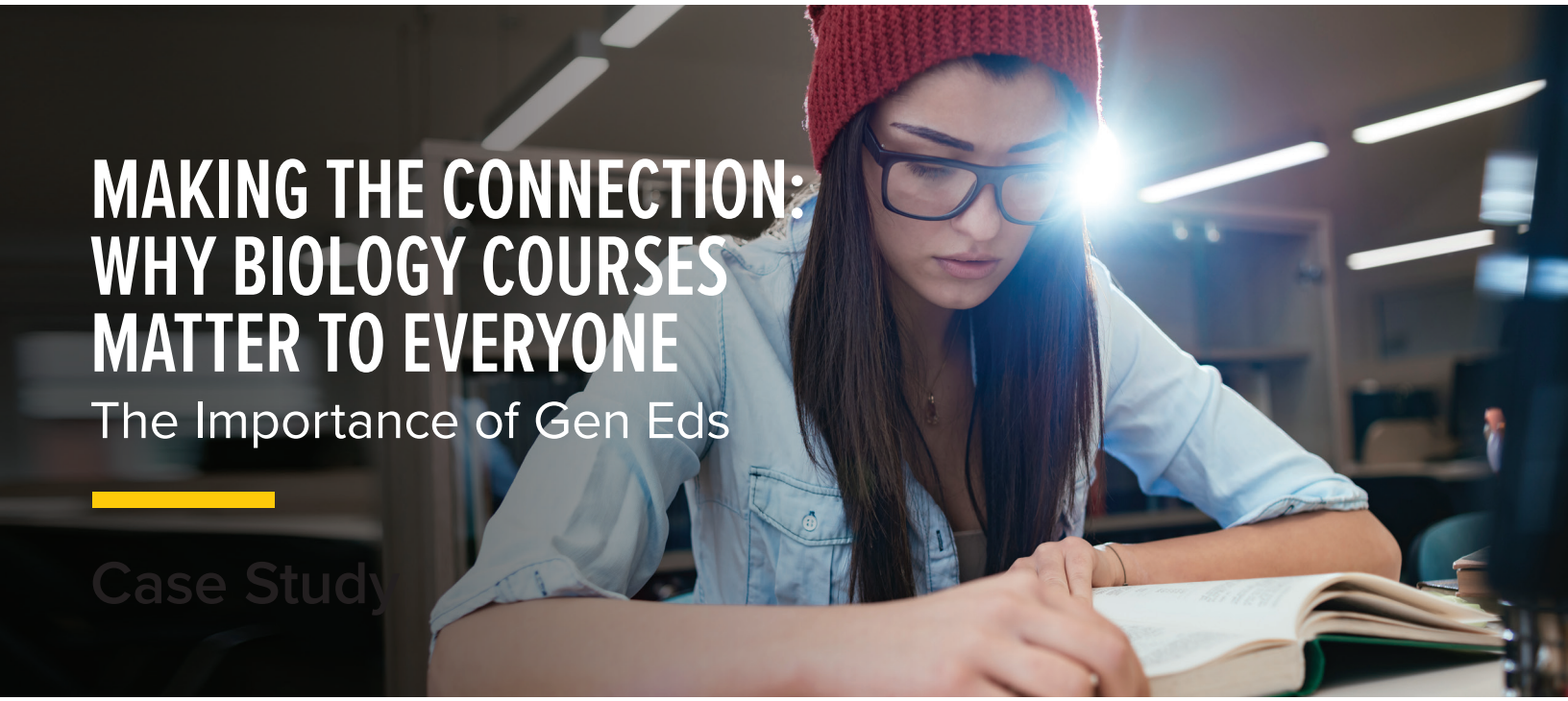

# MAKING THE CONNECTION: WHY BIOLOGY COURSES MATTER TO EVERYONE

## The Importance of Gen Eds

Case Study

**General Education requirements, or "Gen Eds," get a bad rap.**

**For those unfamiliar, Gen Eds are typically introductory classes or requirements, usually outside of one's major, that every college or university requires undergraduate students to complete to obtain a degree. Since these courses aren't related to most students' majors, students often see them as unnecessary "filler" requirements that they are required to take (and pay for) on their way to getting the degree they're actually interested in. Engineering students may ask why they really need to take two Gen Ed English courses, and those going to college to become an accountant may wonder how a required history class really fits into their degree program.**

It's not surprising that some students question the worth of Gen Eds. College is expensive and costs continue to rise; especially considering that Gen Eds can cover between 1/3 and 1/2 of all credits needed for an undergraduate degree, they involve a lot of time, money, and work for a student looking for affordable ways to earn a degree.

