Science Education: Personal and Social
Educação em Ciências: Pessoal e Social

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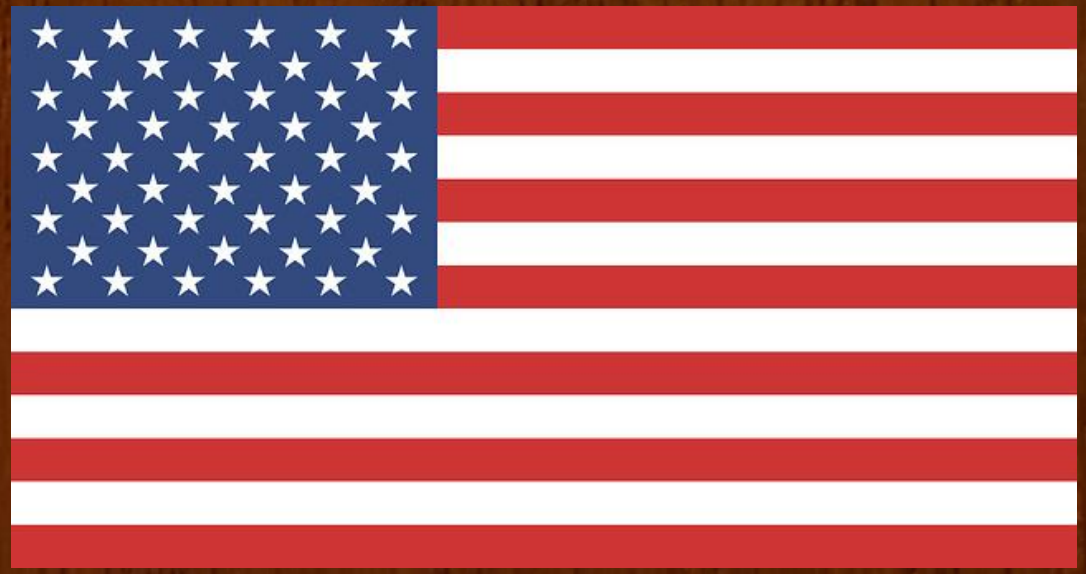
Brazilians like Bull riding?

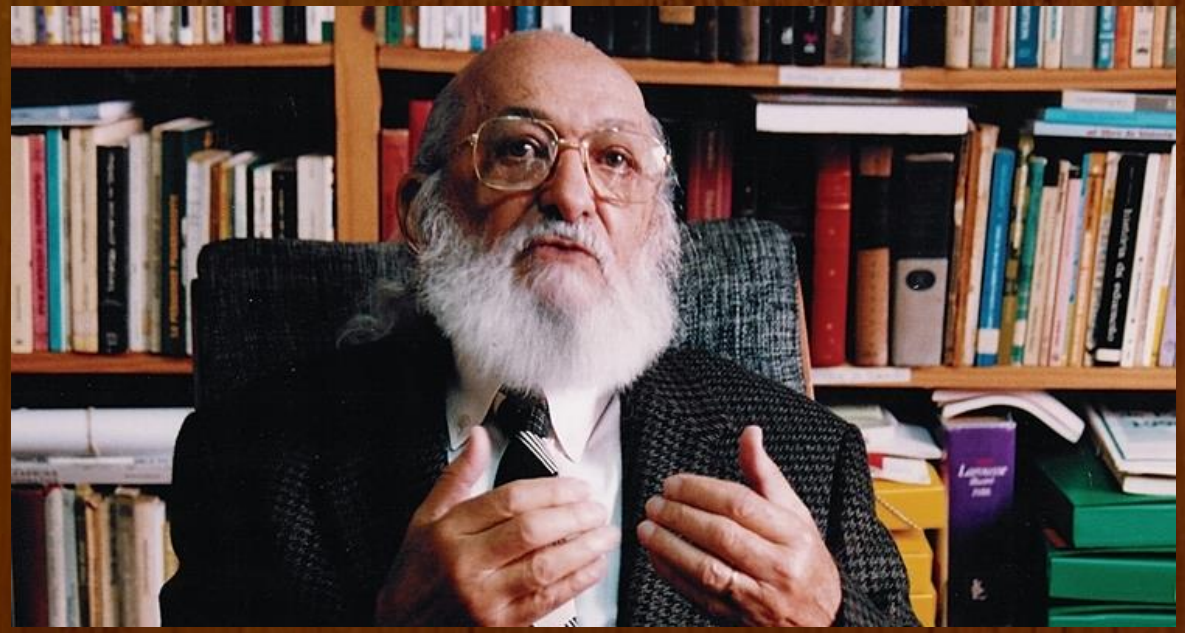
A Brazilian bull rider in America!

