General Education Assessment Report
2019-2021 Results for Scientific Reasoning

Executive Summary

In January 2021, faculty assessed 100 artifacts to determine the extent to which students were achieving the specified outcomes for general education in Scientific Reasoning courses. The outcome that received the highest ratings was students' ability to *apply principles and techniques of scientific inquiry to solve problems.* The lowest rated outcome was students' ability to *recognize how scientific knowledge evolves based on observation of the natural world*. Raters recommended that faculty strengthen outcomes in current assignments and consider redesigning assignments to ensure that all outcomes, especially the outcomes related to evaluation and reasoning, are included. Raters also recommended a coordinated discussion with faculty about the outcomes, the assessment results, and best practices.

Scientific Reasoning Assessment Report

As part of Old Dominion University's general education requirements, students must complete eight credit hours of Scientific Reasoning courses, also known as the Nature of Science (N), at the lower division level. The lower division Scientific Reasoning skills are taught in the department of Biological Sciences, Chemistry & Biochemistry, Ocean & Earth Sciences, and Physics. The criteria approved by Faculty Senate for N courses includes the following student learning outcomes (SLO):

A. Students will demonstrate their comprehension of a body of scientific knowledge
B. Students will recognize how scientific knowledge evolves based on observation of the natural world
C. Students will apply principles and techniques of scientific inquiry to solve problems
D. Students will evaluate the credibility of conclusions drawn from scientific foundations
E. Students will relate scientific concepts to everyday life

Recommendations from the previous assessment in 2013-14 were used to inform this cycle of planning and assessment for Scientific Reasoning. See table 1 below for recommendations and associated actions.

Table 1. Scientific Reasoning assessment recommendations and actions

2013-14 Recommendations	Actions
Revise outcomes to streamline and clarify learning (e.g., SLO B and C were too similar).	Outcomes were revised by a committee of faculty teaching or coordinating N courses in 2018-19, departmental feedback was sought throughout the process.
Review and revise rubric to ensure it represents all disciplines.	Rubric was revised and created by a faculty member from each discipline and the Office of IE&A.
Communicate outcomes to faculty teaching the Scientific Reasoning courses.	Departments were notified of the assessment process a year before artifacts were collected.

Engage faculty early in the process and provide examples.	IE&A hosted a workshop for faculty in each department to align outcomes to course teaching and assignments. Faculty shared and described relevant assignments with one another.

Methodology

A rubric developed by faculty teaching N courses was used to assess Scientific Reasoning. The rubric was created based on faculty feedback, scientific reasoning literature, and nationally validated assessment instruments. In fall 2019 and spring 2020, faculty teaching general education Scientific Reasoning courses in all four departments were asked how and where students demonstrated the Scientific Reasoning outcomes. Faculty members were able to identify an artifact or a series of artifacts that aligned with the outcomes and embedded within the courses. Student learning outcome (SLO) A focuses on comprehension of disciplinary knowledge which the faculty determined is best assessed through final exams in the courses. SLO B - E are part of this Scientific Reasoning assessment process.

In spring 2020, the University switched to remote learning in March because of COVID-19 concerns. Due to the disruption and discussion with faculty it was decided not to use data from the spring 2020 semester. Faculty determined that data from the fall 2019 semester would be representative and useful for decision making. Artifacts were sampled from the following courses: BIOL 105N, BIOL 121/122N, BIOL 123/124N, CHEM 105/106N, CHEM 121/122N, CHEM 123/124N, OEAS 106N, OEAS 108N, OEAS 110N, OEAS 111N, OEAS 250N, PHYS 101N, PHYS 103N, PHYS 112N, PHYS 231N, PHYS 232N, PHYS 262N.

