

# Science Education and Cultural Context: A Testimonial

*Interview with William W. Cobern*

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Enseñanza de las ciencias y contextos culturales: un testimonio de vida  
Entrevista a William W. Cobern

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Entretien à William W. Cobern

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Written by WILLIAM W. COBERN  
WESTERN MICHIGAN UNIVERSITY  
MICHIGAN, UNITED STATES  
[bill.cobern@wmich.edu](mailto:bill.cobern@wmich.edu)

ADELA MOLINA-ANDRADE  
UNIVERSIDAD DISTRITAL FRANCISCO JOSÉ DE CALDAS  
BOGOTÁ, COLOMBIA  
[adela@udistrital.edu.co](mailto:adela@udistrital.edu.co)

GONZALO PEÑALOZA-J.  
UNIVERSIDAD DISTRITAL FRANCISCO JOSÉ DE CALDAS  
BOGOTÁ, COLOMBIA  
[gpjimenez101@hotmail.com](mailto:gpjimenez101@hotmail.com)

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William W. Cobern holds a PhD in Science Education from the University of Colorado Boulder. He is a professor at the University of Western Michigan. His work has evolved around the relationship between traditional cultures and teaching and learning in science education. For several years, he worked in Nigeria on teacher training and education programs for nomad groups. This experience led him to develop his “world view” concept, which is a theoretical and methodological framework to understand and approach the relationship between science and culture. His theoretical work has inspired research in countries such as Brazil, Australia, Nigeria, Japan, and Colombia. Professor Cobern has been a guest editor of *Science Education*, among other journals. The work of William Cobern is available in several formats and publication types.<sup>1</sup>

Below, we present the interview professor William Cobern gave to Adela Molina, on the occasion of this theme issue. It goes around some biographical aspect of his personal life, for which we thank him for letting us be a part of it.

*Adela Molina (AM):* Dear Bill, this interview is to be published in a special issue of *magis, Revista Internacional de Investigación en Educación*, which I am editing, on science education and cultural diversity. Your participation is very important given your intellectual production in this field, which is followed in Colombia, especially in our research group in the area of the teaching of science, context and cultural diversity.

*AM:* Each individual makes his own choices on what he researches and why. Please tell us about your choices and the rationale behind studying the relationship between the culture and the teaching of science; and more specifically on cultural diversity and the teaching of science. Is there a situation or an aspect of your life that you would like to share? If so, when did it happen?

*William W. Cobern (WC):* I have been for a very long time a confessing Christian. As a person who for even a longer time has been interested in science, I have been acutely aware of the tensions that exist between science and religion, and specifically Christianity. However, I learned very early that the idea of warfare going on between science and religion is a myth, and reasonably understood, there was little reason for there to be tension between Christianity and science. The apparent tensions, it seemed to me, were created by people staking out extreme positions. For example,

<sup>1</sup> At the end of the interview, some bibliographical references are included, which may be useful for those who wish to know more about William W. Cobern’s work.

Christians who insist on the absolute literal nature of the first 11 chapters of Genesis create difficulties with science. On the other hand, scientists who think that evolution specifically and science in general disproves the existence of God create difficulties with religion, specifically monotheistic religions. The first group got me interested in theology and biblical exegesis, and the second group got me interested in the philosophy of science and in epistemology. I discovered the concept of worldview from anthropology<sup>2</sup> and began to think about the deep-seated views about the world that we bring to our everyday lives such as in the practice of science or the practices of religion.<sup>3</sup> The Christians who insisted on the absolute literalness of Genesis were staking out an ideological position that was not necessary to Christianity. Similarly, scientists who insisted that science demonstrates that there is no God were staking out an ideological position that was not necessary to science. In both cases belief systems were being invoked that were not at all necessary to the two great domains of Christianity and science that they were respectively seeking to defend. When I had an opportunity to teach and do research in Nigeria for several years, I discovered students who seemed to have difficulties with science in somewhat the same way that very conservative Christians have difficulties with evolution. The difficulties were not so much about the facts, concepts and procedures of science but about trying to understand science from within a set of beliefs that were clearly very important to them. They were unsure how science fit within their culture, but that question was far more implicit in their thinking than explicit. It is from these experiences that I began to think about the importance of science within culture. In all of my work it has become important to me to make sure that the teaching of science and even scientific research recognizes the cultural context in which it operates and to make sure that there is a