How critical a solid and broad foundational education is to people's lives and the numerous ways it can further a student's career are often overlooked. Gen Ed courses provide a foundation in topics and skills that affect people every day—from understanding personal health to communicating ideas effectively to managing personal finances. Gen Eds may seem like a waste of time to a student staring down 2–4+ years of college courses, but their influence and importance in developing future life and career skills is in many ways undervalued.

One critical and often overlooked Gen Ed requirement in an undergraduate's path is the course Essentials of Biology.

## Discovering an Unmet Need

No one knows better how important and how difficult it is to effectively teach the essentials of biology to non-majors than instructor Margaret S. Johnson, a biology instructor at St. Charles Community College in St. Charles, Missouri.

Over her eight years of teaching Essentials of Biology, Margaret saw an increasingly disturbing trend emerge. Course after course, the non-science students voiced that the coursework was intimidating, too technical, and lacked practical, real-life application. They were bored and just going through the motions to pass the class and move on to other classes in their degree program. Although studying complex scientific concepts is not for everyone—it can be quite daunting for non-science majors—a strong foundational understanding of biology is critical for students, not just for college, but in helping them to understand the world, the environment, and even their own health.

What was even more alarming was that the students weren't worried about their lack of understanding of the course material itself. Instead, they approached their instructors with concerns about how their grades and grade point averages might be adversely affected if they did poorly in this class. Students just couldn't seem to see how an Essentials of Biology course would have any practical or tangible effect on them or their future.

**NON-SCIENCE STUDENTS VOICED THAT THE COURSEWORK WAS INTIMIDATING, TOO TECHNICAL, AND LACKED PRACTICAL, REAL-LIFE APPLICATION.**

Margaret found that the lack of connection and relevancy of course concepts to students' everyday life was a key stumbling block for getting her students to engage in the course, saying, "We were hitting critical mass. Course after course, it became apparent we were just not connecting with students in a way that would make biology learnable because it just wasn't relatable. Many students were vocal about not knowing what biology meant for them as non-majors and they questioned why they were required to take Essentials of Biology. Consequentially, we saw the results of this come through in decreased engagement in the class, including poor grades and even some dropouts."

"Course after course, it became apparent we were just not connecting with students in a way that would make biology learnable because it just wasn't relatable."

- Margaret S. Johnson, Biology Instructor, St. Charles Community College

It wasn't just Margaret who was struggling to make the material relevant to her non–biology major students. Other instructors in her department were up against the same problem. So, like scientists performing research, Margaret and her colleagues decided to tackle this problem the best way they knew how: through testing and experimentation of both course content and delivery methods.

## Incremental Improvements, But Not Enough

The first step was to add course content on how biological concepts relate to everyday life. To make chemistry more relatable, Margaret asked her students to read food labels and bring them to class. This resulted in stimulating class discussions about the body's need for food as fuel, but Margaret was challenged to link this technique into the course outline, which followed a more traditional format starting with abstract chemistry concepts. Another step was trying to make the unit on cancer more relatable by using a case study about an individual with an aggressive form of the disease. Students found the case study relatable, but again, the more concrete approach didn't fit or help the students connect with the technical details covered in the course outline and textbook.

