can kill humans and other large animals. Native tribes in the tropics often poison their arrow tips by rubbing them in these frogs. For this reason, these brightly colored amphibians are called poison arrow frogs.		
	Comments:	

Statement # 9	Unit: Vertebrates	p. 749
Tell students the Cherokee legend of Awi Usdi, the Little Deer, which stresses the Native Americans' respect for animals: In early times, people and animals could communicate with each other, and they lived in harmony. People killed animals only as needed for food and clothing. After the development of the bow and arrow, things changed, and some animals were slaughtered to extinction. The animals got together to see what they could do to remedy things. Awi Usdi, the Little Deer, had a suggestion. She would whisper in the ears of the hunters that they must first ask permission of the animals they were hunting and then ask for pardon form the spirit of the animal they had to kill for food.		
	Comments: TE Multicultural Strategy	

Appendix G. continued
Archaeology of Statements Worksheet

Statement # 10		**Unit: Vertebrates**	**p. 794**
Animals play prominent roles in folk tales, myths, and legends of many cultures including the Vietnamese.			
	Comments: TE Multicultural Strategy		

Statement # 11		**Unit: Human Biology**	**p. 988**
Perhaps some of the greatest experts at using toxic plants for beneficial purposes are the tribal peoples of Central and South America. The Tarahumara Indians, for example, use toxic plants for a variety of ailments. One such plant is *Ricinus communis*, the source of the laxative castor oil and a number of highly poisonous substances, which is used to treat headaches, boils, and bruises. Another is jimsonweed, which is used as a hallucinogen during rituals and to treat routine ailments such as swellings and headaches. In most cases, knowledge of the quantity of plant ingested and the way in which it is prepared are essential for the treatment to be safe. The tribal peoples' knowledge is often used by pharmaceutical companies in the development of new drugs for ailments such as heart disease and cancer.			
	Comments: TE Multicultural Strategy		

Statement # 12		**Unit: Ecology**	**p. 1022**
Many Native American legends deal with the sun. One legend from the Muskogee or Creek people form Oklahoma tells how Grandmother Spider stole the sun. According to the legend, all the animals lived in darkness but knew of a wonderful light called the sun. First the fox tried to capture the sun but burned its mouth, which is why foxes to this day have black mouths. Then the opossum tried to grab the sun but burned its tail, which is why opossums to this day have hairless tails. Finally, Grandmother Spider wove a bag of webbing around the sun and carried it home in the bag.			
	Comments: TE Multicultural Strategy		

Appendix H.

List of Eurocentric Terms

Life Sciences (Ecology)

Terms are adapted from:

Hirsch, E. D., Jr., Kett, J. F., & Trefil, J. (2000). The new dictionary of cultural literacy.

Boston, MA: Houghton Mifflin Company

Acid rain – A type of precipitation made up of dilute acids, primarily a by-product of heavy industry.

Balance of nature – A concept in ecology that describes natural systems as being in a state of equilibrium, in which disturbing one element disturbs the entire system. The inference is usually drawn that the natural state of any system is the perfect state and that it is best to leave it undisturbed. Modern ecologists no longer believe that balance of nature exists.

Biodegradable – Material, that left to itself, will be decomposed by natural processes.

Biodiversity – A term that describes the number of different species that live within a particular ecosystem.

Bioethics – The application of ethics to the science and practice of biology, especially as modern science is applied to human life and reproduction.

Biosphere – The thin outer shell of the Earth and the inner layers of its atmosphere; the place where all living things are found.

Carrying capacity – In ecology, the number of living things that can exist for long periods in a given area without damaging the environment.

Carson, Rachel – An American author and scientist of the twentieth century who was fervently devoted to defending the natural world against pollution. Her best-known books are *Silent Spring*, concerning the overuse of pesticides and weed killers, and *The Sea Around Us*.

CFC (chlorofluorocarbon) – Chemical compounds originally developed for use in refrigeration systems, now used widely in industry. When released into the air, these compounds, break down and release chlorine, which causes damage to the earth's ozone layer and is responsible for creating the ozone hole.

