

SUPPLEMENTARY INFORMATION

“Surveying User Experiences in an Inclusive Online Green Chemistry Education Community of Practice”

Nimrat K. Obhi,^{*a} Jonathon W. Moir,^{*a} Sarah Prescott,^b Alisha Szozda,^a Sarah Kennedy,^a Omar Villanueva,^a and Amy Cannon^a

^a*Beyond Benign, Inc., Wilmington, MA 01887, United States*

^b*The BioQUEST Curriculum Consortium*

NOTE: *In cases where there is identifiable information in user comments/written responses (such as names of institutions or colleagues), the word “[REDACTED]” has been inserted in its place.*

2024 Survey Data

The survey data presented in this article was collected from a survey that was distributed to 1349 Green Chemistry Teaching and Learning Community (GCTLC) registered users and was administered by Beyond Benign using Drupal 10’s built-in webform functionality. The survey ran from September 24th to October 21st, 2024. A total of 94 submitted surveys were received (~7% response rate). Note that many of the questions were not mandatory; as such, not all 94 respondents answered every question. In addition, many questions allowed users to select multiple options, sometimes resulting in a response count that was higher than the total number of respondents. Both the total response count as well as total number of respondents for each question is provided in each graph in the manuscript and in the supplementary information. Survey responses were analyzed in aggregate and de-identified prior to publication. Users were informed that by submitting the survey, they were agreeing that their responses would be used anonymously to help improve the GCTLC. They were also provided a link to the GCTLC’s Terms and Conditions of Use document, which provides more details on data usage and privacy on the platform (and which is required for them to accept prior to registering on the platform).

The original survey questions are provided below:

* = required question

General Questions about the GCTLC

1. What parts of the GCTLC website have you visited or used? Check all that apply:^{*}
 - a. Searched for and/or viewed other people’s profiles
 - b. Searched for and/or viewed resources

- c. Downloaded resources or visited resource pages
 - d. Uploaded a resource (Learning Object)
 - e. Viewed the forum discussion spaces
 - f. Posted a comment in the forums or on a resource (Learning Object)
 - g. Searched for an event and/or viewed the events calendar
 - h. Submitted an event to the events calendar
 - i. Searched for a job and/or viewed the job board
 - j. Submitted a job to the job board
 - k. I have not done any of these things
2. What parts of the GCTL website have been the MOST useful to you? Check all that apply:*
- a. Home page of the website
 - b. Search bar
 - c. Your profile page
 - d. Other people's profile pages
 - e. Resource library and/or resource pages
 - f. Curated Collections
 - g. Forums and discussion spaces
 - h. Events calendar
 - i. Job board
 - j. None of the above
3. If you want to provide more feedback about your response(s) to the previous question, we encourage you to do so here (including if you selected "none of the above"). This feedback will help us improve the GCTL.
4. Since becoming a GCTL user, what prompts you to visit the site most of the time?

Using the GCTL

5. Please rate how much you agree or disagree with the following statements:*
- [options: Strongly Agree, Agree, Neutral, Disagree, Strongly Disagree, Not Applicable]
- a. I find the GCTL website easy to navigate.
 - b. I can quickly find what I am looking for on the GCTL.
 - c. It is easy to use search bar on the GCTL.
 - d. It is easy to connect with other people on the GCTL.
 - e. It is easy to find and download resources (learning objects).
 - f. It is easy to submit resources (learning objects).
 - g. It is easy to use the forum discussion spaces.
 - h. It is easy to use the events calendar.
 - i. It is easy to use the job board.
 - j. I like the appearance of the GCTL (the colours, fonts, page layouts, etc.).

- k. Using the GCTLC has increased my awareness/understanding of green chemistry.
 - l. Using the GCTLC has strengthened my belief that green chemistry is important for students to learn.
 - m. I think the GCTLC is the best place to access green chemistry education resources.
6. If you disagreed or strongly disagreed with any of the questions above, please provide more feedback here. This feedback will help us improve the GCTLC.

Resources

7. Have you used any resources (learning objects) from the GCTLC in your teaching?*
- a. Yes
 - b. No, but I plan to in future
 - c. No, and I do not plan to in future
 - d. Not applicable – I do not teach
8. [If the user answered “Yes” or “No, but I plan to in the future” in the previous question] Approximately how many resources from the GCTLC have you implemented (or PLAN to implement) into your teaching?*
- a. 1 – 5
 - b. 6 – 10
 - c. 11+
 - d. I don't plan to use any resources in my teaching
9. Please share how you used the resources (or how you plan to use the resources) in your teaching. You can describe what resource was used (for example Toxicology for Chemists Module 2), which course(s) you used the resources in, what the class size was, if you had any support to help you use these resources, and how you modified the resource. Please feel free to include any other relevant information.
10. We are interested in learning more about how you used resources from the GCTLC in your teaching. Would you be interested in discussing this with us in a follow-up focus group or interview? This may or may not be a paid opportunity.
- a. Yes, I am interested
 - b. No, I am not interested

Forums on the GCTLC

11. Please rate how much you agree or disagree with the following statements:*
- [options: Strongly Agree, Agree, Neutral, Disagree, Strongly Disagree, Not Applicable]
- a. I find it easy to post comments on the forums.
 - b. I find it easy to create forum topics.
 - c. I am satisfied with the appearance of the forums.

- d. I receive responses to my forum posts/comments.
- e. I use the forums to find answers to my green chemistry education questions.
- f. I use the forums to find new people to connect with.
- g. I use the forums to start conversations.
- h. I am satisfied with my experience using the forums.

12. If you disagreed or strongly disagreed with any of the questions above, please provide more feedback here. This feedback will help us improve the GCTLC.