Futebol... o sim?


ORDEM E PROGRESSO



Paulo Freire



Ubiratan D'Ambrosio

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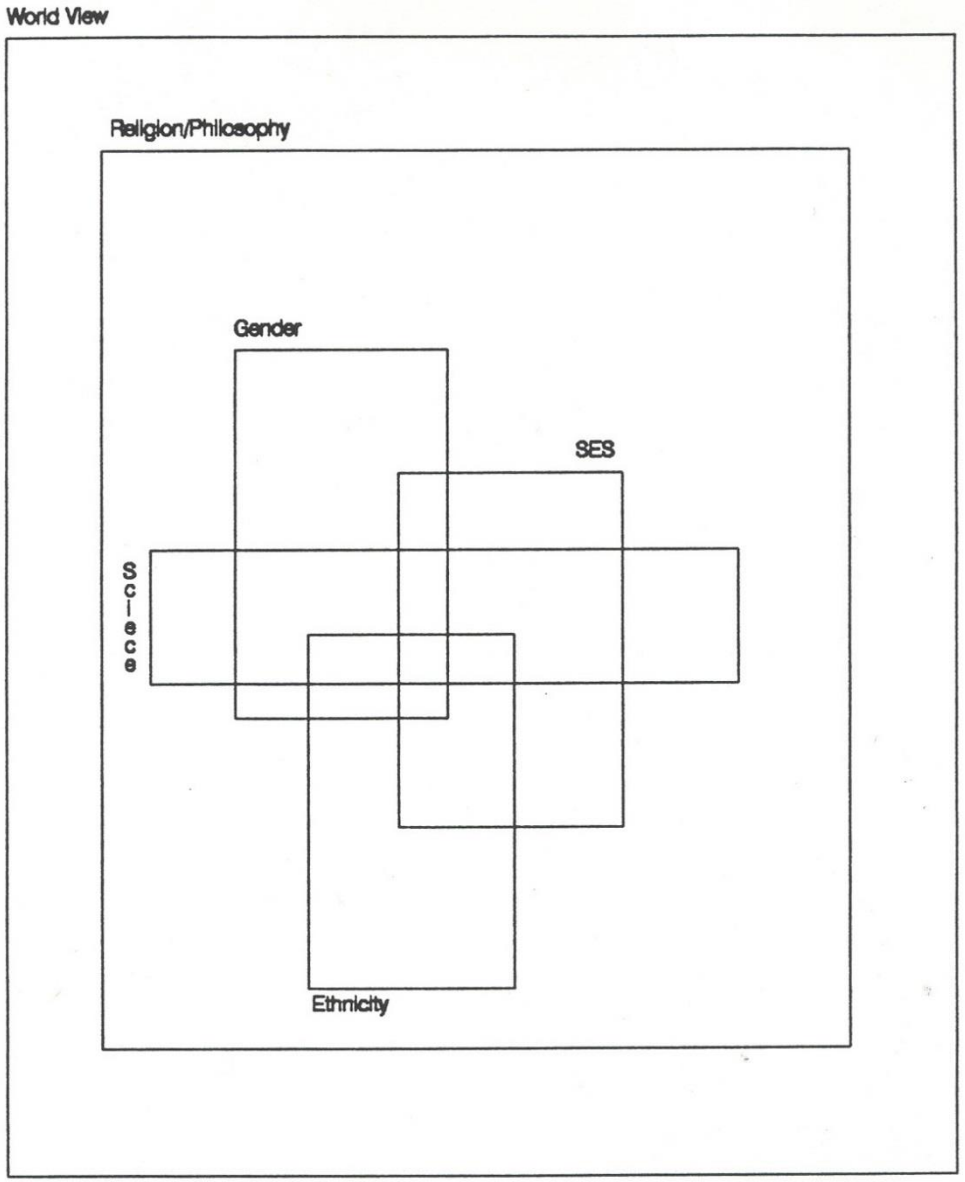
* I begin with a brief account of the theory behind today's remarks on instructional practice.
* Then as an example of science being personal and social, I'll use my own personal reflection on why science became interesting to me.
* Then I will show examples of students and teachers and their personal engagement in science. These will be examples from my research.
* Finally I will wrap-up with implications for instruction using a few Brazilian standards as examples.