Coral Reef – A formation, at or near the surface of tropical waters, formed by skeletal deposits of corals, a form of sea life.

Deforestation – The process of destroying a forest and replacing it with something else. The term is used today to refer to the destruction of forest by human beings and their replacement by agricultural systems.

DDT – A colorless insecticide that kills on contact. It is poisonous to humans and animals when swallowed or absorbed through the skin.

Earth – The planet on which we live – the third planet from the sun.

Ecological niche – The place or function of a given organisms within its ecosystem.

Ecosystem – A collection of living things and the environment in which they live.

Extinction – The disappearance of a species from the Earth.

Florida Keys – Islands off the southern coast of Florida. The best known are Key Largo and Key West.

Food chain – The series of steps by which energy is obtained, used, and transformed by living things. For example, sunlight helps grains to grow, the grain feed cattle and humans eat the cattle.

Global warming – The term attached to the notion that the Earth's temperature is increasing due to the greenhouse effect.

Green revolution – The increase in the world production of cereals such as wheat and rice during the 1960s and 1970s because of better seed and new agricultural technology.

Greenhouse effect – A term used to describe the heating of the atmosphere owing to the presence of carbon dioxide and other gases.

Groundwater – Water that seeps through the soil or rocks underground.

Habitat – The area or type of environment in which a particular kind of animal or plant usually lives.

Horticulture – The science of cultivating garden plants.

Hydroponics – Cultivating plants in an artificial environment in which the necessary nutrients are carried to the roots in a liquid mixture.

Appendix H. continued

Natural resource – Factors of production not created (though harnessed) by effort.

<u>Nature of Knowledge/Nature of Science</u>

Terms are adapted from:

The American Heritage College Dictionary (4th ed.). (2002). Boston, MA: Houghton Mifflin Press.

Stephens, S. (2003). *The culturally responsive handbook*. Fairbanks, AK: Alaska Native Knowledge Network.

Evidence – A thing or things helpful in forming a conclusion or judgment.

Experiment – A test under controlled conditions that is made to demonstrate a known truth, examine the validity of a hypothesis, or determine the efficacy of something previously untried.

How - In what manner or way; by what means: *How does this machine work?*; for what reason or purpose; why.

Hypothesis – In science, a statement of a possible explanation for some natural phenomenon.

Models – A schematic description of a system, theory, or phenomenon that accounts for its known or inferred properties and may be used for further study of its characteristics

Measurement – The act of measuring or the process of being measured.

Procedures - A set of established steps or methods for conducting the affairs of a scientific experiment.

Quantitative – Expressed or expressible as a quantity; of, relating to, or susceptible of measurement; of or relating to number or quantity

Skepticism – A methodology based on an assumption of doubt with the aim of acquiring approximate or relative certainty.

Theory – In science, an explanation or model that covers a substantial group of occurrences in nature and has been confirmed by a substantial number of experiments and observations.

Tools – Something used in the performance of a scientific experiment; an instrument.

Appendix H. continued

Traditional/Indigenous Representations

Terms are adapted from:

Hirsch, E. D., Jr., Kett, J. F., & Trefil, J. (2000). The new dictionary of cultural literacy. Boston, MA: Houghton Mifflin Company

Aborigines – The earliest known inhabitants of a region. The term is most often associated with the native hunting and gathering population of Australia, who preceded the arrival of white settlers.

Apaches – A tribe of Native Americans who live in the southwestern United States.

Aztecs – A Native American people who ruled Mexico and neighboring areas before the Spaniard conquered the region in the sixteenth century.

Bushmen – The nomadic hunting and gathering people of the Kalahari Desert of southern Africa, in Botswana, Nambia, and Angola.

Cherokees – A Native American tribe who lived in the Southeast in the early nineteenth century; the Cherokees were known as one of the "civilized" tribes because they built schools and published a newspaper. In the 1803s the United States government forcibly removed most of the tribe to reservations west of the Mississippi River.

Eskimos – A widely dispersed group of peoples in the Arctic regions of Alaska, Canada, Greenland, and Siberia, who have traditionally survived primarily by hunting and fishing.