A two-day assessment summit was convened in January 2021, where eight faculty, two from each department, read and rated a random sample of student artifacts from N courses. During the morning of the first day, a calibration session was conducted. First, faculty thoroughly reviewed and discussed the rubric and then independently applied the rubric to four sample artifacts. Raters shared their ratings and discussed any differences that arose after each "round" of rating. This discussion helped faculty come to a common understanding of what the outcomes meant and what to look for when rating the artifacts using the rubric's scale: exceeds standard, meets standard, approaches standard, needs attention. Once individual ratings on a shared artifact did not differ by more than one point, raters were given a set of 25 artifacts to rate. The artifacts were read twice by faculty (one faculty member in the discipline and one faulty member outside) and scored using the rubric. If faculty ratings differed by more than one point on the majority (50% or more) of the outcomes, the artifact was sent to a third reader within the discipline.

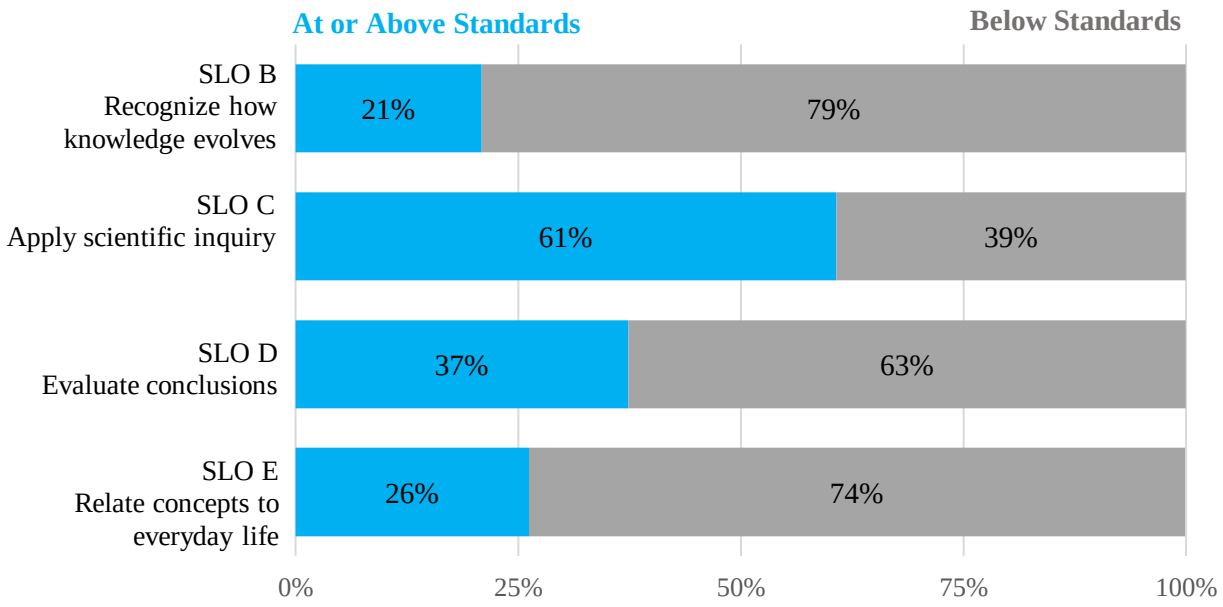
Seven of the 100 artifacts reviewed required a third read due to discrepancies in ratings. A full description of the methodology, including inter-rater reliability data and the rubric, will be made available on the Office of Institutional Effectiveness & Assessment's website: https://tinyurl.com/geneduc

Results

An overview of the findings by SLO is presented in Figure 1. The highest rated Scientific Reasoning outcome was *applying principles and techniques of scientific inquiry to solve*

problems (SLO C: 61% exceeds and meets standards; 39% approaches standards and needs attention). The lowest rated outcomes were *recognizing how scientific knowledge evolves based on observation of the natural world* (SLO B: 21% exceeds and meets standards; 79% approaches standards and needs attention) and *relating scientific concepts to everyday life* (SLO E: 26% exceeds and meets standards; 74% approaches standards and needs attention).

