



So You Want to Teach...?

This is our second installment of subject area advice from faculty. This month, we focus on economics, foreign language, and the sciences: *life and physical.*

Who is the Effective Science Teacher?

Dr. Joseph Hesse taught chemistry and mathematics at West Catholic High School, and physical science and chemistry at Spring Lake High School. He was also the boys' tennis and golf coach at West Catholic. Here at GRCC, he has taught General Chemistry, Polymer Chemistry, Introduction to General Chemistry, Organic and Biochemistry, Physical Science (regular and online hybrid) as well as Introduction to Education.

- *Ahhh...nothing like putting a log on a fire. The beauty of the flames, the warmth of the heat—very cozy. If the log weighs five pounds and the ashes, a few ounces, what happened to the wood?*
- *Does a tray of ice cubes weigh more than the tray of water before freezing?*
- *When you cook, you mix up the ingredients to make a tasty dinner—can you mix up different ingredients and turn an iron nail into a nail of gold?*
- *Why does a refrigerator magnet stick to your refrigerator, but a spoon will not?*

Answering these everyday questions requires knowledge of science.

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Effective Teachers Start with Wonder and Fun

As a young child, I was drawn to science when my parents gave me a Gilbert Chemistry Set for my birthday. Changing the color of solutions or making a solution fizz by mix'n chemicals was fun. In sixth grade, I had a dynamic teacher, Sister Allen, who was working on her Ph.D. degree in Chemistry. With Sister Allen as our guide, we explored our physical world. In her classroom, science became an activity. We were often out-of-doors collecting samples, performing tests, observing the microscopic world with magnifying glasses and microscopes. I worked alone and in groups with my classmates preparing and presenting science reports. "Wow!" and "Cool" were part of our Thursday and Friday afternoon science classes—I couldn't wait. Even today, after forty years as a science teacher, I often think back to my sixth grade teacher who willingly shared with her students the wonder, the joy and the fun of exploring their physical world.

The Challenges of Science Teaching

If you want to be a science teacher, your goal should be to become an effective science teacher—one whose students learn science. As an effective teacher you will demystify science, making science accessible and usable by your students. You will help your students understand that science isn't an infinite collection of facts to be memorized, but a manageable number of laws and theories that are applicable across multiple events. You will help your students focus upon the BIG questions of their physical world: how matter and energy are organized, and how matter and energy change.

To do this, science must be presented in a way that is understandable without compromising the content you are teaching, and must be relevant to the lives your students are currently living. What is relevant to a third grader will certainly be different than what is relevant to a ninth grader. This is where teacher artistry comes into play. Planning lessons around the BIG QUESTIONS that are appropriate for your students is what makes science teaching challenging and rewarding.

Students encountering new content will first try to make sense of it by trying to mesh the new content with what they already know. As uniquely human as this process is, problems can arise that become barriers to real understanding. Trained scientists explain the organization and changes in the physical world by reference to invisible particles and forces. Beginning science students, however, tend to build their understanding around homespun analogies to events taken from their everyday lives. This can lead to deep-seated misconceptions that become mentally comforting and difficult to change.

Misconceptions, once acquired, create challenges for teachers. For example, many beginning science students incorrectly believe that solids—by the fact that they are solid—must weigh more than the same material when it is a liquid. Ice just has to weigh more than liquid water! Research on student learning shows that merely **telling** the student the correct scientific explanation seldom works. Students may memorize an answer, but revert back to their mentally comfortable misconception when asked to explain new scientific phenomena.

Effective Teachers Understand the Processes of Science

Effective science teachers portray science as a powerful tool for making sense of the physical world. Effective teachers have a passion for science—they see themselves as a scientist—someone who is attuned to the processes of science: constructing new scientific knowledge, using that knowledge, and reflecting upon the scientific claims made by others. Scientists construct new

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knowledge by using the Scientific Method to collect, analyze and look for trends within a data set. Scientists use their scientific knowledge to describe, explain, predict and then manage their physical world. Scientific knowledge gives the scientist the power to reflect upon the scientific claims of others who may want to dupe the public into purchasing products that have no scientific basis, or give incorrect explanations to scientific phenomena.

As you see, creating, using and reflecting are all activities. Science at the K-12 level is all about “doing stuff” and thinking about what you did. Too often, under-prepared science teachers have resorted to the imagination-killing practices of making their students read the book, copy down an answer, and memorize it for “the test.”