Theory: We all have a worldview…

The culturally dependent, often subconscious, set of ideas, beliefs, and emotions that provides the cognitive background for our perceptions.


World View
Religion/Philosophy
Gender
SES
Science
Ethnicity

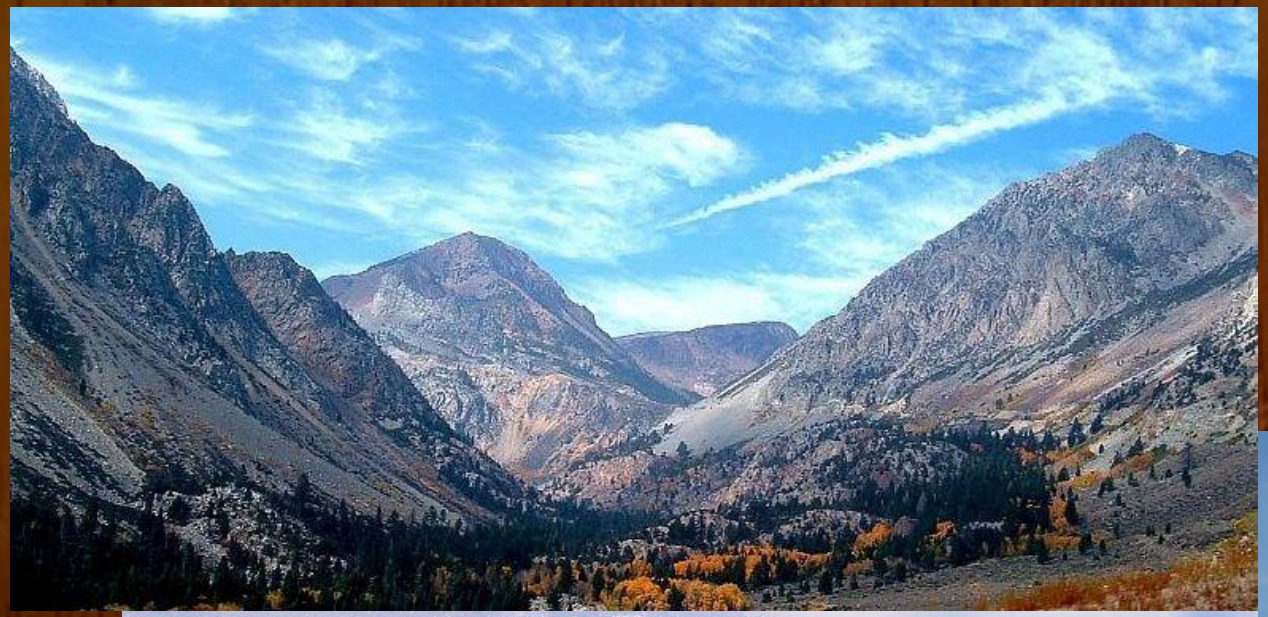
The nature of people is that we are both personal and social.

As persons we wonder about a great many things:

Why is there anything rather than nothing?

Why is the sky blue?

Why should I care about chemistry?



O que é isso?

I would say that the natural world is wonderful… beautiful… majestic… mysterious.

And, I wanted to: How does it work?

For this (that is, for how it works), I look to science.

But what do teachers and their students have to say about the natural world?

In what ways is science *personal* and *social* to them?

Shouldn't science be part of how they understand the natural world?

If we ask teachers and students about the natural world, what will they say?

Science teachers answer the question: What is the nature?

