Common Terms and Acronyms that You Might Hear at the Earth Educators' Rendezvous

Dear Reader,

The following is an alphabetical list that includes terms likely to be heard during the Earth Educators' Rendezvous. We recognize that the conference draws attendees from a wide range of backgrounds. The intent is that this list may provide further information on terms that may be unfamiliar to some attendees. For each item, we provide a brief summary or description as well as a link to website(s) with further information.

Many of the terms on this list include acronyms, which are sometimes used in conversation more frequently than the term itself. In such cases, the term is alphabetized based on the acronym rather than the full term. In addition, a few acronyms are commonly pronounced as words rather than as a sequence of letters; we have offered a phonetic spelling of the acronym as part of the summary.

If you have suggestions of terms for future iterations of this list, please include them on the evaluation form at the close of the conference.

Sincerely,

The 2019 Earth Educators' Rendezvous Planning Committee

3-Dimensional Learning: Within the Next Generation Science Standards for K-12 education, the phrase refers to the three components (or pillars) that are part of each standard, 1) Science and Engineering Practices, 2) Crosscutting Concepts, and 3) Disciplinary Core Ideas. Additional information: https://www.nextgenscience.org/three-dimensions.

Active Learning: "Bonwell and Eison (1991) defined active learning strategies as 'instructional activities involving students in doing things and thinking about what they are doing' (p. 5). This definition was later expanded by Fink (2003) to delineate a 'holistic view of active learning' (p. 105) that consisted of three primary components: 1) communication of information and ideas…(via reading, direct instruction, etc.); 2) experiences, divided into two types ('doing' experiences…and 'observing' experiences); and 3) reflection…" Source and additional information: McConnell, D. A., Chapman, L., Czajka, C. D., Jones, J. P., Ryker, K. D., & Wiggen, J. (2017). Instructional utility and learning efficacy of common active learning strategies. *Journal of Geoscience Education*, *65*(4), 604-625. See also: https://serc.carleton.edu/earth_rendezvous/2019/program/morning_workshops/w7/index.html.

Assessment: "Assessment involves comparing information gathered from subjects relative to some established goal or objective (Kizlik, 2009). These goals, objectives, or outcomes are set in advance, and should be clear to both instructors and students." Source and additional information: https://serc.carleton.edu/earth_rendezvous/2018/program/afternoon_workshops/w9.html. See also classroom assessment, program assessment, and evaluation.

Backwards Design: See Understanding by Design.

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Bloom's Taxonomy: "In 1956, Benjamin Bloom with collaborators Max Englehart, Edward Furst, Walter Hill, and David Krathwohl published a framework for categorizing educational goals: *Taxonomy of Educational Objectives*. Familiarly known as Bloom's Taxonomy, this framework has been applied by generations of K-12 teachers and college instructors in their teaching. … A group of cognitive psychologists, curriculum theorists and instructional researchers, and testing and assessment specialists published in 2001 a revision of Bloom's Taxonomy with the title *A Taxonomy for Teaching, Learning, and Assessment*. This title draws attention away from the somewhat static notion of 'educational objectives' (in Bloom's original title) and points to a more dynamic conception of classification. The authors of the revised taxonomy underscore this dynamism, using verbs and gerunds to label their categories and subcategories (rather than the nouns of the original taxonomy). These 'action words' describe the cognitive processes by which thinkers encounter and work with knowledge." Source and additional information: https://cft.vanderbilt.edu/guides-sub-pages/blooms-taxonomy/.

Classroom Assessment additional information: https://serc.carleton.edu/NAGTWorkshops/assess/index.html. See also program assessment and evaluation.

Climate Literacy and Energy Awareness Network (CLEAN): "The CLEAN Collection of Climate and Energy Educational Resources A collection of 700+ free, ready-to-use learning resources rigorously reviewed by educators and scientists suitable for secondary through higher education classrooms." Source and additional information: https://cleanet.org.

Concept Sketches: "Concept sketches are an excellent approach for learning, teaching, and assessing the understanding of concepts in the geosciences. They consist of simple sketches annotated with complete sentences that describe the features, processes, and interrelationships. When used for assessment, they evaluate whether students have an in-depth understanding of a concept or process. They can be quickly graded and so are appropriate for classes of any size, including online courses." Source and additional information: https://serc.carleton.edu/NAGTWorkshops/careerdev/AcademicCareerTeach2013/march.html.