Folklore – Traditional stories and legends, transmitted orally (rather than in writing) from generation to generation.

Hunting and gathering societies – Societies that rely primarily or exclusively on hunting wild animals, fishing, and gathering wild fruits, berries, nuts, and vegetables to support their diet.

Incas – A Native American people who built a notable civilization in western South America in the fifteenth and sixteenth centuries.

Iroquois League – A confederacy of Native American tribes in upper New York state, dating to the sixteenth century.

Mayas – A Native American people, living in what is now Mexico and northern Central America, who had a flourishing civilization form before the birth of Jesus until around 1600, when they were conquered by the Spanish.

Native Americans – The descendents of the original inhabitants of North America and South America before the arrival of white settlers from Europe, also called Indians or American Indians.

Navajos – A tribe of Native Americans, the most numerous in the United States. The Navajos have reservations in the Southwest.

Phoenicia – An ancient nation of the eastern Mediterranean Sea. Its territory included what are today coastal areas of modern Israel and Lebanon.

Pygmy – A member of any ethnic group in which the average height of the adult male is less than four feet, eleven inches. There are Pygmy tribes in dense rainforest areas of central Africa, southern India, Malaysia, and the Philippines.

Seminoles – A tribe of Native Americans who inhabited Florida in the early nineteenth century. After fighting a war against the United States to keep their land, they were forcibly removed to reservations west of the Mississippi River in the 1840s.

Shawnees – A tribe of Native Americans who inhabited Ohio, Indiana, and other parts of the Middle West during the early nineteenth century.

Sioux – A common name for the Dakota people, a tribe of Native Americans inhabiting the northern Great Plains in the nineteenth century.

Totem – An animal, plant, or other object in nature that has a special relationship to a person, family or clan and serves as a sign for that person or group.

Totem pole – Among some Native Americans, a pole on which totems are carved. The totem pole usually stands in front of a house or shelter.

Wampum – Beads made from polished shells that some Native Americans once used as money and jewelry.

Appendix I.

List of Multicultural Terms

Life Sciences (Ecology)

Terms adapted from:

The American Heritage College Dictionary (4th ed.). (2002). Boston, MA: Houghton Mifflin Press.

Agriculture(al) – The science, art, and business of cultivating soil, producing crops, and raising livestock; farming.

Aquaculture – The science, art, and business of cultivating marine or freshwater food fish or shellfish, such as oysters, clams, salmon, and trout, under controlled conditions.

Agroforestry - A system of land use in which harvestable trees or shrubs are grown among or around crops or on pastureland, as a means of preserving or enhancing the productivity of the land.

Conservation – The protection, preservation, management, or restoration of wildlife and of natural resources such as forests, soil, and water.

Endangered species – A species present in such small numbers that it is at risk of extinction.

Environmental impact statement/assessment – An assessment of the possible impact–positive or negative–that a proposed project may have on the natural environment. The purpose of the assessment is to ensure that decision makers consider environmental impacts used to decided whether to proceed with the project.

Environmental movement – A diverse scientific, social, and political movement for addressing the concerns of environmentalism.

Ethnobotany – The plant lore and agricultural customs of a people.

Everglades – A subtropical swamp area of southern Florida including Everglades National Park. It is noted for its wildlife, especially crocodiles, alligators, and egrets

Gaia hypothesis – A belief that the interactions among the biotic and abiotic factors of the environment have a natural balance.

Land ethic – a perspective on environmental ethics first championed by Aldo Leopold in his book *A Sand County Almanac*.

Pesticides – A chemical used to kill pests, especially insects.

Recycling – To extract and reuse (useful substances found in waste); to use again, especially to reprocess.

Reforestation – The restocking of existing forests and woodlands which have been depleted, with native tree stock

Sustainability/sustainable – Capability of being continued with minimal long-term effect on the environment.

Sustainable agriculture – A method of agriculture that attempts to ensure the profitability of farms while preserving the environment.

Seattle, Chief – Native American leader of the Duwamish, Suquamish, and allied peoples, who befriended white settlers of the Pacific Northwest.