<sup>2</sup> The “World view” concept was originally coined by Wilhelm Dilthey in 1911 (1988), as a part of his work on the foundations of “the human sciences”. Later, authors such as Stephen Pepper (1972) developed similar concepts. In the field of Anthropology, Michael Kearney (1984) structured and developed his ethnographical research using the World View theory as a starting point. In education research, William Cobern put forward the World View theory as a tool through which we can understand the epistemological structures that are the foundations of an individual’s relationship with the world around him.

<sup>3</sup> Fundamentally, William W. Cobern (1989; 1991b; 1993; 1994) considers that worldview is an epistemological macrostructure. All people possess such a structure, which is the foundation of their vision of reality. Worldview consists of a group of suppositions that influence the feelings, thoughts and acts of an individual. It inclines us to certain ways of thinking, but this process is unconscious. Thus, worldview determines both what people are and how they relate to what is around them, both in human environments as outside them. It configures the understanding of the universe, of time and of space; it influences norms and values.

self-awareness of the distinction between what is actually science and what are the values and ideologies that we bring to science.

*AM:* If we extended this argument, do you think that it is possible to separate science from ideology or vice versa?

*WC:* Some may think that it is not possible to separate science from values and ideologies; others may think that there are no values or ideology associated with science. Of course there are values associated with science (for example, scientists value objectivity) and there are metaphysical beliefs (such as the belief in cause and effect) which may seem like ideology. But there are values and ideologies that clearly go beyond anything essential to the practice of science. For example, in the USA there is a movement away from using chimpanzees in biological research. There is nothing intrinsic to science to suggest such a thing; rather it comes from values beyond science. Similarly, many people are opposed to embryonic stem cell research. Whereas there are no values intrinsic to science necessitating the use of embryonic stem cells, scientists and the public bring values to science that lead them to opinions on the appropriateness of such research. One would hope that teachers of science would be especially reflective (to be self-aware) of the values and ideologies that they personally associate with science.

*AM:* Your approach implies taking positions that require critical stands and a de-construction of prevailing concepts; your "World View Theory and Conceptual Change" (1996), for example. At the start, and even now, those positions were not well taken by some academic communities. In this regard, how has this experience been for you? How are your relationships with the communities that do not accept your stands?

*WC:* Well actually the social and cultural study of science and science education has thrived. There are now many articles on social and cultural issues in science education. The journal *Science Education* has a section titled *Science Studies and Science Education* that includes socio-cultural research. There is even a journal devoted to cultural studies in science education (*Cultural Studies in Science Education*). The forthcoming Springer Encyclopedia of Science Education has a section on socio-cultural issues in science education.

I think my work played only a small part in moving the science education community in this direction. I am happy that my work has been cited by many others. There have been disagreements but in fact some of those disagreements have led to pleasant and intellectually stimulating exchanges. For example, a few years back I published a paper in *Science & Education* on the nature of science,<sup>4</sup> belief, and knowledge. Drawing on my work in cultural studies I argued that at least for the classroom one should not attempt to distinguish between belief and knowledge. To some this was offensive because there is a popular view that belief does not have reason or rationality whereas knowledge does. However I argued that nobody believes anything without reasons. People have reasons for the things that they believe. In that sense, there is little difference between belief and knowledge. However, there are enormous differences in the rea-

<sup>4</sup> The controversy about the concepts of knowledge, understanding and belief was published in a 2004 issue of *Science & Education*. The participants were Mike Smith and Harvey Siegel, Peter Davson-Galle, and William W. Cobern (2004).