- Mr. Bradford- The Lover of Scientific Mysteries
- Mr. Hess- The Optimistic Reductionist
- Mr. David- The Scientific Buddhist
- Ms Jackson- The Logical Scientific Optimist

A science teacher answers the question: What is the nature?

Mr. Bradford-The Lover of Scientific Mysteries

Nature is more powerful than the minds of people…

Nature is really not knowable. No one will ever know everything there is to know about Nature and that is part of its appeal; because Nature is so mysterious.

To me, the mysterious nature of Nature is one of its better qualities. Things that are completely discovered are no longer interesting.

A science teacher answers the question: What is the nature?

Mr. Hess-The Optimistic Reductionist

I feel that with enough scientific knowledge all things are understandable.

I think the more we understand about matter, and the more we know about how to make things, the more predictable Nature will be.

Scientific or reductionistic thinking is very powerful… once we know enough about the minutia of the world, breaking it down by using the scientific method, scientists tearing it apart and analyzing the parts of Nature… we will be able to predict just about anything about Nature. Eventually, all Nature will be explainable.

Two science teachers answer the question: What is the nature?

Mr. Bradford

No one will ever know everything there is to know about Nature and that is part of its appeal; because Nature is so mysterious.

Mr. Hess

I feel that with enough scientific knowledge all things are understandable.

A science teacher answers the question: What is the nature?

Mr. David-The Scientific Buddhist

Nature is orderly and chaotic, predictable and unpredictable… Things wouldn't be predictable if you didn't know what unpredictable was.

Things wouldn't be orderly if you didn't know what chaotic was.

It is sort of a Ying-yang relationship between the two - I would call this just the dualistic Nature of reality.

Nature is mysterious and we don't understand it, and it's exciting. There is a lot that we don't know about it.

A science teacher answers the question: What is the nature?

Ms Jackson-The Logical Scientific Optimist

I think that Nature is predictable... logical… explainable.

As scientists, we come up with laws of Nature or theories to predict behaviors… because of the experiments that we have done.

I think Nature, you can understand it, you can know it, and you can predict it. I feel like we know an awful lot. I feel like, that, even though we don't have all the answers, we have so much, ways of finding out answers.

I feel that we know an awful lot. I think we would definitely be up towards the 80 percentile of knowledge.

A student answers the question: What is the nature?

Simon

Although I've thought a little bit about the natural world, I don't really understand a lot of things. I suspect that much of Nature isn't meant to be understood.

Because Nature lacks order and is often unpredictable, it is often unexplainable.

I like the mystery of not understanding everything.

Nature can be peaceful… I also have some religious feelings about nature. I do think that some God created the earth. This confuses me also. I'm not entirely sure of my beliefs but I do think that a god created the earth.

A student answers the question: What is the nature?

Howard

Nature is everything around us… The meaning of our lives is to interact with nature.

I think that Nature can be fully known because it is logical. We don't know or understand all of it yet but as time goes on we will understand more and more.

Sometimes Nature seems chaotic but that is mostly because our knowledge is incomplete. I think that everything can be explained by science.

A student answers the question: What is the nature?

Art

Our knowledge of the natural world is limited.

It is more important to have a spiritual understanding of Nature than just scientific knowledge.

That understanding can't be gained from school. You have to spend time in Nature and learn to feel it.

Unfortunately scientists are increasing our tendency to pollute, destroy and clutter up the earth and space. They are trying to destroy it and study it at the same time.

A student answers the question: What is the nature?

Samantha

Words like beautiful, powerful, pure and peaceful come to my mind when I think about nature.

I also think about God. Because Nature comes from God, we have an obligation to take care of it.

Nature can be understood although it is very complex and sometimes difficult to understand.

Science often leads to understanding interesting questions. It can be used to help in conservation. Scientists and environmental organizations are concerned about conservation and our resources.

These students are diverse!

And so are their teachers!