Figure 1. Scientific Reasoning assessment results



Faculty Rater Discussion and Recommendations

Discussion

At the end of the second day, faculty were asked to reflect upon the strengths and weaknesses of students. Overall, faculty noted that students were able to select a scientific principle or concept and apply logical steps and principles to solve the problem (SLO C). Students showed strength in their ability to follow the procedures and get a result. Nearly half of the students weakly explained if conclusions were appropriate and reasonable based on results or observations. They provided a cursory, surface level explanation that lacked depth (SLO D). Student performance was weakest in the areas of recognizing how scientific knowledge evolves based on observation of the natural world (SLO B) and relating scientific concepts to everyday life (SLO E). Faculty found that students minimally or vaguely described how knowledge evolves based on what has been learned or what can change based on new information. Students who did not meet the standard for SLO E minimally explained how an everyday occurrence takes place based on discipline-specific concepts. Raters also noted that these outcomes were not found in some of the artifacts.

Recommendations

Faculty raters identified the following recommendations to improve Scientific Reasoning outcomes:

Teaching or Assignments

- Strengthen outcomes in current assignments and consider redesigning assignments to ensure that all outcomes, especially SLO B & E, are included and promoted.
- Break out assignment prompts to walk students through the reasoning or evaluation process.
- Provide examples for students and outline a skillful explanation or description of scientific reasoning.
- Develop test questions that are diversified (e.g. multiple choice, short answer, essay, etc.) to ensure that we give students an opportunity to explain and reason.
- Provide regular opportunities (e.g. end of lab) for students to draw relationships between scientific concepts and their everyday lives.
- Support a coordinated departmental discussion about Scientific Reasoning outcomes, assessment results, assignment revisions, and best practices amongst faculty.

Assessment Process

- Add some helpful hints for faculty or raters when creating assignments or reviewing the rubric (e.g., look for SLO B to take place in an experimental setting or a historical setting).

Plan to Improve Learning

The following departments will pursue a plan to improve Scientific Reasoning in the following ways:

Department of Biological Sciences

- An ad-hoc subcommittee of the Department met in Fall 2021 to discuss ways to improve Scientific Reasoning student learning with an emphasis on outcomes B and E.
- The members of the ad-hoc committee identified four topical areas that can be included in assignments / assessments throughout the general education courses offered in the Biological Sciences (see attachment Dept. of Biological Sciences - response to Gen Ed Assessment Report).
- BIOL 111 created and implemented an assignment designed to address outcome B and E for fall 2021 (see attachment BIOL 111 Global Climate Change and Rancor between scientists and Trump).
- The remaining general education courses will implement or revise assignments to address outcomes B and E. Modifications will be made and incorporated into Spring 2022 semester courses.

(See the full plan in Appendix A)

Department of Chemistry and Biochemistry

- Faculty will incorporate information on how scientific knowledge evolves into assignments and course modules. This includes some historical development information: how did scientists' figure this out? What led to what?

- Faculty will create or continue to use breakout assignments (small groups for 5-10 minutes) for students to utilize scientific reasoning. Before breakout, provide an example of sound scientific reasoning on another topic. Then ask students to apply analogous reasoning to the current topic.
- Faculty will develop reasoning skills and writing skills with short answer questions, and at least one longer essay question at some point during the course, on exams and homework assignments.

Department of Ocean and Earth Sciences

- Spring 2022 (February or March)—hold a facilitated workshop with OES faculty teaching N courses (OEAS 106N; OEAS 108N; OEAS 110N; OEAS 111N; OEAS 250N). Facilitation will be arranged with a representative from Office of Institutional Effectiveness and Assessment (IEA). The workshop will ask faculty to share an assignment(s) that demonstrates outcome B and E, faculty peers will provide feedback on the assignment. The workshop will follow a national model for assignment redesign.
- Modified assignments will be due to the Department Chair. Modified assignments will be kept in a repository that can be accessed as a resource for current and future faculty.
- Modified assignments will be incorporated into the N courses to be taught in Fall 2022.

Department of Physics

- Faculty will provide the Chair with recommendations on how to align course content and delivery to achieve better outcomes in each of the identified areas of learning.
- Faculty will improve assessment tools that specifically address the SLO criteria.
- Faculty will enhance critical thinking and problem-solving skills through active learning techniques, which we view as an essential part of modern physics instruction.
- Faculty will enhance the laboratory portion of the courses to improve learning outcomes.