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**Article description / Descripción del artículo / Description de l'article / Artigo descrição**

This text is organized around the interview conceded by Prof. William W. Cobern, who speaks about different topics that emerge when local and cultural contexts are considered in order to achieve adequate science education for each society. Footnotes with explanatory notes on the different subjects discussed were included as an orientation for the reader.

sons that people have for what they believe or for what they consider to be knowledge. And thus the important thing is for people to discuss the reasons that they have. Well, another scholar wrote in the same journal that “no,” distinguishing between belief and knowledge is important, and I was invited to write a rejoinder. It was an informative and pleasant discussion. As is almost always the case, difficulties arise because of those who hold extreme positions. So for example there are those within both the science and science education communities who are adamant that science disproves the existence of God.<sup>5</sup> These people are implacable and in my opinion they are beyond reason.

*AM:* I would like to invite you to analyze your own path in that topic. Which periods or stages have they gone through? Which were your initial assumptions? Which questions did you ask? What changes of direction did they originate? How have you reformulated your initial assumptions?

*WC:* Oh this is difficult! There is a popular phrase, “scientific worldview.” I have from the very beginning been interested in whether that phrase makes any sense at all. And I am quite convinced that it does not. I should modify that and say that for the vast majority of people it makes no sense and that as a concept it is damaging to science education. This is what I mean. I have been interested and remain interested in separating the idea that science is an all-encompassing perspective on life and indeed reality from the more modest idea that science helps us to understand the natural world—it is extremely effective in helping this to understand the natural world. Of course, often times when the idea of a scientific worldview is invoked what the person really means is a scientific “perspective”.

*AM:* In this context, could you tell us about the idea of scientism in school?

*WC:* To take scientific worldview literally is to embrace scientism: science is everything. Francis Crick provides a case in point, albeit extreme. According to Crick’s astonishing hypothesis, “your joys and your sorrows, your memories and your ambitions, your sense of personal identity and free will, are in fact no more than the behavior of a vast assembly of nerve cells and their associated molecules.” Such a blinkered view of science is distasteful for most people, and quite unbelievable.

So when a science curriculum refers to a scientific worldview it is unlikely that the curriculum is advocating scientism. It is however an

5 Cobern’s position (2004) is to reject a categorical distinction between knowledge and belief, as proposed by Smith & Siegel (2004). He considers that even if from a philosophical point of view it is possible to distinguish between belief and knowledge, this distinction is not relevant in pedagogical terms, given that all people have (irrational and intuitive) fundamental beliefs, which they use when judging knowledge. Thus, one’s knowledge is built on beliefs. In the field of teaching, Smith & Siegel’s proposal (2004) is that scientific education should be limited to comprehension, leaving beliefs out of its scope. Cobern believes that it is not appropriate or even possible that teachers or students leave their beliefs “outside the classroom”. Therefore, his position is that the content of beliefs, and not the distinction between belief and knowledge, is most important. According to Cobern (2004), the problem of Smith & Siegel’s position (2004) is that teachers do not critically assess their presuppositions and beliefs when they speak about knowledge. He proposes that in the classroom, discussions should be held about what the participants believe and about why they think that things are the way they are. This implies that teachers should have a broad cultural and philosophical training.

This controversy is especially relevant when addressing the relationship between religious beliefs and scientific educations, particularly when discussing topics where both cross paths, such as biological evolution.

unfortunate choice of words because it does seem to imply that everything in the world can appropriately be seen through the lens of science. This is a line of thought that has stayed with me from the beginning. Another line of thought that has stayed with me is that a person's worldview cannot be assessed with any sort of survey. Given the comprehensive nature of a worldview, there are no quantitative ways of assessing worldview. And hence I disapprove of the various efforts in the literature to develop "worldview surveys." Where I have changed from early days, although perhaps only in subtle ways, is about what to do with all these ideas in the science classroom. I have moved away from the idea of culturally appropriate science teaching to the idea of open classrooms where students are encouraged to share what they believe about science and where teachers are self-aware of their own metaphysical and value commitments that can possibly, and often do, creep into their teaching of science. These days my primary interest, at least in the area of cultural studies, has to do with metaphysics and science. This arises out of my initial interests in religion and science.