Traditional ecological knowledge – The science of long-resident oral peoples and a biological label for the expanding literature base which explores that knowledge.

Virgin forest – Also known as old growth forest; a type of forest that has attained great age and so exhibits unique biological features.

Wetlands – A lowland area, such as a marsh or swamp, that is saturated with moisture, especially when regarded as the natural habitat of wildlife.

Wilderness – An unsettled, uncultivated region left in its natural condition, especially: a large wild tract of land covered with dense vegetation or forest

Nature of Knowledge

Terms are adapted from:

The American Heritage College Dictionary (4th ed.). (2002). Boston, MA: Houghton Mifflin Press.

Stephens, S. (2003). *The culturally responsive handbook*. Fairbanks, AK: Alaska Native Knowledge Network.

Belief – Something believed or accepted as true, especially a particular tenet or a body of tenets accepted by a group of persons

Appendix I. continued

Holistic – Emphasizing the importance of the whole and the interdependence of its parts.

Inherited wisdom – A body of information, also referred to as a chronicle, that serves as a reference relating important information, as example, to the survival of the tribe, how to prepare certain foods, how to cure certain diseases, directions of where to find useful resources, how to make tools and weapons.

Metaphysical – Supernatural.

Moral code – Conforming to standards of what is right or just in behavior; virtuous.

Practical application – Habitual or established practice; custom.

Oral record – compilation of historical data through interviews, usually tape-recorded and sometimes videotaped, with participants in, or observers of, significant events or times; primitive societies have long relied on oral tradition to preserve a record of the past in the absence of written histories.

Qualitative – Of, relating to, or concerning quality

Respect – The state of being regarded with honor or esteem.

Subsistence practice – a traditional way of life among many indigenous peoples; in a physical sense, it refers to the practice of relying on the surrounding environment as a source of food and materials for daily living.

Value – To regard highly; esteem.

(A)other ways of knowing – world views, or ways of thinking about or understanding the natural world.

Traditional/Indigenous Representations

Terms taken from:

The American Heritage College Dictionary (4th ed.). (2002). Boston, MA: Houghton Mifflin Press.

Adobe – Sun-dried brick of clay and straw; a structure build with this brick.

Appendix I. continued

Anasazi – A Native American culture flourishing in southern Colorado and Utah and northern New Mexico and Zrixona from about A.D. 100, whose descendents include the present-day Pueblo peoples.

Ancestor worship – A practice based on the belief that deceased family members have a continued existence, take an interest in the affairs of the world, and/or possess the ability to influence the fortune of the living.

Ceremony – A formal act or set of acts performed as prescribed by ritual or custom.

Cheyenne – A member of a Native American people, divided after 1832 into the Northern and Southern Cheyenne, inhabiting respectively south-east Montana and southern Colorado, with present-day populations in Montana and Oklahoma.

Clan –A tribal division tracing descent from a common ancestor.

Coyote – An anthropomorphic hero and ancestor of the coyote that shares his name.

Creek – A member of a Native American people formerly inhabiting eastern Alabama, south-west Georgia, and northwest Florida, and now located in central Oklahoma and southern Alabama.

Guarani – A member of a South American Indian people of Paraguay, northern Argentina, and southern Brazil.

Haida – A member of a Native American people inhabiting the Queen Charlotte Islands of British Columbia, Canada, and Prince of Wales Island in Alaska.

Hopi – A member of a Pueblo people occupying a number of mesa-top pueblos on reservation land in northeast Arizona.

Indigenous – Native to a place or area, originating in and characterizing a particular region or country.

Inuit – A member of Eskimoan peoples inhabiting the Arctic from northern Alaska.

Kiowa – A member of a Native American people formerly inhabiting the southern Great Plains, with a present-day population in southwest Oklahoma.

!Kung – A member of a San people of E Namibia and W Botswana.

Legend – An unverified story handed down from earlier times, especially one popularly believe to be historical.

Appendix I. continued

Maori – A member of a people of New Zealand, of Polynesian-Melanesian descent.

Medicine man – A male shaman or shamanistic healer especially among Native American peoples.