Effective science teachers embrace technology and the power it gives to make invisible, often mathematically complex content understandable to their students. Elementary and secondary science teachers should go beyond the text book and explore the plentiful resources available on the Internet. Almost every topic that is part of the K-12 science curriculum has numerous video clips and animations available on the Internet. These can be used as an introduction to a topic to raise student interest and as part of a more formal presentation on the content. Since much of the content is based around invisible particles and forces, hands-on-minds-on demonstrations and labs are keys to making textbook content something students will remember and understand.

Effective science teachers are themselves learners, presenting science as a magnifying lens—piercing the layers of mysterious jargon and letting their students grasp the wonder and simplicity of their physical world.

Making Language Less Foreign

Mrs. Hillery Haney taught in secondary schools for ten years, two of which also included some elementary teaching in a K-12 school in Morocco.

I have been absolutely fascinated with the language acquisition of my four-year-old and one-year-old. Little ones just soak up language and don't ask why, but adults and older students (including those in high school) need to understand how a new language relates to the language they already know. When I taught the little ones, we did activities such as stories and role-play, cartoons and puppets to help bring the language to life. They also would use stuffed animals of their own or finger puppets to act out a story. We did a lot of running around, singing and dancing, and it is amazing how they just accepted the language for what it was as they played. The younger the child, the less they need to understand the target language through their primary language. With them, I could do many more immersion activities with visuals than I could with older adults.

To teach a language in depth, teachers must have a strong academic background and proficiency in the target language, as well as knowledge of the culture, history, and geography of the region(s) in which the language is spoken. It is very hard to teach beyond a basic level without decent proficiency, so aspiring language teachers need to have a major or minor in the actual language they want to teach. They wouldn't be able to get a job teaching language without that specialty. Today most colleges have adopted proficiency standards that students must meet in order to get their teaching certificate in a particular language.

If, however, a teacher is simply having fun with a language and introducing it to elementary-age students as a part of their own particular curriculum, whatever that teacher can do will enhance the learners' experiences. For example, an elementary teacher studied French for a couple of years and would like to explore that language with his or her students by reading books, or teaching numbers, colors, the alphabet, or animal names. Those activities will expose the youngsters to that language and instill an interest in learning it that could be life long. Even if a teacher does not have a language major or minor, there are ways to study other cultures, include some language, and enrich students' lives forever.

With personal enthusiasm on the part of the teacher, language learning can be contagious and infect the students in many ways. Personal stories and experiences make the language and culture come alive. Interaction and group work are also effective so that the students have opportunities to use the language themselves. With YouTube and other Internet sources, there are so many authentic materials that a teacher can expose learners to. If you have fun teaching, the students will have fun learning because there is a definite trickle-down effect with language learning. Since students are often nervous about saying things incorrectly, they become easily embarrassed and can shut down. By promoting an environment that is friendly and encouraging, you can create an atmosphere where everyone is comfortable and “foreign language” isn't so foreign anymore.

Science Literacy

Mrs. Sarah Krajewski is an Assistant Professor in the Biological Science Department where she currently teaches Biology 101 for Elementary Educators and Biology 101. Before assuming her position at GRCC, she taught biological, physical and forensic science at Northview High School. She is passionate about science education and is currently pursuing her Ph.D. in Science Education at Western Michigan University.

It is difficult if not impossible to pick up the newspaper or turn on the news and not come in contact with current life science topics. Genetically engineered foods, stem cell research, global warming, endangered species, gene therapy, and health and environmental concerns name just a few. As educators our curriculum needs to go beyond the basic skills of reading, writing and arithmetic and to challenge students to be “scientifically literate.” The ability for students to read or hear scientific data, comprehend, and apply the data to a new situation, is a skill that is necessary in today's world. Throughout their lifetime, individuals will be faced with legislation on topics such as stem cell research, global warming, gene therapy, and evolution in education. These types of situations will require each individual to make informed decisions, based on scientific data. While an emphasis on key vocabulary and basic science standards are important, an understanding of experimental procedures and the actual nature of science is even more imperative as scientific advances continue to occur.