Mr. Hess	Howard
I think that everything has patterns. We haven't necessarily discovered those patterns, yet I feel that with enough scientific knowledge all things are understandable. Scientific or reductionistic thinking is very powerful. I feel that once we know enough about the minutia of the world, breaking it down by using the scientific method, scientists tearing it apart and analyzing the parts of Nature and seeing how they interact, that we will be able to predict just about anything about Nature. Eventually, all Nature will be explainable.	I think that Nature can be fully known because it is logical. We don't know or understand all of it yet but as time goes on we will understand more and more. Most things about Nature are somewhat orderly or have a pattern to them. Because of this, the study of science allows us to explain what is going on in nature. The orderliness lets us predict many things that are going to happen, like the weather. I think that everything can be explained by science

Mr. Hess	Art
I think that everything has patterns. We haven't necessarily discovered those patterns, yet I feel that with enough scientific knowledge all things are understandable.	At the present time our knowledge of the natural world is limited.
Scientific or reductionistic thinking is very powerful. I feel that once we know enough about the minutia of the world, breaking it down by using the scientific method, scientists tearing it apart and analyzing the parts of Nature and seeing how they interact, that we will be able to predict just about anything about Nature.	You have to spend time in Nature and learn to feel it…. Unfortunately scientists are increasing our tendency to pollute, destroy and clutter up the earth and space. They are trying to destroy it and study it at the same time.
Eventually, all Nature will be explainable.	It is more important to have a spiritual understanding of Nature than just scientific knowledge. That understanding can’t be gained from school.

What can one make of all this?

Do teachers' personal and social perspectives on science influence what they do in classrooms?

Or how they talk about science?

In the classroom:

- Mr. Hess *is* the optimistic reductionist…
- Ms. Jackson *is* the logical scientific optimist…
- Mr. Bradford *is* the lover of scientific mysteries…
- Mr. David *is* the scientific Buddhist…

They talk about science in ways that are personally natural.

What can one make of all this?

Here is another interesting finding...
What about science?

The students had much to say– just not much about science.

Even for students with good grades in their science courses, few had not integrated science into their everyday way of thinking.

For them, science was not very personal and not much a part of their social environment.

Again we can ask: What can one make of all this?

What happens when a student like Art is in a classroom with a teacher like Mr. Hess?

Now you ask: where am I going with this?

Does this research have any implications for the science classroom?

Ausubel's dictum…

Ascertain what your students already know and then teach them accordingly.

So what is it that these teachers decided to do?

They decided to introduce into their science courses opportunities for open dialogue with their students.

- Why do you think we are studying these things?
- Are these things important?
- Who thinks these ideas are important and why?
- Do you have concerns about the ideas we are studying?

Does this research and this idea have implications for the Brazilian science classroom?

ORIENTAÇÕES CURRICULARES PARA O ENSINO MÉDIO (CURRICULAR GUIDELINES FOR MIDDLE SCHOOL)

Page 117:	Translation
Defende-se uma abordagem de temas sociais (do cotidiano) e uma experimentação que, não dissociadas da teoria, não sejam pretensos ou meros elementos de motivação ou de ilustração, mas efetivas possDibilidades de contextualização dos conhecimentos químicos, tornando-os socialmente mais relevantes. Para isso, é necessária a articulação na condição de proposta pedagógica na qual situações reais tenham um papel essencial na interação com os alunos (suas vivências, saberes, concepções), sendo o conhecimento, entre os sujeitos envolvidos, meio ou ferramenta metodológica capaz de dinamizar os processos de construção e negociação de significados.	It is defended an approach of social (everyday) subjects and experiments that, not dissociated from the theory, are not pretenses or mere elements of motivation or illustration, but effective possibilities of contextualization of the chemical knowledge, making them socially more relevant. For this, it is necessary to articulate in the condition of pedagogical proposal in which real situations play an essential role in the interaction with students (their experiences, knowledge, conceptions), being the knowledge, among the involved subjects, a methodological tool or medium capable of dynamizing the processes of construction and negotiation of meanings.