**THE FIRST STEP WAS TO ADD COURSE CONTENT ON HOW BIOLOGICAL CONCEPTS RELATE TO EVERYDAY LIFE.**

These initial steps were incremental solutions, and they didn't solve the bigger the problem in the long run. The overall approach still did not resonate with students: feedback continued to indicate that the science was still intimidating and confusing and students couldn't see a bigger picture of how this material would ever be useful to them down the road. According to Margaret, "We were trying to fix the situation with 'educational Band-Aids' that didn't work long-term. The problem was that our textbooks for non-majors were written as simplified textbooks for majors that didn't tailor the content for a non-major." The lack of engagement in the classroom continued and students seemed to be there to just earn a grade. Many students had a defeatist attitude about science classes and remained incredibly intimidated by the course material.

So, the faculty team decided to try experimenting with the course format itself, moving from a traditional print textbook and lecture setup to integrating more robust digital technology, visuals, and graphics to break down key concepts and make them more understandable. This more robust course did slightly improve the situation. Students found the format accessible and engaging, with its simplified biological concepts and terms, but they still could not make the leap from concepts and terms to a real-life connection within the course structure and content.

## THE FACULTY TEAM DECIDED TO TRY EXPERIMENTING WITH THE COURSE FORMAT ITSELF.

Students still struggled to engage with the learning process, failing to see any connection between the abstract biological concepts and their daily lives.

"We were still constrained by structure—chapters that followed a traditional biology course instead of one that led with relevancy to everyday life," noted Johnson. "But we were close to solving the problem. We realized that to teach biology in a way that's relatable we would have to teach by taking sections from different chapters to create a relevancy model."

The faculty were understandably frustrated; despite their best efforts to break down the scientific concepts and course materials in thoughtful and creative ways, the material still wasn't resonating with students like they hoped. The experiment was looking more and more like a bust, so they decided to seek outside solutions.

### A Transformational Solution

Faculty at St. Charles Community College knew that the lack of connection between the Essentials of Biology course material and the non-major students' lives was at the root of the problem. If they could get their non–biology major students to see the importance and relevancy of the material to their own lives, instructors were confident that student engagement and learning (as well as grades) would improve. After doing some outside

research, they decided to lean on learning sciences company McGraw-Hill to help them investigate what a possible solution might look like.

McGraw-Hill recommended a potential solution, but it was very different than their current course structure. For decades biology textbooks—and by extension classes—had always presented material in a particular fashion, beginning with the basics and concepts and then working their way up to how all the pieces fit together. This seems like a logical approach at first glance; after all, how can you possibly understand the implications of say, cancer, if you don't even know how a cell works?

What McGraw-Hill offered with their new digital product, called *Connect Master: Why Biology?*, was a radically different pedagogy. This pedagogy took a "theme-based" approach to learning, starting with relevant, everyday life topics, such as climate change, vaccines, GMOs, and cancer, approaching the topic holistically first in order to grab students' attention. From there the program threads in biological concepts, definitions, and processes. Starting from the big picture and moving to the more technical aspects enables non–science major students to create connections, become more engaged with the content, and learn to make informed decisions as scientifically literate citizens.

Now Margaret saw her students truly learning: "*Why Biology* opens their mindset to be receptive to learn because they see how it will apply to their life. And the course flow allows them to navigate a path of personal learning and discovery in a way that isn't intimidating."

The customizable *Connect Master: Why Biology?* solution was designed around key theme-based and interesting topics that could easily stimulate classroom discussion:

- Cancer
- Energy drinks
- Influenza A
- Sickle cell disease
- Climate change
- GMOs

Developed by Dr. Michael Windelspecht, who has taught introductory biology, genetics and human genetics in online, traditional, and hybrid environments at community colleges, universities, and military institutions, the program was designed intentionally around

**THIS PEDAGOGY TOOK A "THEME-BASED" APPROACH TO LEARNING, STARTING WITH RELEVANT, EVERYDAY LIFE TOPICS.**

the idea of relevancy, focusing on making biology concepts interesting by using common, thought-provoking topics that nearly all students can relate to in everyday life.

