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green chemistry education

An Introduction to Undergraduate Green Chemistry Teaching & Practice

Course Syllabus

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GREEN CHEMISTRY COMMITMENT

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Join our Introduction to Undergraduate Green Chemistry Teaching & Practice course:

Beyond Benign continues to explore ways to support educators in building capacity to educate students about sustainability through Green Chemistry. We're excited to introduce this new on-demand online course - designed by educators, for educators like you!

What is the Introduction to Undergraduate Green Chemistry Teaching & Practice?

This **multi-session course** offers an in-depth exploration for higher education chemical educators - anyone teaching chemistry or chemistry-related subjects - on how to integrate Green Chemistry into their courses and curricula. Green Chemistry is an essential framework for sustainable decision-making, aligning with the United Nations Sustainable Development Goals, to foster a sustainable future. By prioritizing informed choices in the design of chemical products and processes, Green Chemistry promotes consideration of human, environmental, and societal impacts.

Throughout this course, you'll engage deeply with Green Chemistry principles through activities, including asynchronous discussions with other course participants in the Green Chemistry Teaching & Learning Community (GCTLC) platform (www.gctlc.org). You'll get ideas to develop lecture and laboratory activities and explore the intersections between Green Chemistry and broader societal issues, including social and environmental justice. The course will also highlight valuable resources, such as funding and professional networking opportunities within the Green Chemistry education community.

> "Personally, I wish there were more professional development opportunities to help train us in teaching the Green Chemistry and Toxicology courses. Many of us did not receive training in green chemistry in our undergraduate careers, so we can use the support to help guide our teaching to ensure that our students will have the necessary knowledge and tools."
>
> — HIGHER EDUCATION CHEMISTRY EDUCATOR

Why should you join?

This course is designed to empower and equip instructors in higher education - and anyone interested in teaching Green Chemistry - by providing essential tools and insights for integrating Green Chemistry into the curriculum. By the end of this course, you'll have the knowledge, skills, and confidence to create curriculum and activities that use Green Chemistry principles as a framework for making informed decisions in the design of chemicals, chemical products, and processes.

Target Audience:

This course is primarily designed for current and future higher education chemistry instructors who are committed to advancing Green Chemistry and sustainability education. Specifically, those yet to fully adopt Green Chemistry into their curriculum, educators seeking to integrate Green Chemistry into their lectures and laboratory courses and instructors aiming to engage their students in sustainable chemistry education.

K-12 educators may benefit from the course as well, as content can be scaffolded to suit their teaching needs and goals.

While non-chemistry educators can take this course, it is primarily designed for those teaching or conducting research in chemistry, with content tailored to this audience.

Learning Objectives:

This course features text- and video-based lessons and activities designed to provide participants with a foundational understanding of various themes related to integrating Green Chemistry into the chemistry curriculum. Each session includes resource materials to supplement the content and support further learning.

Learning Objectives (cont.):

By the end of this course, participants will be able to:

1. Explain the history and importance of Green Chemistry.
2. Give examples of Green Chemistry applications in industry and research.
3. Identify strategies to integrate Green Chemistry education holistically into the classroom and laboratory.
4. Identify strategies to align course and curriculum content with Green Chemistry and sustainability standards, following guidelines from organizations such as the American Chemical Society (ACS), Royal Society of Chemistry (RSC) and the Green Chemistry Commitment Student Learning Objectives.
5. Demonstrate the ability to implement course or curricular changes to incorporate Green Chemistry principles.
6. Identify ideas for designing a dedicated Green Chemistry course.
7. Identify and explain the connections between chemistry and society, with a focus on environmental justice, and develop strategies to integrate these topics into chemistry instruction.

Course Format and Structure:

This is a 4-hour on-demand, self-paced course delivered entirely online (estimated 1 hour per session), allowing for a flexible schedule. Each session features engaging content through bite-sized videos coupled with informative text, activities, quizzes and assignments. It also includes a discussion forum through the GCTLC group, and supporting materials, all of which you can access at any time during the course period.