Events on the GCTLC

13. Please rate how much you agree or disagree with the following statements:*

[options: Strongly Agree, Agree, Neutral, Disagree, Strongly Disagree, Not Applicable]

- a. It is easy to find green chemistry events on the events calendar.
- b. I find it easy to submit an event on the events calendar.
- c. I am satisfied with the appearance of the events calendar.
- d. I use the events calendar to find green chemistry events.

14. If you disagreed or strongly disagreed with any of the questions above, please provide more feedback here. This feedback will help us improve the GCTLC.

Jobs on the GCTLC

15. Please rate how much you agree or disagree with the following statements:*

[options: Strongly Agree, Agree, Neutral, Disagree, Strongly Disagree, Not Applicable]

- a. I find it easy to browse jobs on the job board.
- b. I find it easy to submit jobs to the job board.
- c. I am satisfied with the appearance of the job board.
- d. I use the job board to find green/sustainable chemistry jobs.

16. If you disagreed or strongly disagreed with any of the questions above, please provide more feedback here. This feedback will help us improve the GCTLC.

Connection, Engagement, and Belonging on the GCTLC

17. Please rate how much you agree or disagree with the following statements:*

[options: Strongly Agree, Agree, Neutral, Disagree, Strongly Disagree, Not Applicable]

- a. The GCTLC has helped me connect with other people in green chemistry.
- b. I have made new collaborations (or strengthened existing collaborations) on the GCTLC.
- c. I feel like I want to engage with other people on the GCTLC.
- d. I want to invite other people to sign up for the GCTLC.

- e. I want to use the GCTLC as a place to connect with other people in green chemistry.
 - f. The GCTLC has helped me learn more about green chemistry.
 - g. The GCTLC is a space for me to find support when I am in doubt about green chemistry content.
 - h. Being on the GCTLC has helped me feel more confident teaching green chemistry.
 - i. Being on the GCTLC has helped me feel like I belong in the green chemistry education community.
18. If you disagreed or strongly disagreed with any of the questions above, please provide more feedback here. This feedback will help us improve the GCTLC.

Communications

19. Please rate how much you agree or disagree with the following statements:*
- [options: Strongly Agree, Agree, Neutral, Disagree, Strongly Disagree, Not Applicable]
- a. The weekly digest emails help me know what is happening on the GCTLC.
 - b. I want a page on the GCTLC that looks like the weekly digest and is updated every day.
 - c. The GCTLC quarterly newsletters help me know what the latest updates are for the GCTLC.
20. How do you feel about the amount of communication you currently receive about the GCTLC?*
- a. Do not change anything.
 - b. I want more communications.
 - c. I want less communications.

Submission Page

21. What other features would you like to see on the GCTLC?
22. How do you see yourself using the GCTLC in the future? For example, what would make you keep returning to the GCTLC?
23. Do you have any other feedback for us? Please write it here.

Survey Results

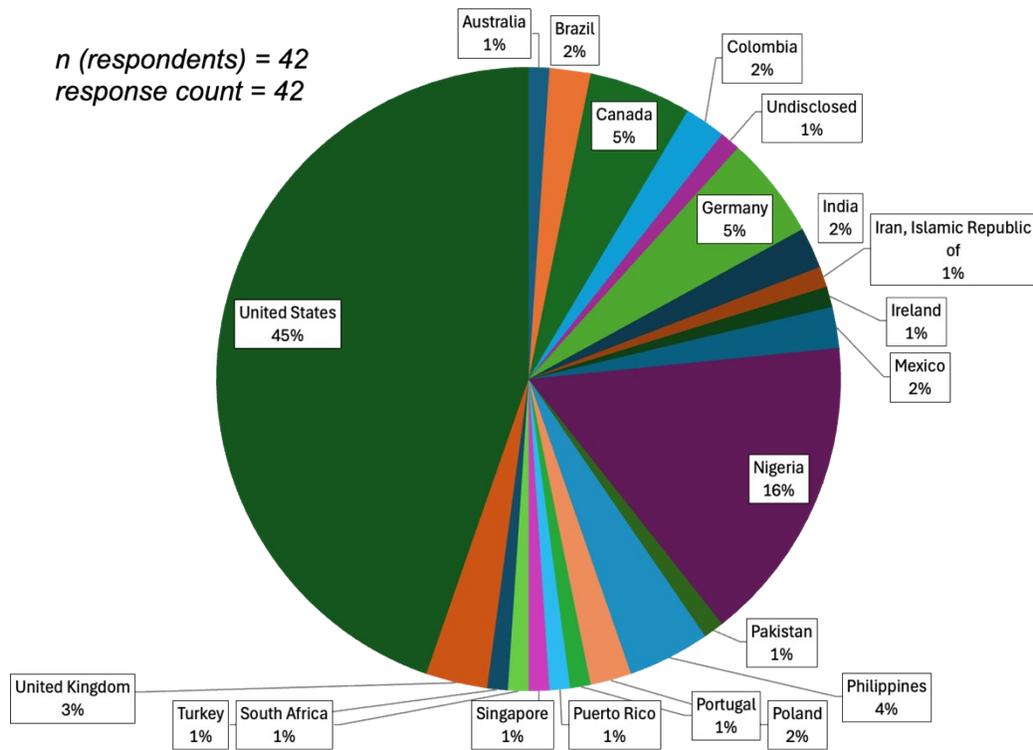


Figure S1. Representation of survey respondents from different countries, based on their self-reported geographic location through their GCTLC user profile. Only 42 users provided this demographic information in their user profiles. One country is listed as undisclosed to preserve the identity of the individual.