ORIENTAÇÕES EDUCACIONAIS COMPLEMENTARES AOS PCNs

(ADDITIONAL EDUCATIONAL GUIDELINES FOR PCNs)

Page 126:	Translation:
Destaca-se, assim, que a organização curricular deverá obedecer ao princípio da flexibilidade e adequação à realidade escolar. Assim, nas propostas pedagógicas das escolas, conhecimentos químicos são organicamente contemplados e vêm sendo acrescidos. Todavia, cabe ressaltar a necessidade de que a elaboração dos programas não se perca em excessos de conteúdos que sobrecarreguem o currículo escolar, sem que o professor tenha condições temporais de explorá-los adequadamente, de maneira que os alunos possam significá-los e compreendê-los de forma socialmente relevante. Atualmente, muitos programas de Química estão carregados com conceitos e classificações obsoletos e um excesso de resoluções de exercícios por algoritmos, que pouco acrescentam na compreensão dos conceitos químicos.	It should be emphasized, therefore, that the curricular organization should obey the principle of flexibility and adequacy to the school reality. Thus, in the pedagogical proposals of the schools, chemical knowledge is organically contemplated and has been added. However, it is important to emphasize the need for the elaboration of the programs not to be lost in excess of contents that overload the school curriculum, without the teacher being able to exploit them in a timely manner so that the students can signify them and understand them, in a socially relevant way. Today, many chemistry programs are loaded with obsolete concepts and classifications and an excess of algorithm-based exercise resolutions that add little to the understanding of the chemical concepts.

I think these documents are saying:

- Science learning should be socially relevant and connected to students' experiences and knowledge.

- Teachers should plan lessons so that there is time for students to reflect socially and personally on what they are learning.

Page 88:	Translation:
Assim, as escolhas sobre o que ensinar devem se pautar pela seleção de conteúdos e temas relevantes que favoreçam a compreensão do mundo natural, social, político e econômico. E, para isso, a forma de tratamento desses temas e conteúdos é determinante e deve contemplar o desenvolvimento de procedimentos, atitudes e valores.	Thus, the choices about what to teach should be guided by the selection of relevant contents and themes that favor the understanding of the natural, social, political and economic world. And for this, the treatment of these themes and contents is determinant and must contemplate the development of procedures, attitudes and values.

make curriculum and instructional choices that help students integrate science into their social and personal worlds…

Reconhecer a origem e ocorrência de materiais **CBC 2007**	**Recognize the origin and occurrence of materials.**
1.1.1. Identificar os materiais mais abundantes no planeta: rochas, minerais, areia, água e ar.	1.1.1. Identify the most abundant materials on the planet: rocks, minerals, sand, water and air.
1.1.2. Relacionar a constituição dos seres vivos com os materiais existentes no ambiente.	1.1.2. Relate the constitution of living things materials in the environment.
1.1.3. Relacionar as propriedades dos materiais como plásticos, metais, papel e vidro aos seus usos, degradação e reaproveitamento.	1.1.3. Relate properties of materials such as plastics, metals, paper and glass to their uses, degradation and reuse.
1.1.4. Apontar, por exemplo, a diversidade de usos dos materiais e suas conseqüências ambientais, principalmente relacionadas ao aquecimento global.	1.1.4. To point out, for example, the diversity of uses of materials and their environmental consequences, mainly related to global warming.

Reconhecer a origem e ocorrência de materiais CBC 2007	
1.1.1. Identificar os materiais mais abundantes no planeta: rochas, minerais, areia, água e ar. 1.1.2. Relacionar a constituição dos seres vivos com os materiais existentes no ambiente. 1.1.3. Relacionar as propriedades dos materiais como plásticos, metais, papel e vidro aos seus usos, degradação e reaproveitamento. 1.1.4. Apontar, por exemplo, a diversidade de usos dos materiais e suas conseqüências ambientais, principalmente relacionadas ao aquecimento global.	Looking at curriculum objectives such as these, one has to ask…. how do make learning this material socially relevant and connected to students' experiences and knowledge? **Easier said than done!**

Its easier said than done, because…

the teacher can rarely know what things are personally or socially interests to students.

For example, we know that one can use of knowledge of chemistry when thinking about the foods one buys at the supermarket and the preservatives that are in foods,

but that does not mean all students will find that interesting.

