

New Frontiers for Frontiers of Science

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Introduction:

The goal of integrating “modern science into the Core Curriculum” is a laudable effort on Columbia’s part. It is important that in adhering to its original purpose, the Columbia College Core Curriculum inform students about important issues in the world of science. Science is an integral component of a broad liberal arts education that aims to expose students to a diverse set of subjects beyond one’s own area of specialization.

Nevertheless, since its induction into the Core Curriculum, Frontiers of Science has received much criticism. It is in response to this criticism that the members of the Academic Affairs Committee and CCSC seek to consider ways to improve the course. We understand that there is a full-time faculty engaged in modifying the course every semester and we look forward to creating a dialogue between student council and the faculty regarding this course.

Several methods were used to gather information for this report. First, the seven members of this committee considered their own personal experience with the course. Second, we reached out to a wider group of students by canvassing the major first-year dorms. This second process, while unconventional, was very illuminating. Student after student had similar thoughts regarding what their experience with the course was lacking. The themes of these complaints are noted and detailed below. They are then followed by a discussion of potential solutions.

Overwhelming Breadth

Background:

Many students expressed frustration with the rapid pace of the course and its difficulty. There are general extremes about how students viewed the course: some felt it was too difficult, while others found it too simple in content. The cause of this is generally traced to the discrepancy in students’ scientific aptitude.

Of course, it is true that some students are more apt at certain subjects than others. However, in the context of Frontiers of Science, this discrepancy is a serious problem. Since the course has great breadth in subject matter, the disparity in students’ abilities is further compounded and complicated.

Potential Solution:

Considering the breadth of the material covered and the disparate academic backgrounds of students in the course, the Frontiers of Science committee should engage students in the process of shaping the course each semester.

As it stands, every week faculty meets to discuss the upcoming material covered in the lectures, discussions, and the WIA. Currently, professors who do not specialize in a

given area of scientific knowledge are in charge of checking the material presented by professors who specialize in that subject matter. They check that material in order to verify that students can grasp the material without the necessary academic background. We feel this approach is insufficient since ultimately, a scientist already has the habits of mind to make the connections where “lay” students cannot.

It would be helpful to choose several students each semester from the preceding class of Frontiers of Science students to give their input in these faculty discussions. The faculty can gain a better idea of student perspectives on course content through such a “focus group.” This way, professors can see whether an untrained student can understand this material. Such an approach is not without precedent. Currently, the Committee on the Core (COC) has students who work with the faculty in putting together the curricula of courses such as Literature Humanities and Contemporary Civilizations. Since the COC does not directly control the course content of Frontiers, such student voices are lacking. While informal dialogue exists between students and the faculty, we believe that it would be effective to have several invested students as part of this process. The process of selecting students could be done by the Faculty itself; however, the select students should have diverse scientific backgrounds.

Discussion Sections

Background:

One of the prominent complaints many students voiced was the frustration with the content of discussion sections. According to most students, two hours provide more than ample time to discuss and explain the previous lecture. Thus, seminars are often unnecessarily lengthy as some section leaders struggle to fill up the extra time. While some students found their discussion section leader to effectively use the entire two hours, others felt that the time could be used more effectively.

Potential Solution:

A reorganization of discussion sections could utilize the two hour period more efficiently. As it stands, the discussion sections review the material of the previous lecture and provides it context. While the current setup has its benefits, it would be beneficial if each discussion devotes a certain portion of time to presenting a preview of the upcoming lecture towards the end of the discussion section

This way, the discussion section would equip students with a foundation for the upcoming lecture. Considering how sometimes in a single lecture or two, broad areas of science are discussed; it would be helpful if students were not approaching this material for the very first time without any prior exposure. This solution would benefit students with a limited scientific background by giving them greater context to more comprehensively understand the material in the coming lecture.

WIA & Help Room

Background:

The Frontiers of Science Help Room caters to students, providing guidance in completing the WIAs. This Help Room is a recent improvement to the course and a step in the right direction. While the help room offers flexible hours for the students' convenience, at times there is only one individual staffing the room to answer students' questions. As the help room is often crowded, there are sometimes too many requests to be addressed in a timely manner. Thus, a significant disproportion in the student to teacher ratio arises. Instead of granting individual assistance, the instructor works through and solves the problems in their entirety to everyone in attendance. This fails to meet the individual needs of each student. The high demand for assistance and explanation of the vaguely worded questions results in hour-long waits that frequently end with questions left unanswered due to either time constraint or lack of understanding on the teacher's part.