n (respondents) = 94
response count = 94

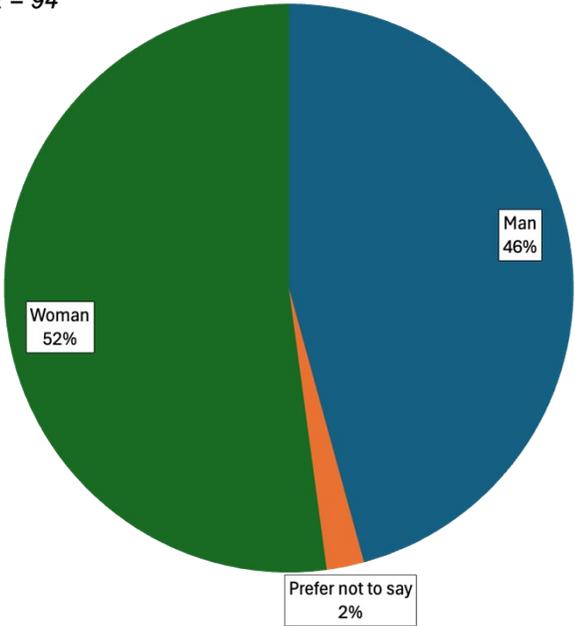


Figure S2. Representation of survey respondents based on self-reported gender identity through their GCTL user profiles.

n (respondents) = 94
response count = 94

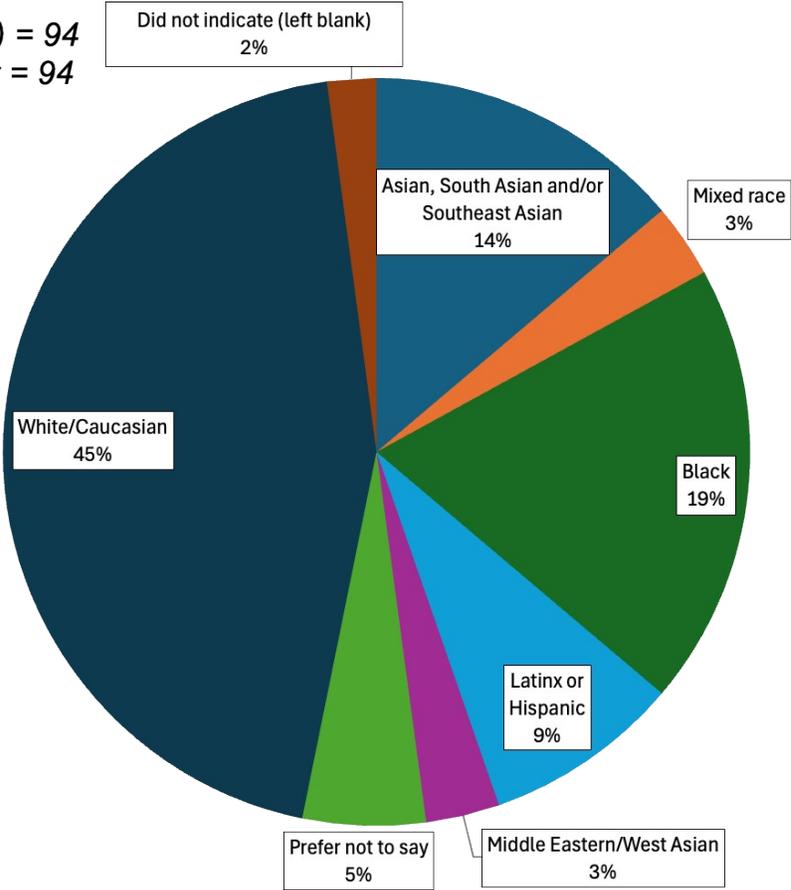


Figure S3. Representation of survey respondents through their self-reported race/ethnicity identities through their GCTL user profiles.