(See the full plan in Appendix B)

Faculty Senate Recommendations

[to be shared in 2022]

APPENDIX A Department of Biological Sciences Plan to Improve

The Department of Biological Sciences will pursue a plan to improve Scientific Reasoning in the following ways:

- An ad-hoc subcommittee of the Department met in Fall 2021 to discuss ways to improve Scientific Reasoning student learning with an emphasis on outcomes B and E.
- The members of the ad-hoc committee identified four topical areas that can be included in assignments / assessments throughout the general education courses offered in the Biological Sciences (see attachment Dept. of Biological Sciences - response to Gen Ed Assessment Report).
- BIOL 111 created and implemented an assignment designed to address outcome B and E for fall 2021 (see attachment BIOL 111 Global Climate Change and Rancor between scientists and Trump).
- The remaining general education courses will implement or revise assignments to address outcomes B and E. Modifications will be made and incorporated into Spring 2022 semester courses.

Response to the General Education Assessment Report of Progress Made Toward Achieving the Student Learning Outcomes (SLOs) in the Natural Sciences

Department of Biological Sciences

The Department of Biological Sciences has been asked to design a plan to improve its progress in achieving Student Learning Outcomes B, recognizing how scientific knowledge evolves based on observations of the natural world, and E, relating scientific concepts to everyday life. An ad-hoc sub committee of the department met to discuss these issues, and we are able to provide several examples of how these SLOs can be addressed in the various biology general education courses. Drs. Lobova and Olechnowski were also able to relay the semantics and interpretation of Student Learning Outcome "B" to the rest of the committee. This was first discussed in the College of Sciences committee which assessed the assignment artifacts in 2020.

The members of the ad-hoc committee identified four topical areas that can be included in assignments / assessment throughout the various general education courses offered in the Biological Sciences. These topics would adequately improve the department's success in achieving both student learning outcomes of concern. These include:

1) The evolution of our understanding of COVID-19. For example, Trump allies criticized Dr. Anthony Fauci's statements early in the pandemic that wearing masks would not necessarily stop the spread of the virus. But as Fauci and other scientists learned more about the virus, their assessments evolved with that knowledge. Fauci stated the following: "That's really the nature of science…you look at the data and the information you have at any given time, and you make a decision with regard to policy based on that information. As the information changes, then you have to be flexible enough and humble enough to be able to change how you think about things." (The full article is attached)

2) The evolution of our understanding of global climate change. Once simply called global warming, we now know that patterns of global climate change are much more complex, differentially impacting temperature and precipitation patterns all over the world. Models of climate change constantly fluctuate, and management plans for mitigating and adapting to climate change must also be consistently evaluated to reflect these updated models. Students can also draw sociological and psychological connections to the impacts of climate change, appreciating the interdisciplinary nature of this issue. (An example of an assignment is attached)

3) During the Great Depression, cheap chemicals called chlorofluorocarbons (CFC's) began to become widely available for coolants in appliances such as refrigerators and air conditioners (freon becoming the most popular). This was seen as a wonderful advance in chemistry. However, as our understanding of the negative environmental side-effects of this chemical evolved, we then realized these same chemicals were causing a mass depletion in stratospheric ozone; a compound which protects biological tissues from harmful UV-radiation. We then responded to this new scientific data as a global community when the Montreal Protocol was signed in 1987, leading to an international effort to outlaw CFC production in participating nations.

4) The Green Revolution in agriculture arguably prevented widespread famine in many regions of the world during the mid-1900s. New fertilizers, novel genetic strains of global cash crops, and new pesticides led to increased yields of rice, wheat, and corn. This was seen as a major advance in biotechnology. However, as data were analyzed, negative environmental side-effects of the Green Revolution were soon realized. Agronomists, botanists, and geneticists were forced to develop new farming methods and technologies as pesticide resistance increased, and erosion, desertification, and pollution became more widespread. Sustainable agricultural techniques such as terrace farming, no-till, and crop rotation evolved due to our understanding of the negative environmental side-effects of the Green Revolution.