*AM:* You mentioned you spent a year in Turkey. What are you currently working on? Which academic communities from which countries are you involved with in joint projects?

*WC:* When I was in Turkey I lectured on three topics that represent my ongoing research interests.

*AM:* Which topics?

*WC:* One topic was the effective teaching of science and had to do with our new ideas about approaching inquiry teaching from a different perspective. Inquiry in the classroom is always an inductive process; we have developed a deductive inquiry process that draws on the strengths of both direct instruction and inductive inquiry.

The other topic was on our work in formative assessment in science teacher education. My third lecture was about the teaching of evolution in religious climates. From those topics we have some cooperative projects going on. There are many people in Turkey who are concerned about teaching evolution in an Islamic environment. There are very conservative Islamic teachings that present the same hurdles to evolution as presented by Christians who insist on a literal interpretation of Genesis. Some of that research has to do with identifying more precisely where the difficulties lie for students in Turkey learning about evolution. However our main cooperative projects have to do with effective science teaching. We have developed

a new formative assessment device for working with preservice teachers and in professional development. We have several colleagues in Turkey who are beginning to use these in their science methods courses and for research purposes. We are always very interested in partnerships. By "we" I mean my colleagues and myself at the Mallinson Institute.

*AM:* As a closing, could you please tell us how you perceive the current development of the field of science teaching and cultural diversity? Which are the challenges ahead? Have you found differences in approach, interests, and objectives in research carried out in western and non-western societies?

*WC:* The field of cultural studies is very lively. As far as Western and non-Western societies, I think there is a very strong and appropriate interest in developing science education that is "scientific" without being culturally Western. I don't really like the phrase "Western science." I think science properly understood is simply science. However, all science and certainly all science education takes place within a cultural context; and hence it is important for the field understand the difference and to derive ways of teaching science compatible with local culture (but it is not that I think that any culture should be considered sacrosanct; all cultures have room for growth and change). People who work in this field are concerned about the imperialism of "Western science." I think the field also has to be concerned about the concept of "indigenous science." One must be careful not to fall into the trap of thinking that unless you can apply the word "science" the knowledge you are thinking about is less important. Knowledge resident in indigenous communities does not need to be legitimated by adding the imprimatur of "science." However the teaching of science can be linked with local knowledge and thus bring about more successful science instruction.

*AM:* Would you like to add something for our readers?

*WC:* It has been a pleasure having this conversation and I would hope to have the opportunity of coming to visit someday!

### **Some of William W. Cobern's publications**

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### About the authors

**William W. Cobern** graduated in both Biology and Chemistry at the University of California, San Diego. In 1979, he received his PhD in Education from the University of Colorado Boulder. Currently he is a professor at the University of Western Michigan, in the United States. He developed the World View concept for the field of science education. He has participated as a guest editor for *Science Education*, among other journals, and has worked jointly with different research groups in several countries.

**Adela Molina-Andrade** holds a teaching degree in Biology from Universidad Distrital Francisco José de Caldas (UDFJC), a Master's degree in Education from Pontificia Universidad Javeriana and a PhD in Education specializing in Science Education from Universidad de São Paulo, Brazil. She is a faculty member at the Interinstitutional Doctorate Program in Education and the Master's Program in Education at Universidad Distrital. Her research interests include Science Education, Context and Cultural Diversity, and Children's Scientific Thinking. She is the leader of the research group Intercitec.

**Gonzalo Peñalosa** is a biologist graduated from the Universidad Nacional de Colombia, with a Master's in Science, Technology and Society at the Universidad Nacional de Quilmes (Argentina) in progress. He is currently enrolled in the PhD program in Education, with a focus on Science Education, at Universidad Distrital Francisco José de Caldas.

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