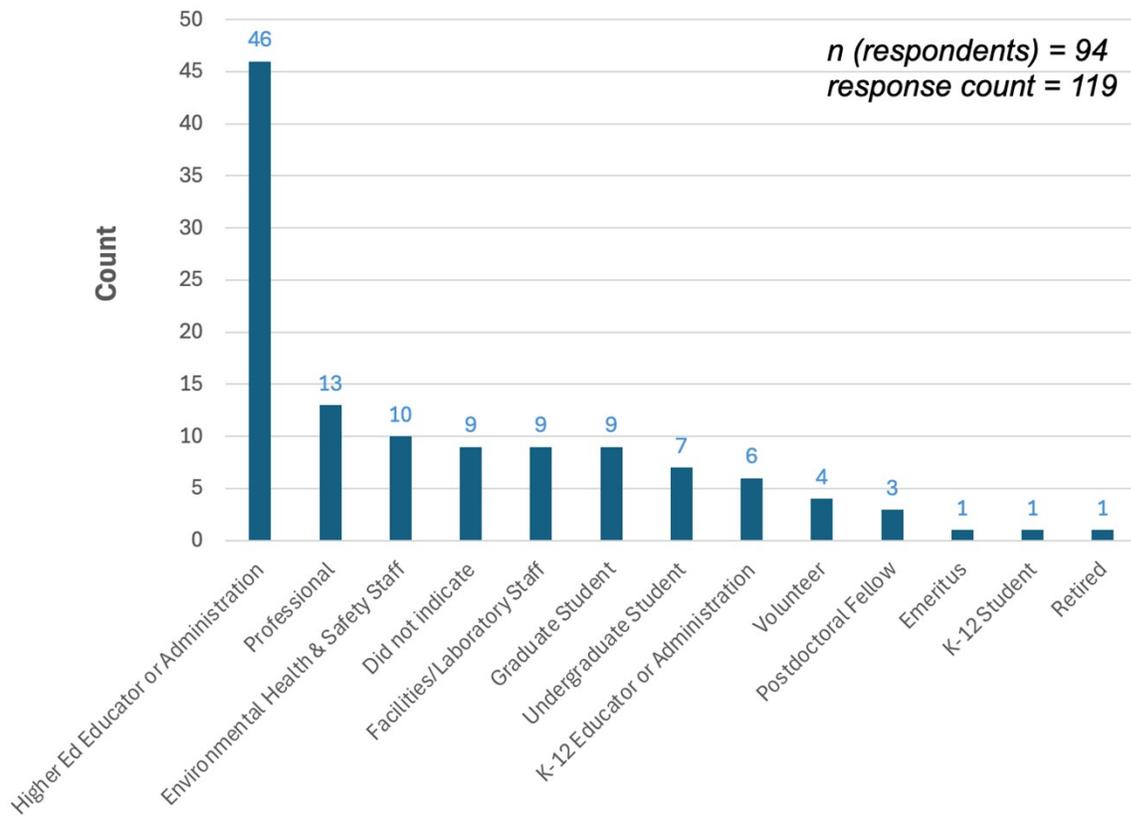


Figure S4. Representation of survey respondents through their self-reported career stage data through their GCTL user profiles. Note that users can select multiple career stages (e.g., they may select “Postdoctoral Fellow” and “Higher Ed Educator or Administration” if both options apply).

n (respondents) = 94
response count = 336

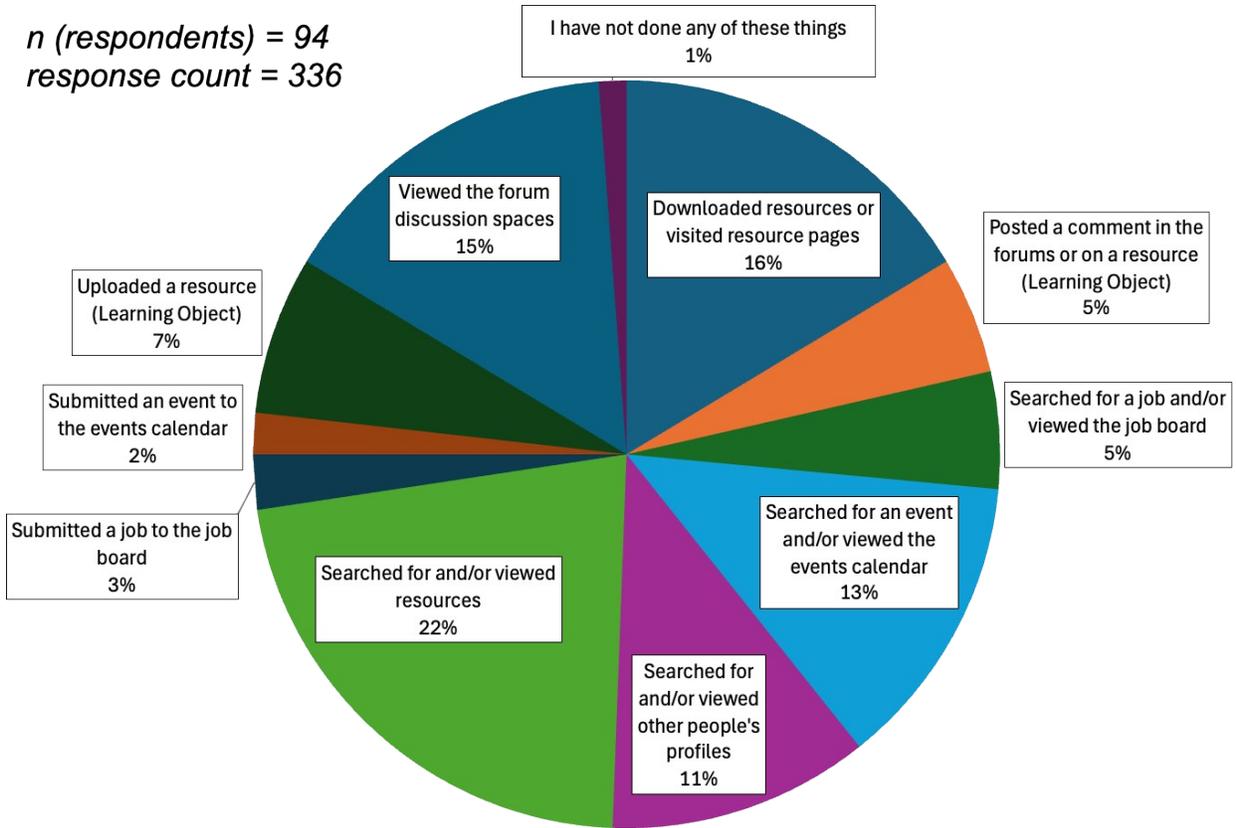


Figure S5. Responses from users regarding which parts of the GCTLC (features/pages) they have visited or used (respondents could select multiple options).

Table S1. Responses to question #4 in the survey (“Since becoming a GCTL user, what prompts you to visit the site most of the time?”). Responses have been grouped into broader themes/categories, although many of the comments fall under multiple themes. References to specific individuals, institutions or projects have been replaced with the word “[REDACTED]” to maintain the anonymity and confidentiality of responses.

Curiosity, Passion, Interest and/or Intrinsic Motivation (4 comments)

I love Green chemistry so much, so immediately I saw green chemistry I became interested
My love and passion for green chemistry and the knowledge shared here which help me to understand the importance of imbibing green chemistry into everything I do see what is available

Curiosity

Searching for Resources, New Materials, Learning Approaches or Inspiration (29 comments)

I am interested in new topics in green chemistry, and I am looking for other people with teaching experience in this field.

Looking for a resource that I can use in my teaching and/or outreach.

Looking for material that I can adapt and incorporate into my courses.

I'm looking for laboratory materials for my class.