This is a non-exhaustive list of a few topical areas that can be included in several assignments / assessments in the biology general education courses. We believe that topics, such as the ones listed above, demonstrate how the department can move forward in achieving the SLO's of the College of Sciences at ODU (namely, the goals of concern, B and E).

Biology 111: Laboratory in Environmental Science
Climate Change Documentary Exercise
Due: Written responses by your lab period the week of November 29th, 2021 – 25 points

For this final laboratory assignment, you will view the 2014 documentary, *Disruption: Climate. Change.* This documentary is especially important to me (Dr. O.) because it focuses on the organization of a momentous event in my hometown of New York City 7 years ago, the People's Climate March. I also had the privilege of personally participating in this occasion.

Link for the documentary: https://www.youtube.com/watch?v=uWPj6CxtsGo

It is suggested that you read the questions below before viewing and discussing the documentary in class. You will notice many links to other concepts and material that we have covered throughout the course of this semester. Each of your answers to these questions should be thorough (a few paragraphs per answer). Full credit will only be awarded if the questions are adequately addressed. Evidence of critical thinking should be displayed in your answers.

1. Why do you think the documentarians opened with footage of the moon landing? What point(s) were trying to be conveyed? Do you think this was effective? Did it grab your attention? (3 points)

2. Do you think it's "fair" to compare the climate change activist movement to the civil rights movement? Why or why not? (3 points)

3. What evidence in the documentary supports the idea that climate change is not only a scientific issue, but an ethical issue. Cite 3 specific examples from the film. (Hint: consider the concepts of environmental / social justice). (9 points – 3 per each explained example)

4. We are currently emerging from a global pandemic. Our state and federal governments responded swiftly and dramatically once we realized that coronavirus would become a health crisis in the United States. Why did we, as a society, react so quickly to coronavirus, but we have lagged in our collective response to the climate change crisis? Are the crisis' equivalent – why or why not? Think about the psychology of action here; and the concepts of the "finite pool of worry" and "single action bias" (6 points)

5. What is your personal review / opinion of the documentary? What feelings are you left with – are you inspired? Infuriated? Was the presentation of the material too extreme, or did you find it balanced? (4 points)

The Washington Post

National-Politics

Rancor between scientists and Trump allies threatens pandemic response as cases surge

By Philip Rucker;Laurie McGinley;Josh Dawsey;Yasmeen Abutaleb

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This week's remarkable character assault by some top White House advisers on Anthony S. Fauci, the nation's leading infectious-disease expert, signified President Trump's hostility toward medical expertise and has produced a chilling effect among the government scientists and public health professionals laboring to end the pandemic, according to administration officials and health experts.

As novel coronavirus cases surge out of control coast to coast, the open rancor between the scientific community and a White House determined above all to resuscitate the economy and secure a second term for Trump threatens to further undermine the U.S. response, which already lags behind those of many other developed nations.

A chorus of voices — including Fauci; Robert R. Redfield, the director of the Centers for Disease Control and Prevention; and even Mick Mulvaney, the White House chief of staff during the start of the pandemic — has been speaking out publicly and with increasing urgency about the crisis in ways that contradict or undermine Trump. Some of them have sharply criticized testing capacities and efficiencies, suggested that everyone wear masks and warned of the virus spread worsening.

Though Trump does not automatically distrust the expertise of public health officials, he is averse to any information or assessment that he considers "bad news," that compromises his economic cheerleading message or that jeopardizes his reelection, according to several administration officials and other people with knowledge of the dynamic.

In addition to Fauci, the White House has repeatedly undermined and sidelined the CDC over the last several months, which prompted four former CDC directors to pen an op-ed in The Washington Post this week that argued no president had politicized the CDC to the extent that Trump has.

The result has been open warfare from some hard-line Trump loyalists seeking to discredit Fauci, the longtime director of the National Institute of Allergy and Infectious Diseases who is shown by polls to be regarded as a truth-teller by a majority of Americans.

Two of the White House officials with the closest and longest-standing ties to Trump, deputy chief of staff Dan Scavino and trade adviser Peter Navarro, attacked Fauci this past week. Navarro penned an op-ed in USA Today in which he stated that Fauci was "wrong about everything," while Scavino shared a cartoon on social media mocking Fauci as "Dr. Faucet," drowning Uncle Sam with a deluge of "extra cold" water.