An effective science educator instills an understanding in their students that science is not a collection of facts to be memorized, but rather a way of understanding the world around them. They tap into their student's natural curiosity and real world experiences to teach the process of science. Both primary and secondary educators need to successfully incorporate instructional techniques that actively engage students in transferring the science content to their understanding of the world around them. Science education at all levels is imperative in creating a scientifically literate society.

Science as Inquiry

Mrs. Foster taught Advanced Placement Biology, Anatomy and Physiology, and General Biology in grades 9-12 at both Wayland Union Schools and Jenison Public Schools. Here at GRCC, she teaches Anatomy and Physiology and General Biology for non-science majors. Her area of emphasis is in promoting the advancement of science education. She is a recipient of the "Biology Teacher of the Year" award by the Michigan Science Teachers Association.

Biology from Greek: bios "life" + logia "study of."
Educate from Latin: *ēducātus* - to bring up, to lead

Combine the two and you have my life's vocation—but why a biology teacher? In short, I think made my way into science by being curious, but also by recognizing that my passion and skills rested with helping others understand difficult concepts.

Instrumental to many of us who joined the education profession, was a teacher who I had in the 7th grade. Ms. Hurlburt taught science, and her enthusiasm, energy and challenges inspired me and kept me attentive and eager to learn more about the nature of science. Equally influential were those teachers who provided opportunities for their students to explore research topics. Then too, encouragement to participate in regional, state and national science fair competitions throughout my middle and high school years spurred my interest further! At the same time, I was always keenly aware of other students in my classes who were struggling with topics that seemed so easy for me. I had to help, and my particular gift was finding ways in which I could explain complex biology mechanisms to my friends. That was the beginning of a career in the making.

Early in my college life, I had biology professors who encouraged me to become involved in area outreaches for children, including being an assistant, coach and judge for Science Olympiad and Odyssey of the Mind. I would also draw attention to the vital role of a good advisor. A professor I had pushed me to take a very rigorous selection of courses not only in my major and minor, but also in my electives. I am convinced that this watchful attention to my studies was instrumental in preparing me for what lay ahead for my teaching. In addition, I became an active participant in the Michigan Science Teachers Association while I was still completing my undergrad work. This experience allowed me to meet inspiring teachers, learn creative ways to teach complex biological topics, and made me feel like I was a professional even before becoming a certified teacher. I was hooked by those around me who had so much unbridled passion for their work!

Today, I find myself reflecting back over my years of teaching and I am convinced that inquiry science must be a basic in the daily curriculum of every elementary school student at every grade level. In the last decade, numerous reports have been published calling for reform in education. Each report has highlighted the importance of



Demonstrating a hands on approach to science

early experiences in science so that students develop problem-solving skills that empower them to participate in an increasingly scientific and technological world.

To this end I have found that students learn science best when—

1. they are involved in first-hand exploration and investigation and inquiry/process skills are nurtured.
2. the learning environment for science fosters positive attitudes towards self and each other, as well as science.
3. a variety of presentation modes are used to accommodate different learning styles, and students are given opportunities to interact and share ideas with their peers.
4. the scientific contributions of individuals from all ethnic origins are recognized and valued.
5. other subject areas are infused into science.
6. inquiry skills and positive attitudes are modeled by the teacher and others involved in the education process.
7. teachers keep abreast of appropriate science education research and incorporate that into their delivery.

I have been thrilled and honored to be able to teach a course called Biology for Elementary Education over the past eight years at GRCC. I am convinced that our future educators of science must first be **comfortable** with the material. This then builds **confidence** and with that comes a greater assurance of **competency**. The three C's are my guiding principles as I work with the students who will be teaching science to our nation's children.

The essence of what I believe makes an outstanding teacher begins with the influence of those teachers who went before us—opening up our doors of inquiry, and promoting a rigorous line of study to become both rounded and grounded in the subject area in which we have endless passion. Stay fresh by purposeful affiliations with colleagues who share in the enthusiasm for teaching. When all of these components align, you will be part of a most noble profession, filled with intrinsic rewards that can only be truly appreciated as you yourself experience it. There is a kinship of educators that I am convinced comes from these common backgrounds: our shared passion for working with children, the great joy in the enlightenment as our students learn, and our pride in knowing that we have played a role in their future.



So many future scientists!