These sessions are designed to complement each other, but you have the flexibility to take each session individually.

Course Format and Structure (cont.):

The course is structured into four main sessions with relevant sub-thematic topics as follows:

Course Sessions	Content
1. Overview and Immersing Students in Green Chemistry	*1.1 Introduction to Green Chemistry* *1.2 Historical impact of the chemical Industry* *1.3 Green Chemistry: Applications, Challenges and Strategies* *1.4 The need for Green Chemistry Education* *1.5 Empowering Educators and Institutions to Advance Green Chemistry Education* *1.6 Green Chemistry curricular activities*
2. Aligning Green Chemistry Education to Professional Academic Standards	*2.1 Overview of undergraduate chemistry programs accreditation and approval processes* ● *American Chemical Society* ● *Royal Society of Chemistry* ● *Royal Australian Chemical Institute* *2.2 Connecting Green Chemistry to Laboratory Safety*
3. Implementing Green Chemistry Content in the Curriculum	*3.1 Green Chemistry in the Curriculum* *3.2 Designing Changes to Courses or Curriculum* *3.3 Embedding Green Chemistry into Existing Courses and Curriculum* *3.4 Developing Dedicated Green Chemistry Courses and Curriculum*
4. Green Chemistry and Environmental Justice	*4.1 The Unintended Consequences of Chemistry on People and the Environment* *4.2 What is Environmental Justice?* *4.3 Green Chemistry for Environmental Justice* *4.4 Environmental Justice in the Chemistry Curriculum* *4.5 Approaches for Bringing Environmental Justice into the Chemistry Curriculum* *4.6 Environmental Justice Curricular Activities*

Assessments and Certification:

The course contains checkpoint quizzes within each lesson to assess and strengthen the learner's understanding of the content. At the end of each session, there will be an assignment that would require participants to reflect on their own teaching and attempt to make adjustments, if necessary.

A digital badge is awarded to participants who complete:

- All lessons, quizzes and end of session assignment.

A certificate of completion is awarded to learners who complete:

- All sessions including lessons, quizzes and assignments;
- the final capstone project.

Course Evaluation:

At the start of the course, a short survey measures participant's knowledge, motivation and "intent-to-use" course knowledge. At the end of the course, participants will complete the course evaluation survey which measures their course experience.

Participants in this e-course will have the opportunity to take part in a follow-up survey and interview assessing the concrete application of knowledge. Additionally, they will have an opportunity to participate in the annual impact surveys Beyond Benign organizes with alumni course takers.

Technical Requirements:

Participants will need a computer with internet access and a web browser. The course is compatible with mobile devices but best experienced on a desktop or laptop computer.

Green Chemistry Teaching and Learning (GCTLC) Platform Access:

The GCTLC, a central online platform for the Green Chemistry education community will serve as a key platform for course participants to enrich their Green Chemistry learning and teaching experience. It will be integrated into the course in two primary ways:

Green Chemistry Teaching and Learning (GCTLC) platform Access (cont.):

- Participants will use the group space for discussions, which will play a vital role in completing end-of-session assignments.
- Participants will explore the GCTLC's open-access, peer-reviewed library of community-contributed green chemistry resources - including greener lab experiments, lecture slides, modules, assessments, in-class activities, and linked journal articles. In addition, the GCTLC offers site-wide forums for networking and dialogue, an events calendar, a job board, and more.

To this end, each participant will be expected to create a GCTLC account and join the course's online group on the GCTLC. There, participants will be able to chat with other course participants and share best practices, upload files and documents, and access additional course materials and information even after the course is completed. The course will frequently reference resources from the GCTLC. Finally, participants will be encouraged to upload newly adapted and implemented resources they develop as a result of their participation in the course to the GCTLC's library.

To get started, participants are encouraged to login to the GCTLC or create a new GCTLC account before the course begins.

Enrollment and Access:

Participants can enroll at any time and will have lifetime access to the course materials, unless otherwise notified.

Curriculum Developer Information:

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Green Chemistry Commitment Signer (2019)