According to Johnson, "When we met the team at McGraw-Hill we had already exhausted several options to teach the relevancy of biology and jumped at the chance to work with them to implement a solution that didn't intimidate students and engaged them to achieve course outcomes." The biology department was fully committed to this transformative approach of teaching with relevant, theme-based course structures and sought to validate it. Instructors spoke with some of Margaret's students to get a clearer picture of whether the theme-based learning model would resonate in the classroom. Margaret also surveyed her students in the first few semesters of piloting Why Biology and found that nearly all respondents preferred the relevancy themes versus the traditional approach.

The biology department shared the new model with students to get their feedback and found they had an overall positive reaction and increased engagement in classroom. Margaret observed, "We showed students the theme-based learning model and they were genuinely curious and wanted to know more about the topics. We saw less 'bored stares' and students began asking questions about course material in a meaningful way, wanting to know 'why does this happen?'"

## Making a Change

Margaret and her colleagues decided to take the leap and went completely digital with the *Connect Master: Why Biology?* program. This, of course, led to a pedagogy shift in the way the course was taught.

To start, each unit now begins with a 15–20-minute prep assignment that covers the topic theme in a personalized, low-pressure environment and provides an

interactive learning experience. Practicing ahead of time in a more relaxed environment allows students to contextualize and relate to the material, making it easier to dive into the concepts in further detail. The program also adapts to each student's learning rhythm, altering the learning path to give harder questions when the student is ready to be challenged and easier questions when they're struggling. To help reinforce the material, students are given immediate, automated feedback so they can track their progress, and when difficulties do arise the program serves up additional resources such as slides and short videos to help students better understand the content. Even the assessment follows the unit theme.

**"IT'S SHOWING THEM WHAT THE PUZZLE WILL LOOK LIKE BEFORE ASKING THEM TO PUT THE PUZZLE TOGETHER."**

– Margaret S. Johnson, Biology Instructor, St. Charles Community College

The prep assignments are due before the first class each week. Margaret compares students kicking off the weekly themed units with the prep assignments to "a construction crew coming to work with tools each week."

Students whose interest in the overall topics had been piqued by the prep assignments found it easier to engage with the more difficult concepts than students in traditional course structures approaching those concepts with no context.

This shift to a pre-class prep assignment isn't the only change that helped students better connect with the material. The six theme modules present lessons with real-life relevancy integrated with biological concepts, and students tackle course questions designed to encourage critical thinking. Key challenging concepts are enhanced with interactive and animated content to help students visualize processes and provide them with a more active, just-in-time learning experience. Each lesson in the modules concludes with "Quick Check" questions to help students practice the concepts they just read about, providing immediate feedback. The Biology faculty at St. Charles Community College uses assessments built into *Connect Master: Why Biology?* to assign questions at the end of each module for homework, quizzes, or exams. The questions can include animations, tutorials, and applications of what students learned in the prep assignment and readings, and the instructors can customize reports to assess student learning.

But what made this change in approach so much more effective? As Margaret Johnson puts it, "We not only transformed how we taught the course, we also changed how we evaluate student progress. We now look at the connection we're making with students in the classroom and their level of engagement with the themes, in addition to their grades." Introducing dense, complicated biological concepts using situations relevant to everyday

life not only made the material more relatable, but also forged a connection to something students wanted to better understand.

For example, the scientific concepts of cells and cell division are covered within the context of the cancer unit, which integrates an overview of the disease, its characteristics, causes of genetic mutations, and treatment. In a traditional pedagogy this unit starts out by addressing several technical concepts that are important but often difficult for students to visualize and understand. Students often tune out discussions at a cellular level of topics such as mitosis, protein synthesis, and genetic mutations because they come across as boring or inconsequential to things they're dealing with each day. By flipping the pedagogy and starting with something as impactful and universal as cancer, students are immediately hooked. After all, most people either know someone affected by cancer, are concerned for their own health, or have at least passing familiarity with the topic. Beginning with the outcome creates an easier path for students to make the effort to learn the more complicated, detailed biology concepts, because they're first drawn in by their own personal experiences and interests.

Similar approaches are taken with other high-interest topics such as energy drinks, climate change, influenza, and sickle cell disease. Teaching the science interwoven with relatable themes from everyday life has been transformational for Margaret and her colleagues. She notes that "so many non–biology major students were not at all interested in Essentials of Biology and took the course to purely fulfill a graduation requirement. Realizing this is really the last opportunity for many of them to engage with science is why I think teaching the course with relatable topics is absolutely key to making a lasting impact with our students."

