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Introduction To Astrobiology: A Model For Integrating Research Into an Undergraduate Class

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Introduction: We have developed and taught a course at our college entitled Honors Seminar: Introduction to Astrobiology. This is a course for first or second-year college students suitable for non-science majors. We designed the course to be research-based learning [1-3] using the reverse classroom approach. Students worked in pairs to find answers and critically evaluate their findings. Our strategy was to promote student engagement and creative inquiry, demystify the research process, and thereby increase student knowledge and interest. The goals of the course were to discover and understand what comprises astrobiology by qualitatively and quantitatively evaluating data and theories to understand the quest to know if life exists beyond Earth.

The course was co-taught by two instructors, one with expertise in astronomy and the other in biology and chemistry. Each instructor led sessions or activities in his area. As the course evolved, we integrated these different approaches to the study of astrobiology. This approach provided a deeper learning experience. Before class, students had to complete any assigned reading, view assigned videos, and post to the discussion board. During class we discussed what they didn't understand and students completed class activities for the day working in groups. Each week they had two hands on activities – one from each instructor. These often involved analyzing real world databases, e.g., the exoplanet database, Jupiter observational data, or lunar observational data. We also had journal club every week. Each week, one student was assigned to select an article related to astrobiology and make a presentation to the class explaining the article. The other students were expected to read the article and ask questions of the presenter. We had two outside guest speakers in astronomy/astrobiology that talked about their research and engaged in a question answer session with the students. One guest speaker talked with the class via Skype. For some activities (e.g., theories on the origin of life) students had to work in groups and make a class presentation explaining and critically analyzing their presented theory.

Finally students had to work on a semester-long research project. They could work in groups of up to three students. They had to define a research question, use the scientific method to answer, and write a report on their project. On the last day of class we had poster presentation day (similar to posters at scientific conferences) where each group had to present their research project in poster format to the rest of the class and answer questions. We also had a few co-curricular activities outside the classroom, which were talks, presentations, or activities. There were no exams. Grades were based on student participation, journal club, class activities, and their major research project. The course format was well received even by students that were non-science majors. In fact we were given a standing ovation by the students last year!

References:

- [1] Russell SH Hancock MP McCullough J (2007) *Science* 316: 548-549. [2] Linn MC et al. (2015) *Science* 347 no. 6222. Lopatto D (2007) *CBE – Life Sciences Education* 6: 297-306.