Their critiques were echoed by one of Trump's outside economic advisers, Stephen Moore, and come after the White House anonymously shared last week with The Post a lengthy, researched list of comments Fauci has made intended to support Trump's earlier claim that "he's made a lot of mistakes." The list was reminiscent of research that campaign operatives distribute to reporters about their political opponents.

Trump sought to distance himself from those efforts and insisted he has a good relationship with Fauci, despite the fact that Fauci no longer briefs the president on the pandemic and is rarely if ever in the Oval Office anymore. Trump told advisers to tamp down their criticism of Fauci because he believed it was politically harmful to him,

aides said, and in a show of solidarity Vice President Pence tweeted a photograph of him meeting with Fauci in the Situation Room.

Fauci said the push to discredit him was "bizarre," telling the Atlantic, "If you talk to reasonable people in the White House, they realize that was a major mistake on their part, because it doesn't do anything but reflect poorly on them."

The interpersonal strife and the deliberate push by some inside the White House to protect Trump by sowing distrust of scientists is hampering the nation's efforts to combat the virus, according to public health experts.

"It seems that some are more intent on fighting imagined enemies than the real enemy here, which is the virus," said Thomas R. Frieden, a former CDC director and president of Resolve to Save Lives.

"The virus doesn't read talking points," Frieden said. "The virus doesn't watch news shows. The virus just waits for us to make mistakes. And when we make mistakes, as Texas and Florida and South Carolina and Arizona did, the virus wins. When we ignore science, the virus wins."

Trump in recent weeks has been committing less of his time and energy to managing the pandemic, according to advisers, and has only occasionally spoken in detail about the topic in his public appearances. One of these advisers said the president is "not really working this anymore. He doesn't want to be distracted by it. He's not calling and asking about data. He's not worried about cases."

White House spokeswoman Sarah Matthews countered in a statement: "President Trump has always acted on the recommendations of his top public health experts throughout this crisis as evidenced by the many bold, data-driven decisions he has made to save millions of lives. Any suggestion that the President is not working around the clock to protect the health and safety of all Americans, lead the whole-of-government response to this pandemic, including expediting vaccine development and rebuilding our economy is utterly false."

At federal health agencies, the barrage against Fauci has taken a significant toll, seen by many as a broadside against their community at large. The acrimony has angered career scientists at the National Institutes of Health, where Fauci is hailed as a hero, and at the Food and Drug Administration, where officials work closely with Fauci and his team, according to current and former government officials.

Many FDA career scientists and doctors see the White House criticism of Fauci as an effort to bully him — to make it clear that no one should consider crossing the president in the months leading up to the election, according to people familiar with the scientists' thinking.

"To see an NIH scientist and a doctor attacked like that, the feeling is, 'Oh, my God, that could just as easily be me,'" said a former FDA official, who like some others interviewed spoke on the condition of anonymity to be candid without risking retribution.

Some agency professionals worry the episode is a sign the FDA might come under political pressure to approve a vaccine or treatment for covid-19, the disease caused by the coronavirus, before it has been fully vetted for safety and efficacy.

Furthermore, they say the character attacks further undermine America's historic standing as a worldwide leader in public health, which is already tarnished by the nation's beleaguered response to the coronavirus and inability to contain it.

Another former senior administration official called the Fauci attacks a global embarrassment. "It's one thing to question science," this official said. "It's another thing to attack science."

Scott Becker, chief executive of the Association of Public Health Laboratories, which represents state and local labs, said, "The whole public health community has been demoralized by this."

Indeed, almost 90 organizations — including the American Society for Microbiology, the Infectious Diseases Society of America and several AIDS groups, as well as the public-labs association — sent a letter to Pence, who chairs the White House's coronavirus task force, condemning the recent moves.

"We object to any attempt to cast doubt on science and sow mistrust for public health expertise, and to spread misinformation during this challenging time for all Americans," the letter read. "Such efforts not only put the health of our population in greater peril, but also undermine the work underway to move our country beyond the pandemic and return to normalcy."