## Relevancy Leads to Results

Like any good experiment, the answer was inevitably in the results. After deploying *Connect Master: Why Biology?*, the faculty at St. Charles Community College saw its immediate, positive impact on their students. According to Margaret, "Overall, I have seen an increase in student participation, both online and in class. Teaching relatable themes that integrate the biological concepts gives students a more approachable, less intimidating way of learning science that they

"We not only transformed how we taught the course, we also changed how we evaluate student progress. We now look at the connection we're making with students in the classroom and their level of engagement with the themes, in addition to their grades."

– Margaret S. Johnson, Biology Instructor, St. Charles Community College

can use well out of our introductory course." "Overall grades, exams, student dropouts, homework, participation—all of it improved," says Johnson. From an academic performance standpoint, after beginning to use *Connect Master: Why Biology?*, Johnson sees a class grade average between 91–92.3 percent. "Students come to class more prepared with notes and questions, and assessment scores increase because of the continual interaction with the material." Another instructor in the department teaching the course with *Connect Master: Why Biology?* reports his online participation levels across multiple courses jumped from around 70 percent to above 90 percent.

The change in participation isn't just about

**OVERALL GRADES, EXAMS, STUDENT DROPOUTS, HOMEWORK, PARTICIPATION—ALL OF IT IMPROVED.**

– Margaret S. Johnson, Biology Instructor, St. Charles Community College

getting better grades. Instructors have observed that the change in perspective as to the utility of these Gen Ed classes, including Essentials of Biology, has be seismic to truly benefit students beyond the GPA.

"The cancer unit is often an emotional one for students because so many of them know someone with the disease," said Johnson. "For example, I had one student say that had she known what she learned in the Cancer unit it would have changed how she helped her mother with breast cancer. She would have asked different questions of the doctors and known how to help her mother better understand what was happening. Now this student understands her risks for breast cancer. Another student, a cancer survivor,

"This product helps me relate what I'm learning to everyday life. I was able to better understand the content and it was presented in a way that prevented me from questioning "Why do I need to learn this?" since I'm not a biology major. It kept me engaged and interested in the topics."

- Kristi K., Student at Drexel University

**"THIS TYPE OF LEARNING WILL HELP STUDENTS RELATE WHAT THEY ARE LEARNING TO THEIR OWN LIVES. EVERYONE KNOWS SOMEONE WHO HAS CANCER. EVERYONE HAS TRIED AN ENERGY DRINK."**

- Zak S., Student at St. Charles Community College

shared with me that our cancer module made clear so many discussions with their doctor that they previously didn't understand."
The changes aren't limited to the personal, either. As biology faculty at St. Charles Community College have observed, the all-too-important climate change module now makes a critical impact. It's taught in a very relatable way that illustrates the link between plants, nature, and the real, living world and climate change. By presenting the usually not-so-exciting topics of photosynthesis and biomes with the climate change theme, students' gain an appreciation for the natural world and the consequences of human activities. Students, like many people today, see ongoing news and reports around climate change but often lack the foundational background to fact-check or analyze the results and implications, which of course can lead to further misinformation. Provoking attention and interest in these topics now, particularly for non-biology majors who might never take another science class, offers a key educational building block to becoming a more informed person.

## Making Science Matter

Changing a course's pedagogy is never easy, and it takes a lot of hard work from the faculty who teach it. The results, though, often speak for themselves. "My students now ask great questions in the course. They want to know more and are making connections to the material. Teaching with relevancy and themes makes students more comfortable with learning biology and it's now so easy to start a stimulating class discussion," said Margaret Johnson. "Science is intimidating enough for many students. Putting the course material into a context where they find it personally relatable can make a long term, positive impact on students well after the course ends."

## GET IN TOUCH

We share your passion for learning and we believe that all students should have access to affordable, high-quality learning solutions built to help them succeed.

**mheducation.com**