Experiments

I'm looking to direct someone to these resources

I want to learn of any updated events and/or course materials, as [REDACTED] has embarked on a journey into green chemistry.

looking at different types of teaching materials and reading and participating on the discussion boards

Looking for active learning ideas that I can incorporate into teaching green chemistry (i.e. trying to go beyond "lecturing")

I've visited the site most of the time for either 1) resources and 2) community. For resources, I usually will start with the curated collections, then a general search or browse to find what I'm looking for. For community, I've been going through the various discussion forums to get to know people but also look for areas where I can contribute or learn from.

I'm a [REDACTED] and I often submit learning objects.

Looking for new ideas to try in classroom

Access to Resources and what is happening internationally

New teaching material for the laboratory/classroom

New teaching material and projects for my school.

i am interested in getting resources that would enhance my teaching skills and assist to be current in research.

Looking for teaching inspiration.

I am searching new teaching material for green chemical engineering

I am looking for new material for my class

I am looking for new teaching material for my classroom.

I am looking for new resources and lessons to use in my classroom.

Looking for new material for lectures and labs

I am looking for new materials for my class.

Looking for new material to share with my students/colleagues at [REDACTED]. Introducing students to green chemistry and materials available.

Looking for lessons, assessments & data base of assessments for target topics & how to connect with green chemistry.

I'm looking for substitutions (chemical or experiment) for greener, more sustainable labs for both teaching and research.

Looking for replacements for labs with DCM, and to reduce hazardous waste

Resource library and/or resource pages

To look for resources other people have shared.

Connections, Community, Forums and Discussions (7 comments)

I'm curious about the discussions that people are having in the forums

Aside from my [REDACTED] role. I enjoy reading the comments from the forums and sometimes connect with professional members with same research interest. The resources also helps a lot in our previous activity for the revision of chemistry curriculum program. profiles

I like reading through the weekly emails, seeing who's joined and the current forum posts.

When I check the emails and I see interesting discussions in the forums then I will go to the website sometimes.

meet people for other institutions to make collaborations

I am reaching out to seek like-minded partners and support for an exciting venture [REDACTED].

Upcoming Events (3 comments)

Events connected to the GCTLTC and resources

To check for a scheduled webinar on green chemistry content.

To search for an event and to attend one as i have keen interest in green chemistry

Jobs, Opportunities, Professional Development or Personal Growth (5 comments)

As a student studying chemistry education , what prompt me to visit this site most time is for my professional development and training purpose

I want to know about research sponsorship and job

Since becoming a Green Chemistry Teaching and Learning Community (GCTLTC) user, my commitment to advancing green chemistry education has only deepened. The GCTLTC platform serves as a living hub for me, allowing me to stay informed about the latest developments in green chemistry practices, educational resources, and research. I am particularly drawn to the collaborative aspect of the GCTLTC. Moreover, the GCTLTC offers valuable resources, including webinars, articles, and discussions that keep me engaged with current trends and best practices. The platform allows me to showcase my work to be an effective advocate for green chemistry, inspiring my colleagues to embrace sustainable practices in their work.

Training opportunities and information for developing training opportunities for our professors and students

To search for grants available to support students' research work and conference attendance. Also, I am looking for relevant workshops to broaden my knowledge of green chemistry and grants to support research works and outreach programmes.

Other/Miscellaneous (12 comments)

emails from GCTLC

What always prompt me to visit the site most time is by receiving email from GCTLC every week which contain all activities and information about the site

It is very informative, respectful, and professional!

Weekly emails highlighting what is happening, specifically info related to webinars or workshops.

soon

When I need latest information about green chemistry

Questions about green chemistry and climate change.

Wanting to share resources and post upcoming symposia at conferences.

I am looking for new innovations strategies for pollution remediation

The weekly digest email contains something that catches my eye.

interest in green chemistry, environmental awareness and best practice

I currently work at the [REDACTED] of the [REDACTED] which is mandated by government to monitor and regulate pollutants that are being expose into the environmental matrices. I would like to incorporate knowledge gain from GCTLC to expand on my work at the [REDACTED].

n (respondents) = 82
response count = 82

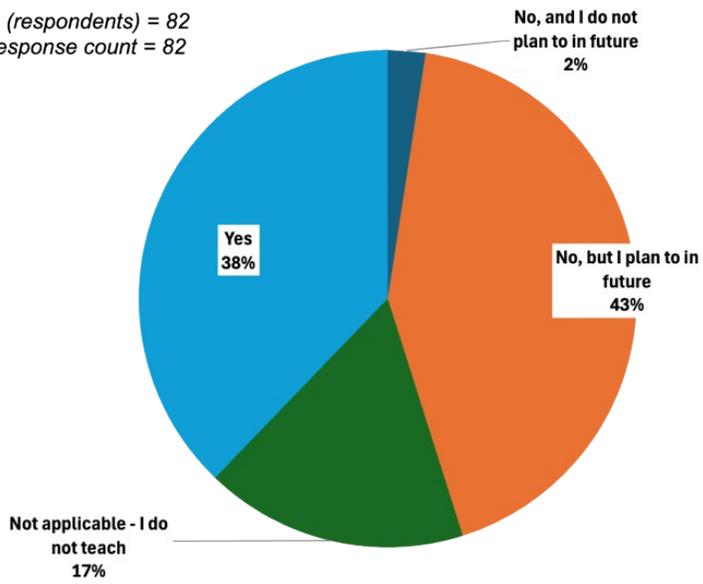


Figure S6. Responses to whether respondents have used or plan to use any of the GCTL's teaching resources (learning objects) in their teaching/courses.

Table S2. Responses to question #9 in the survey (“Please share how you used the resources (or how you plan to use the resources) in your teaching...”). References to specific individuals, institutions or projects have been replaced with the word “[REDACTED]” to maintain the anonymity and confidentiality of responses.