The substance of Trump allies' criticism of Fauci centers on his statements early in the pandemic that wearing masks would not necessarily stop the spread of the virus. But as Fauci and other scientists learned more about the virus, their assessments evolved with that knowledge.

"That's really the nature of science," Fauci said Thursday in a live-stream conversation with Facebook founder Mark Zuckerberg. "You look at the data and the information you have at any given time, and you make a decision with regard to policy based on that information. As the information changes, then you have to be flexible enough and humble enough to be able to change how you think about things."

Moore, a conservative economist who is on leave from the Heritage Foundation to run a group called Save Our Country focused on reopening the economy, said the fact that Fauci is heralded in the media and trusted by the public is a problem for efforts to convince schools and businesses to reopen.

"I've seldom seen someone who has been more wrong more consistently over his whole career than Dr. Fauci that continues to be listened to and held up as some kind of expert," Moore said.

He went on to express dismay that Fauci does not act like "a team player" by parroting to the public Trump's talking points.

Navarro has led a fierce campaign inside the White House against Fauci, telling colleagues that the infectious-disease expert "has no clue what he's talking about," according to a person who heard his comments.

Others in Trump's orbit have privately shared frustrations about Fauci, including White House chief of staff Mark Meadows and Pence chief of staff Marc Short. Still, Meadows reacted angrily about Navarro's op-ed, and Short told others he thought it was a mistake, White House officials said.

In recent weeks, there was what one adviser described as a "widespread effort" by White House officials, lawmakers and outside advisers to convince Trump to wear a mask in public — something he did for the first time last weekend when he visited Walter Reed National Military Medical Center.

In the coming weeks, health officials plan to more forcefully urge people to not only wear masks but to wear them consistently and correctly and to emphasize that masks are a supplement — not a substitute — for social distancing, one federal official said.

"You have to acknowledge the obvious, that this thing is going to be with us for a long time," said Josh Holmes, a Republican strategist close to Senate Majority Leader Mitch McConnell (R-Ky.). "You have to be realistic. People are willing to do difficult things if you give them a pathway of how do we get to the end of it."

This week, Redfield said that Trump ought to "set an example" by wearing a mask and that the epidemic could be brought under control in four to eight weeks if everyone wore one.

On June 30, Scott Gottlieb, a former FDA commissioner and an informal Trump adviser, had a call with House Republicans, organized by Rep. Liz Cheney (R-Wyo.), on which he laid out a grim prediction of rising case numbers and encouraged people to wear masks.

"At some point, we're going to have a confluent epidemic in the U.S.," Gottlieb said in an interview. "At some point, we're going to have so much infection that it's going to be hard to prevent a simultaneous national epidemic. It's going to be very difficult for us when this starts to run into flu season."

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Action Plan to Address Deficiencies of Student Learning Outcomes in Physics

1. The SLO results will be shared with all faculty to raise the level of awareness of the current assessment data.
2. Faculty will be asked to provide the Chair with recommendations on how to align course content and delivery to achieve better outcomes in each of the identified areas of learning.
3. Faculty will be asked to improve assessment tools that specifically address the SLO criteria.
4. Faculty will be reminded of the need to place current course content in the proper historical context, thereby demonstrating how scientific thinking evolves over time.
5. Faculty will be encouraged to connect course content to modern-day technology, thereby providing students with a better understanding of the intertwined nature of science, technology and its application in everyday life.
6. Students will be challenged on their pre-conceived notions of physics and technology to demonstrate that built-in assumptions are not always correct.
7. We will continue to enhance mathematical skills of physics students (at the appropriate level for the course) to better connect mathematical concepts to physical concepts.
8. We will enhance critical thinking and problem-solving skills through active learning techniques, which we view as an essential part of modern physics instruction.
9. We will enhance the laboratory portion of the courses to improve learning outcomes. In this regard, please note that former physics major and current College of Education graduate student Rachel Sparks White is designing an assessment project for a physics education research project that may evolve into her PhD research. IRB submission for this project is expected within a week.