While the Help Room is beneficial to the general student population, the unclear WIA questions create higher volumes of students utilizing the service than the department anticipated. If the department clarifies the homework questions and what it expects of the students from the work, then the Help Room would better serve its purpose.

Potential Solution:

As one of the main problems surrounding the effectiveness of the Frontiers Help Room is a limited staff. By having an additional instructor in the help room, more student questions could be addressed. Also, the staff in the room should have the requisite knowledge in the scientific field being discussed in the particular WIAs of that week so they are able to better assist students. Additionally, in order to minimize repeat questioning, students with questions on the same problem should be encouraged to work on the problem as a group. Students who come in with specific questions could go straight to the group that addresses their specific needs instead of having to sit through an explanation of every problem.

The main issue surrounding the help room resides in the difficulty students have in understanding the homework. These issues would be eliminated if the assignments were worded less ambiguously. For many of the problems in the WIA, students simply do not understand what is being asked of them. Consequently, often these problems are simple and require only a brief explanation from the professor. If the WIA's were worded more clearly, these problems would not have to be addressed in the help room, allowing the professor to help students who are confused about broader concepts rather than instructions.

Course Readings

Background:

Many students have expressed a general criticism regarding the core text of the class, *Habits of Mind*, and frustration with the difficulty of reading technical, scientific articles. While the content of the book is engaging, many students feel that it does not provide a sufficient foundation to follow the material that is presented throughout the course in the lectures and more technical readings. While the technical readings promote a positive academic experience, it can frustrate students with a limited scientific background. One interviewed student went so far as to say that “the antipathy for the course mostly derives from the vague and highly technical reading materials that daunt the students in learning a relatively simple concept by explaining concepts such as parallax in an article that requires a much deeper understanding of astronomy and that goes beyond the principle of parallax.” Simply put, there is a gap between the overly simple material in *Habits* and the technical articles that must be filled.

Potential Solution:

In most introductory level courses, a fundamental introduction to the course material is provided in the form of a course textbook. As a result, the members of the student body feel that it would be greatly beneficial if this core course introduced a textbook or course pack in addition to *The Habits of the Mind* that would help students better understand core concepts. This additional text would be used throughout the semester as an explanatory guide. Such a text would ideally help students understand the fundamentals of the subjects covered in the course before they are expected to read more technical scientific articles. While this “textbook” would have to change from semester to semester as class content changed, it is hoped that at the very least, it could provide reading material at a simpler level that would help students grasp the more technical scientific articles already used in the course.

Miller Theatre

Background:

One of the most unique and important aspects of the Frontiers of Science course is the weekly lectures. The lectures expose students to cutting edge technology and discoveries in otherwise unfamiliar fields. While this aspect of frontiers is integral to the overall experience of the course, improvements are necessary to make the lectures more intellectually stimulating for everyone.

As it stands, Miller Theatre does not create a stimulating atmosphere for these important weekly lectures. It has bad lighting and all the seats lack desks. Under such conditions, even the students with the best intentions of learning the complex material presented in every lecture are at a disadvantage. The theatre is more conducive to

napping than rigorous focus and concentration. This is likely a factor that contributes to students' difficulty with following the material taught in each lecture.

Solution:

While procuring space for approximately 500 students is a difficult logistical issue on this campus, we can remedy this problem by apportioning the weekly lectures into two sections. A space such as 407 IAB can accommodate up to 300 students which would suffice for students divided into two separate sections of the lecture. This split will not only move the lecture to a sufficiently lit room with desk space, but also provide other benefits. Many students find the inflexible single section problematic when they are signing up for classes, as it tends to conflict with other classes. The creation of a second section would give students greater flexibility and more choice.

Conclusion

While the above recommendations represent the positions of the Academic Affairs Committee of CCSC, we believe that the most important first step for lasting change is dialogue. We hope that this report will be the initial step towards creating working relationships between the faculty and students aimed at achieving the philosophical goal of Frontiers of Science. Making Frontiers of Science a permanent pillar of the Core requires a lot of work, but we believe it is necessary and possible.