I made use of the Acid and Base resources for my research work

I did use the Toxicology module, as I have implemented a signature assignment to explore how PFAS exposure affects the community of color. i plan to explore ChemForward in my organic chemistry lab...if time allows.

I have used some of the resources before the GCTLC database was in use, so I didn't count those. I am now beginning the process of looking for good resources to incorporate into my General Chemistry lab (24 students per section). I will not have any additional support in modifying/implementing the resources.

I usually use resources on my laboratory. I also distribute some of the resources here to my students so that they can use it.

I think submitting 8-page lesson plans (ugh!) is just too much. If a teacher wishes for more advice, then they should contact the author. Teachers know their audience and should adapt the idea accordingly.

I have used some of the info in the Beyond Benign sites to in Gen Chem 1 and 2 lab, and in my Environmental Chem class

I plan to use these in courses highlighting sustainability in agriculture and environmental issues next semester.

Modifying existing practical work in current scheme.

Using data / alternatives to generate questions around chemical calculations and using resources responsibly

for comparing safety between greener and the more traditional methods.

I utilized the resources from the GCTLC my Green and Sustainable Chemistry seminar course, specifically integrating the Toxicology for Chemists Module 2 as wells 12 Green Chemistry principles

the publications listed as teaching materials is interesting to be used since i can adapt it to my teaching outcomes

Toxicology (for product design)

I downloaded Green Chemistry and Sustainable Science: A Green Approach to Sustainable STEM. I plan to use the experiment in Chapter 5 in [REDACTED]. I also downloaded Greening Technical and Vocational Education Training. The contents of this book are adopted in developing the curriculum for Technical and Vocational Education that would be mounted [REDACTED] in my institution next year.

Websites, information on books/resources

In general we use the YALE UNIDO for the revision of all our chemistry subject in [REDACTED], although we use some of the learning materials found here in GCTLC for providing examples for waste prevention and atom economy.

I use the resources to teach my students, especially during lab practicals. However, I plan to use the resources to guide my students on career opportunities and the importance of imbining green chemistry into their daily lives in order to keep our world green.

The majority of the resources I've used or plan to use are lab experiments appropriate for general chemistry. I've used some of the labs as they are, adapted some of them based on previously labs I used, and used some of them for inspiration to greenify the existing labs in the curriculum.

I use the Tox for Chem resources, most of the modules, except for 4 and adapt them for non-science majors.

These are for 20 person sections of [REDACTED], and our [REDACTED] Class.

Next semester I teach a new Tox for non-chemists course, and will further adapt the Tox for Chem resources.

We have not implemented the resources yet.

I have used in my classroom Stoichiometry challenge and the Acids, Bases, and pH resources. I have used the resources for 9th-12th chemistry and AP-Chemistry classes. Each class has between 15-20 students. I would add more research and reflection questions to the resources so that students can go further in their written reports.

I will use part of "The anthropogenic N₂ cycle" in general chemistry.

Chemforward module

I used some resources to explain more about the 12 green chemistry principles and teach about making labs greener. My class consists of about 20 students, with five groups per semester. I posted photos and comments on the materials I used.

I used the Careers in Green Chemistry and Sustainable Design: Video Series for Secondary Classrooms and Activity Guide as homework in my general chemistry 1 course. I asked students to fill out the activity for three scientists of their choice. I have also sent the ChemTox Tidbits to my colleagues who teach organic chemistry.

Toxicology for Chemists

I based a part of my lectures on the resources and tried to tailor them to the needs of my class. I attended a webinar and checked out the potential for my class. However, I did not intergrate it immediately because I am teaching chemical engineering, and the resource needs adaption for this audience.

Greener glue, biomimicry, Planet to plate, shark let are used to inform preservice educators about green chem. The BB site as a whole to provide a resource to both pre and in service educators. Total students 50 this semester, 30 last.

used different resources as guides for possible topics for courses on sustainability in chemistry. Chemistry students B.Sc. and M.Sc. level. Adapted specifically to [REDACTED] university chemistry programs

We are going to try the green tea iron in vitamins lab in Analytical Chem in the spring. We do the Harris lab, and it generates SO much waste.

I have used the Green Chemistry Modules for High School to conduct research studies and integrate green chemistry principles into the teacher education chemistry curriculum at my University. The reviewed curriculum will be implemented in the new academic calendar starting in November 2024 with the year one Education Chemistry Students.

Preparing Organic Chemistry lab green experiments

not in a teaching scenario but working in pharmaceuticals i like to explore other perspectives and best practices on green chemistry.

