THE GEOLOGICAL SOCIETY OF AMERICA®

GSA Position Statement

THE IMPORTANCE OF TEACHING EARTH SCIENCE

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Position Summary. To meet the environmental challenges and natural resource limitations of the twenty-first century, and to inspire future generations of scientists, Earth-science education must be integrated into science education across all public and private schools, starting in kindergarten and continuing through twelfth grade. Earth-science curricula should be delivered by teachers with direct training in Earth-science education.

This position statement (1) summarizes the consensus views of GSA on the importance of teaching of Earth science at the K–12 levels; (2) advocates for training at the college level that will produce highly qualified Earth-science teachers (see the companion statement on Expanding and Improving Geoscience in Higher Education); and (3) provides specific recommendations and opportunities for advocacy and action.

Conclusions and Recommendations

GSA encourages and supports the following:

- Teaching Earth science at all levels of K–12 school systems;
- Teaching Earth science at the same academic level as physics, chemistry, and biology;
- Teaching Earth science as a high school laboratory capstone science course that contributes toward college credit and college admission;
- Development of Advanced Placement (AP) courses and the acceptance of an AP examination in the Earth sciences;
- Inclusion of undergraduate and/or graduate geoscience courses in the educational training of all teacher candidates seeking elementary school licensure and middle and high school science licensure, depending upon state and institutional requirements;
- Inclusion of Earth science as a category in science fairs, student research forums, and similar events;
- Teaching Earth science as part of a common core as developed by the National Academies;
- Adoption of the Next Generation Science Standards by all public and private school systems, including incorporation of Earth science into all educational levels, from kindergarten through twelfth grade;
- Support of dual-credit geology or Earth science courses at school, district, state, and national levels;
- Continued research into innovative teaching methods in Earth-science education;
- Teaching current Earth-science models, concepts, and theories that contribute to informed public decision making.

3300 Penrose Place, P.O. Box 9140, Boulder, Colorado 80301-9140 USA ▪ Tel 303.357.1000, Fax 303.357.1070 ▪ www.geosociety.org

RATIONALE

This is a critical time for students to understand how the Earth works as a system and how humans interact with the Earth. Understanding the causes and potential societal consequences of natural Earth processes (e.g., earthquakes, floods, landslides, tsunamis, volcanic eruptions, weather, and global climate change) and the production, availability, and potential depletion of natural resources (e.g., water, soil, mineralsn and energy) are of particular importance. These processes and resources impact our economy, our security, and the safety and sustainability of our environment. Our understanding of modern Earth processes comes from deciphering the record of Earth s past. An understanding of Earths processes and of humanity s capacity to influence them is therefore critical to the wellbeing of humanity and the planet. As of October 2018, only two states require a year-long Earth or environmental science course for high school graduation, compared with 26 states requiring a year-long physical science course and 32 states requiring a year-long life science course. Moreover, only eight states require the study of Earth and space science concepts before graduation, while 29 accept an Earth and space sciences course for graduation (of these, 13 require this course to be "laboratory-based (reference 1). Empowering students from diverse backgrounds with scientific knowledge and skills to make informed decisions as citizens of our common home is a vital undertaking and a key responsibility for science educators and geoscientists.

Earth science is an integrated science that brings together mathematics, biology, chemistry, and physics as they apply to the workings of the Earth system. The applied, and often visual, nature of Earth science helps learners see its relevance to their lives and to their communities. Engaging students in learning about the Earth supports the development of problem solving and critical thinking skills and highlights the importance of science, technology, engineering, and math (STEM) careers to society. Therefore, Earth science can serve as an introduction to the life and physical sciences or as a capstone course requiring students to apply their knowledge of these sciences. Earth science can also serve as a framework for investigating life and physical sciences in museums and other informal education venues.

REFERENCES

1. Center for Geoscience Education and Public Understanding (2018). Earth and Space Sciences Education in U.S. Secondary Schools: Key Indicators and Trends (No. 3.0). Alexandria, VA: American Geosciences Institute. Retrieved from https://www.americangeosciences.org/sites/default/files/SecondaryEdu2018Report_20pgPlusCovers_PrintRes_120618.pdf

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Opportunities for GSA and its Members to Help Implement Recommendations

Everyone can play a role in the improvement of general Earth-science literacy. GSA encourages the following actions:

SCIENTISTS:

- Develop a Research Experience for Teachers program in your field or laboratory research;
- Engage with audiences of all ages in a variety of venues such as schools, museums, libraries, outdoor youth activities, and other appropriate events;
- Support student science competitions, such as Science Olympiad, science fairs, or knowledge bowls;
- Become involved in local school activities (running for school board, joining ad hoc district or curriculum committees, participating in parent-teacher organizations);
- Visit schools in person or virtually, volunteer to mentor students, and welcome them into research opportunities and internships;
- Form partnerships with Earth-science educators (formal and informal) focused on promoting the use of Earth-science data, specimens, and supplies to develop engaging, level-appropriate activities and lessons;
- Engage with teachers at state or national science teachers meetings;
- Partner with municipal, state, and federal lands officials to develop interpretive programs and promote public lands use in education;
- Participate in a "communicating science to the public" workshop;
- The research findings of the scientific community must be clearly communicated to non-scientists, including students, the general public, and policy makers, to enable informed decision making.
- Communicate Earth science to the public, including local school communities.
- Become involved with teacher candidate programs at their institutions or in their region to help formalize required undergraduate/graduate coursework in the geosciences in their pre-service tracks.

K–12 EDUCATORS:

- Participate in online professional development opportunities, such as the Science Educational Resource Center's (SERC) Teach the Earth, Earth Exploration Toolbook, Digital Library for Earth Science Education (DLESE), and others;
- Get involved in professional organizations, such as GSA, NAGT, NSTA, and NESTA; attend their meetings and participate in workshops and field trips that they sponsor;
- Partner with geoscience faculty at local colleges and universities and learn about their research and the tools they use and provide promising students with research opportunities;
- Assist colleagues of all grade levels with Earth science content and pedagogy to ensure that best practices are employed.

SCHOOL ADMINISTRATORS:

- Advocate Earth science in the district program of studies and encourage all students to take Earth-science courses along with mathematics, chemistry, physics, and biology;
- Support curricular decisions that include rigorous high school–level Earth-science courses.

SCHOOL BOARDS AND PARENT-TEACHER ASSOCIATIONS/ORGANIZATIONS:

- Invite Earth-science professionals to speak to the school board about the role of Earth-science education in preparing students for college, careers, and their future as informed citizens;
- Support teacher initiatives that promote Earth-science education.

PARENTS AND STUDENTS:

- Request a dual-credit Earth-science course at the high school level;
- Participate in discussions about Earth-science–related topics that you see in the news;
- Seek out informal science venues to continue learning about Earth-science topics outside school settings.

PUBLIC OFFICIALS:

- Stay informed on the role of research in Earth science.
- Promote a thorough and comprehensive K–12 curriculum that includes Earth science.