Reconhecer a origem e ocorrência de materiais CBC 2007	
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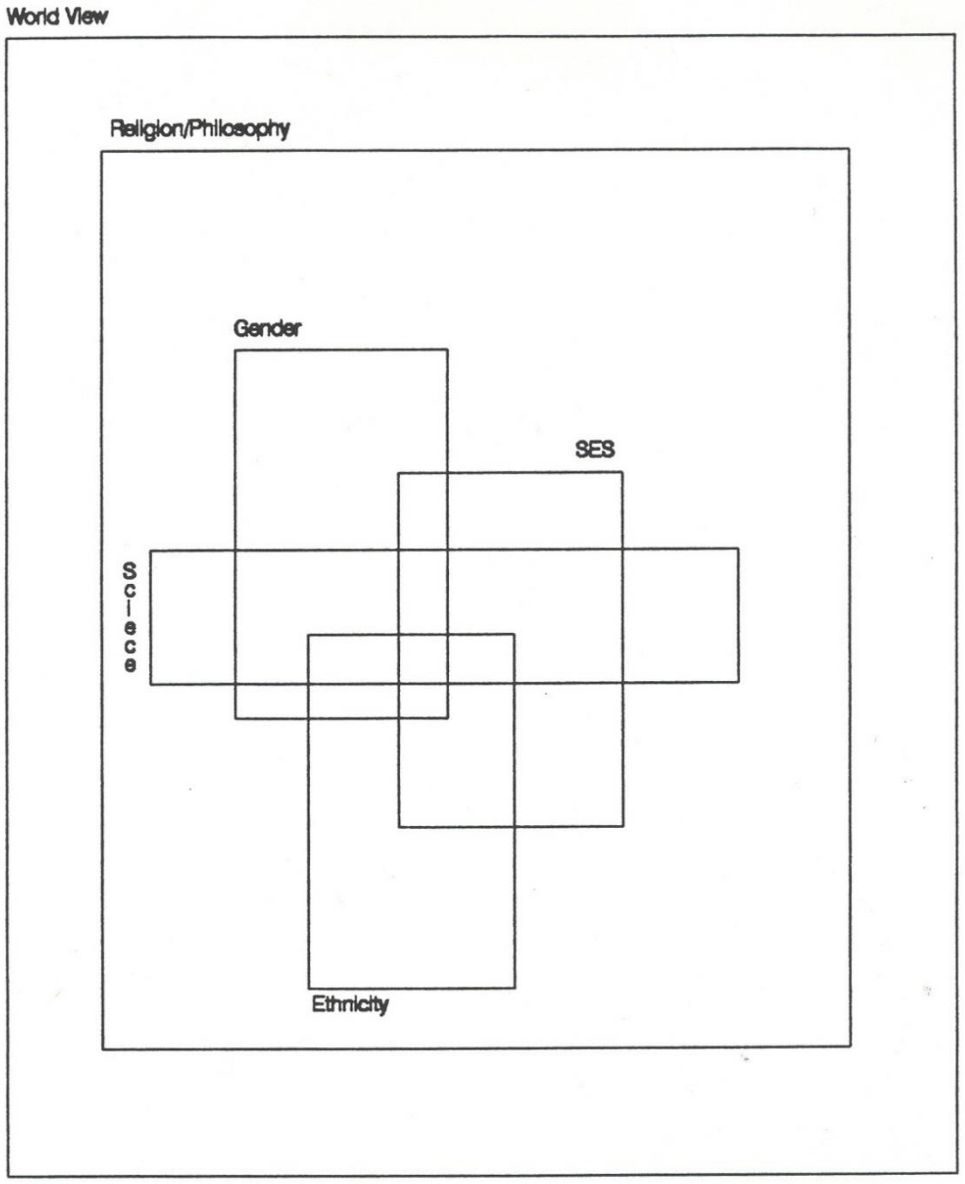
World View
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Of course these aren't the only questions you could use….

-Be creative!
-Think of questions that invite students to express themselves.
-You might find that visuals can be helpful.

And yes you could suggest connections with social, cultural, or environmental issues.

(but not too quickly!)

In conclusion, please remember:

1. There is more to the effective teaching of science than simply the science.
2. Passing an exam or even getting a good grade in science does not mean that the science has had a significant impact on how the student understands the world.
3. The way the teacher contextualizes science may have more of an effect on the students than the teacher ever imagined.

In regard to how teachers contextualize science for the students…

Consider providing your students with opportunities for *open dialogue* about the science they are to study

as a way introducing science subject matter.

THANK YOU

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