Mestizo – A person especially a man or a boy, of mixed racial ancestry, in particular of mixed European and Native American ancestry.

Mohawk – A member of a Native American people formerly inhabiting northeast New York, with present-day populations chiefly in southern Ontario and extreme northern New York.

Myth – A traditional story dealing with supernatural beings, ancestors, or heroes that informs or shapes the worldview of a people, as by explaining aspects of the natural world or delineating the customs or ideals of society.

Native – Being a member of the original inhabitants of a particular place; one of the original inhabitants or lifelong residents of a place.

Nez Perce – A member of a Native American people formerly inhabiting the lower Snake River and its tributaries, with present-day populations in western Idaho and northeast Washington.

Ojibwa – A member of a Native American people originally located north of Lake Huron before moving westward in the 17th and 18th centuries into the upper Midwest, with later migrations onto the northern Great Plains.

Pagan – One who is not a Christian, Muslim, or Jew especially a worshiper of a polytheistic religion.

Papago – A member of a Native American people inhabiting the desert regions of southern Arizona and northwest Mexico.

Pima – A member of a Native American people inhabiting south-central Arizona.

Plains Indian – A member of any of the Native American peoples inhabiting the Great Plains.

Prayer – A reverent petition made to an object of worship.

Proverb – A short pithy saying in frequent and widespread use that expresses a basic truth or practical precept.

Appendix I. continued

Pueblo – A member of any of some 25 Native American peoples, including the Hopi, Zuni, and Taos, living in established villages in northern and western New Mexico and northeast Arizona.

Ritual – The prescribed order of a religious ceremony; the body of ceremonies or rites used in place of worship.

Shaman – A member of certain tribal societies who acts as a medium between the visible world and an invisible spirit world and practices magic or sorcery for healing, divination, and control over natural events.

Samoa – A native or inhabitant of the islands or country of Samoa.

Swahili – An inhabitant of coastal eastern Africa for whom Swahili is the mother tongue.

Spiritual – Of or belonging to a religion; sacred; relating to or having the nature of spirits or a spirit; supernatural.

Traditional society – Term used to identify a particular group of indigenous people.

Tribal religion – Religion that may be divergent from the official teachings and doctrines of the majority faith.

Tribe – A unit of sociopolitical organization consisting of a number of families, clans, or other groups who share a common ancestry and culture and among whom leadership is typically neither formalized nor permanent.

Walbiri – The Austronesian languages spoken by Australian aborigines

Yaqui – A member of a Native American people of Sonora, a state of northwest Mexico, now also located in southern Arizona. Many Yaqui sought asylum in the United States in the early 19th century because of conflict with the Mexican government.

Zulu – A member of a Bantu people of southeast Africa, primarily inhabiting northeast Natal province in South Africa.

Appendix J.
Evaluation Coefficient Worksheet
Textbook code ____ Set _________
Content ____ Score _________

Page	Term	+/-	Page	Term	+/-	Page	Term	+/-

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Appendix K.
Visuals/Illustrations Worksheet

Textbook Code: ____

Photo #	**Page #**	**Unit**		**Comments:**	
Aerial □	Child □	Adult □	Child/Adult □	Illustration □	Non-Human □
Male □	Female □	Comments:			
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Photo #	**Page #**	**Unit**		**Comments:**	
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Ind. Rep □	Group:		Other □		
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Photo #	**Page #**	**Unit**		**Comments:**	
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Photo #	**Page #**	**Unit**		**Comments:**	
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Photo #	**Page #**	**Unit**		**Comments:**	
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About the Author

Margaret Delgato graduated from Clemson University with a bachelor's degree in biological sciences and a master's degree in agricultural education. She has taught and developed curricula, including an award-winning ecology program, for students in middle and high school science courses and has served as a curriculum specialist for a charter high school that allows students to simultaneously earn a high school diploma and an associate's degree. Ms. Delgato earned National Board Certification in biology in the fall of 2001. She currently serves as Director of Curriculum and Student Success for the College of Nursing at St. Petersburg College in St. Petersburg, Florida.