Teach Them How to Learn

Mr. Steve Abid taught high school for sixteen years, mostly at West Catholic High School in Grand Rapids. As a high school teacher, he taught Economics, Accounting, Business Law, Consumer Economics and typing. He also coached football as a varsity assistant and later coached at one of the Catholic elementary schools. He served as Business Department Head, Senior Class Advisor, Student Government Advisor, and for a brief time was Interim Principal. Currently, he is head of the Social Science Department here at GRCC.

To teach Economics, strong math skills are a must, but more important is the ability to **explain** mathematic principles. Math is just one portion of this discipline, because as a social science, economics is first the study of people, their relationships with each other, and scarce resources. So knowing math is great, but being able to explain to non-math lovers how the math is applied in this subject is critical.

Additionally, an understanding of history, business, and as much as possible, the realities of governmental relationship to the economy is also important. Depending on what you teach in an economics course at the secondary level—macroeconomics, microeconomics, or a combined approach—and the grade level of the students, you will want to be able to explain things from multiple perspectives. For example, in teaching about recession and unemployment, you will want to discuss the Great Depression, and it may help the students to have the historical context of the 1920's & 1930's, the business context of over-production, inflexible prices and the political and governmental context of laissez faire vs. fiscal policy).

Effective teaching occurs in the social sciences in general and in Economics in particular when teachers combine a traditional lecture approach with collaborative learning strategies. Connected with that, various cultural references help to bring some concepts into focus for students. Movies can provide a launch pad for discussion. Talking to business owners, local government leaders, and others in the community can provide a way to contextualize the information. The effective teacher makes sure that students are **learning how to learn**, and not just learning for the test! Have them write essays, for example, comparing and contrasting various concepts (fiscal policy vs. monetary policy or laissez faire vs. government intervention). Doing that gets them engaged in articulating what they understand about these concepts. Identify the learning styles of your students and try to incorporate a variety of teaching styles to accommodate them.

No matter what you teach, don't think of teaching as a job. Think of it as going to school each day! Most of us became teachers because we loved our subject, we loved school, and we loved learning. So love what you do and let your students know it! But, don't be alarmed if students don't love the subject as much as you do – especially if it is a required class! If there are opportunities to engage with students outside of the classes, it can be tremendously rewarding. Be a club sponsor, or advisor. Coach a sport, mentor students, and tutor them. Create or be a part of a service organization at the school. These are all ways to get to know the students and model some other behaviors for them. Finally, appreciate your students for who they are and the potential they have!



Students observe and make notes.

The World is Now a Neighborhood

Mr. Richard Reid began teaching Spanish in 1966 at Creston High School. In the fall semester of that year, he started the German program at Creston. Later he occasionally taught English classes as well. For a brief time, he was Creston's Assistant Principal, then returned once more to the classroom to teach German and Spanish. In 1980, he left Creston to teach English 101 and later Spanish and German at Grand Rapids Junior College, which in 1991 became Grand Rapids Community College.

Even students with a history of difficulties in English can, if sufficiently motivated, be successful in the study of an international language. Although high school students who begin Spanish would have studied English grammar in both elementary and junior high, their study of an international language would introduce structural elements common to both languages to help make the conceptual leap to Spanish. Grammatical structure by itself is just a beginning. Students will also have to master a new phonetic sound system using the Latin alphabet, shared by all western European languages. Vocabulary, syntax, and usage have customary forms peculiar to Spanish, some of which parallel English. Although a good grounding in English grammar seems essential for studying international languages, students who had difficulty with English grammar actually discover aspects of their own mother tongue through the study of Spanish, German, French, and others.

Sentence pattern repetition spoken aloud and in writing helps reinforce grammatical structures and other elements of mastering an international language. Encouraging study with classmates both in and outside of class enhances the social aspect of language use. Speaking, reading, understanding the printed and spoken word are all-important components, which must be practiced daily. Language learning is not unlike the daily regimen required to play a musical instrument. Lecture can only play a minor part of teaching international language. The necessary occasional cacophony of student voices talking to, and practicing with one another in the target language, is a joyful sound.

Helping students reach beyond their native culture and language creates in them a kind of magical wonder. They discover the common and profound humanity of people in distant and not-so-distant cultures and places. Teachers of international language enjoy the satisfaction of guiding students to consider heretofore unknown aspects of ethnicity and complexion. This is powerful confirmation of what they learn in biology and anthropology. There is also that staggering urgency to help students gain a sense of human interrelatedness, living as now we must in a world contracted to a neighborhood.

teacher EDUCATION

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