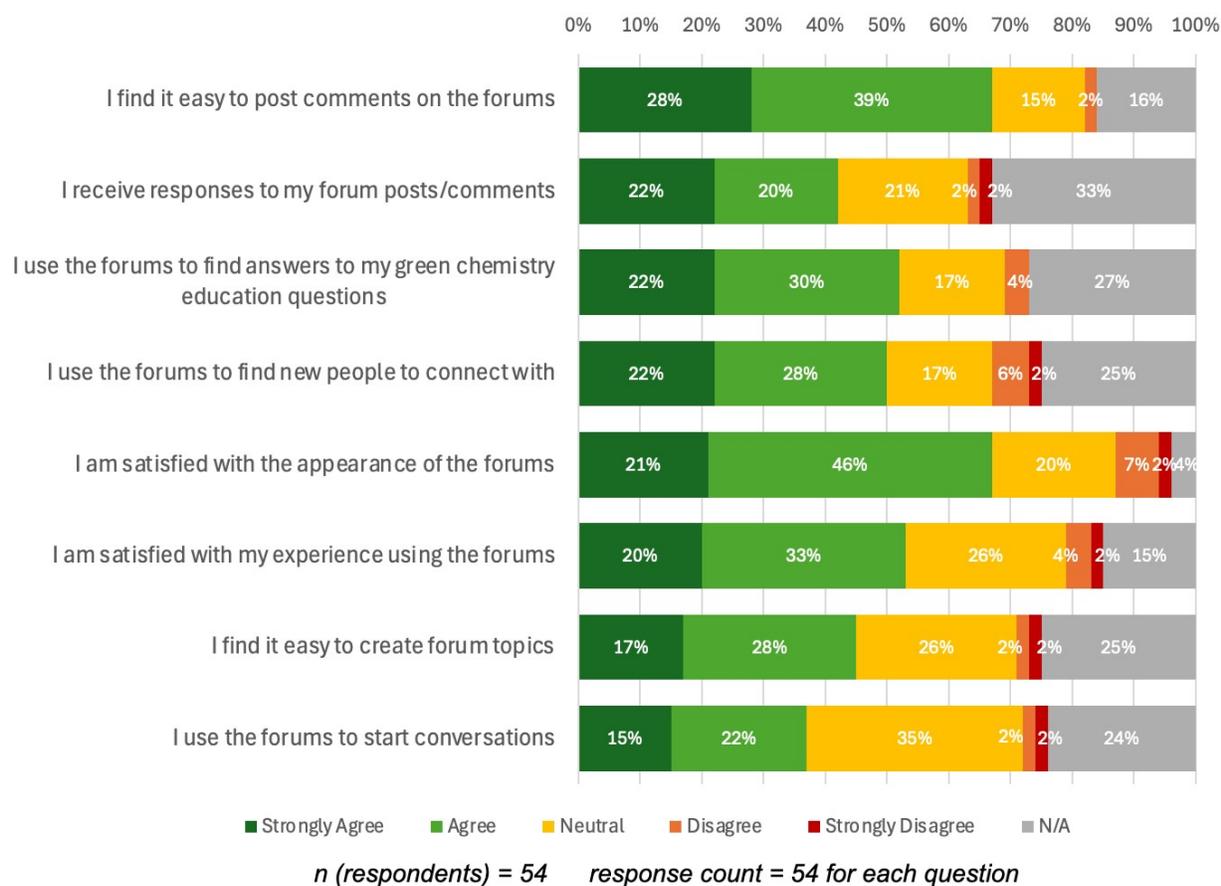
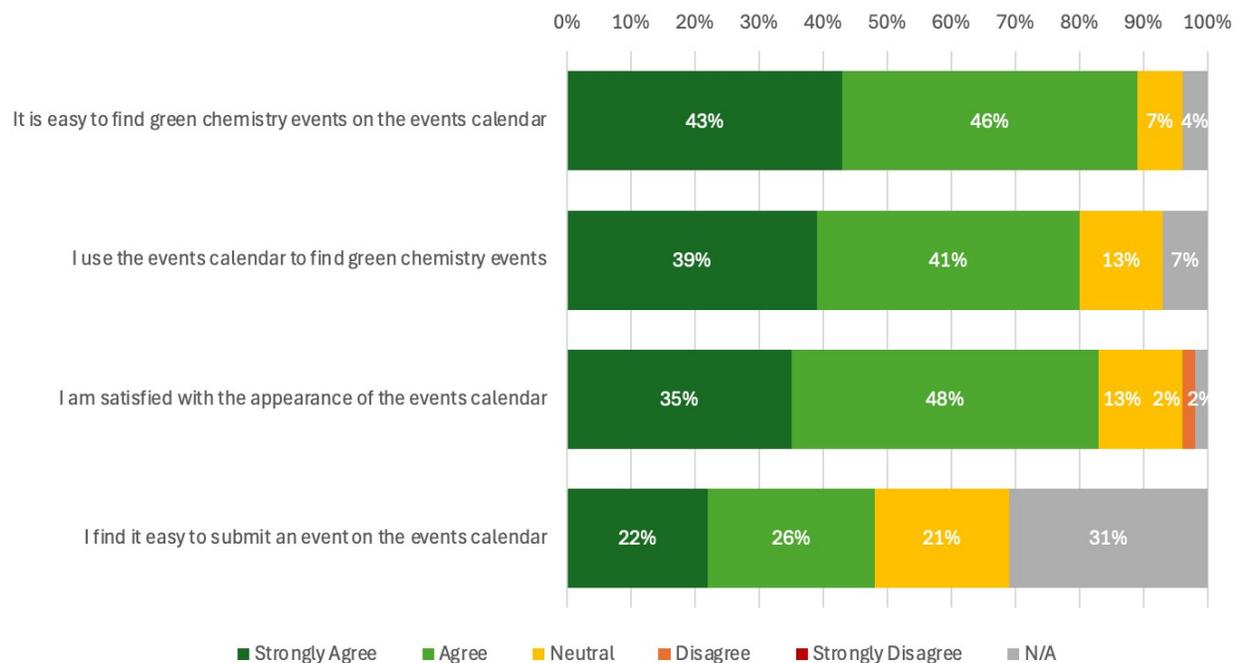
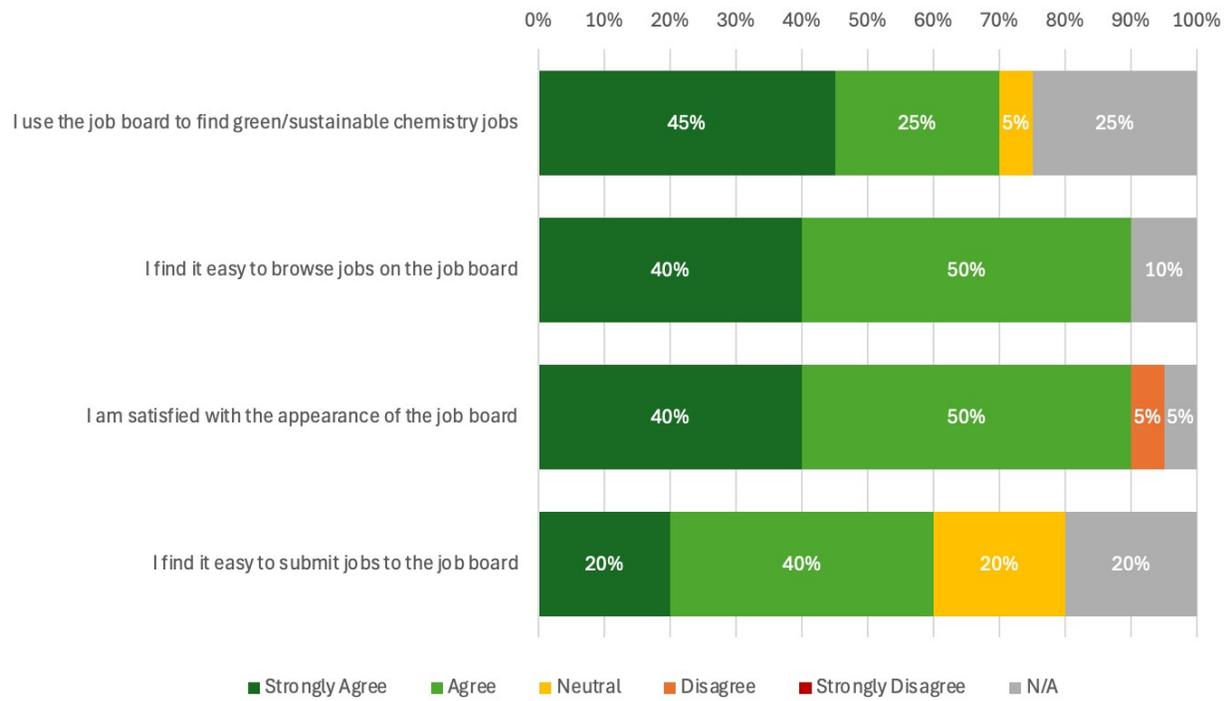


Figure S7. Responses to survey question #11 regarding user experiences and feedback using the GCTLC's discussion forums.



n (respondents) = 46 response count = 46 for each question

Figure S8. Responses to survey question #13 regarding user experiences and feedback using the GCTLC's events calendar.



n (respondents) = 20 response count = 20 for each question

Figure S9. Responses to survey question #15 regarding user experiences and feedback using the GCTLC's job board.

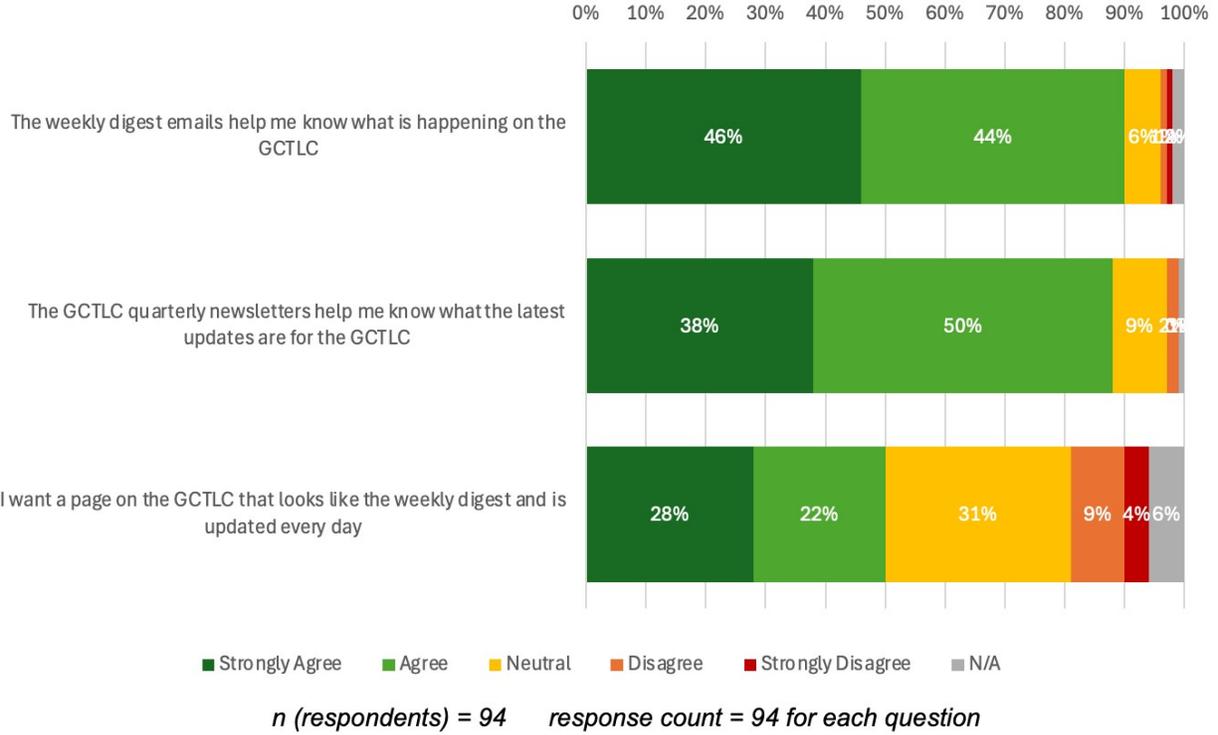


Figure S10. Responses to survey question #19 regarding experiences surrounding communications from the GCTLC (including receiving the GCTLC’s weekly digest).