ConcepTest: "ConcepTests are conceptual multiple-choice questions that focus on one key concept of an instructor's learning goals for a lesson. When coupled with student interaction through peer instruction, ConcepTests represent a rapid method of formative assessment of student understanding. ConcepTests are products of a teaching strategy known as peer instruction that was initially developed to provide a mechanism for introducing effective active learning strategies into physics lecture classes without having to make acute changes to course content or organization (Mazur, 1997)." Source and additional information: https://serc.carleton.edu/NAGTWorkshops/teaching_methods/conceptests/index.html.

Crosscutting Concepts (CCCs): Within the Next Generation Science Standards, crosscutting concepts are one of the three central components of each standard. **"**Crosscutting concepts have application across all domains of science. As such, they are a way of linking the different domains of science. They include: Patterns, similarity, and diversity; Cause and effect; Scale, proportion and quantity; Systems and system models; Energy and matter; Structure and function; Stability and change." Source and additional information: https://www.nextgenscience.org/three-dimensions and http://www.nap.edu/openbook.php?record_id=13165&page=83.

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Disciplinary Core Ideas (DCIs): Within the Next Generation Science Standards, disciplinary core ideas are one of the three central components of each standard. "Disciplinary ideas are grouped in four domains: the physical sciences; the life sciences; the earth and space sciences; and engineering, technology and applications of science." Source and additional information: https://www.nextgenscience.org/three-dimensions and http://www.nap.edu/openbook.php?record_id=13165&page=3.

Discipline-based Education Research (DBER): "The goal of DBER is to test theory and produce generalizable findings focused on teaching, learning, and ways of thinking in a science disciplines, in our case geoscience. DBER can also include investigations into the development and nature of expertise in a discipline as well as strategies for making science more inclusive. While DBER may differ slightly between disciplines, common to all is that researchers systematically gather data that leads to knowledge for improved teaching and student learning. The findings should be broadly applicable beyond a single course or instructional context; they are usually published in peer-reviewed journals. Further information is available in the 2012 National Research Council volume entitled Discipline-Based Education Research: Understanding and Improving Learning in Undergraduate Science and Engineering." See also the following link for a webinar on DBER and geoscience education: https://nagt.org/nagt/profdev/workshops/geoed_research/dber_webinar.html. The acronym is sometimes spoken like a single word, pronounced "dee-bur". For comparison, see also Scholarship of Teaching and Learning (SOTL).

EarthConnections Alliance (ECA): "The EarthConnections Alliance supports development of pathways linking opportunities to learn geoscience with community involvement across grade levels." Source and additional information: https://serc.carleton.edu/earthconnections/.

Evaluation: "Evaluation allows the establishment and communication of the worth of an activity (Kizlik, 2009). This worth can be determined by the extent to which decisions of instructional approaches, arrangements, organization, etc., are effective in aiding students into reaching the desired outcomes." Source and additional information: https://serc.carleton.edu/earth_rendezvous/2018/program/afternoon_workshops/w9.html. See also assessment, classroom assessment, and program assessment.

Gallery Walk: "Gallery Walk gets students out of their chairs and actively involves them in synthesizing important concepts, in consensus building, in writing, and in public speaking. In Gallery Walk teams rotate around the classroom, composing answers to questions as well as reflecting upon the answers given by other groups. Questions are posted on charts or just pieces of paper located in different parts of the classroom. Each chart or "station" has its own question that relates to an important class concept. The technique closes with an oral presentation or "report out" in which each group synthesizes comments to a particular question." Source and additional information: https://serc.carleton.edu/introgeo/gallerywalk/index.html.

GEO 2YC (Two-Year College Division): GEO 2YC is one of three divisions of the NAGT and its mission is to support and connect those with a "shared professional interest in geoscience education at two-year colleges (2YC)." Source and additional information: https://nagt.org/nagt/divisions/2yc/.

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Geoscience Education Research Division (GER): GER is one of three divisions of the NAGT and its mission is to promote "high quality, scholarly research in geoscience education that improves teaching and learning in K-12, higher education, and informal learning environments." The acronym is sometimes spoken by articulating each letter i.e. "G-E-R" or may be spoken like a single word, pronounced "grr" or like a growl. Source and additional information: https://nagt.org/nagt/divisions/geoed/.

InTeGrate (Interdisciplinary Teaching about Earth for a Sustainable Future): "InTeGrate was a 5-year, NSF-funded STEM Talent Expansion Program Center grant, running from 2012 through 2016. The project had two overarching goals. "The first goal of the InTeGrate project is to develop curricula that will dramatically increase Earth literacy of all undergraduate students. The second major goal is to increase the number of majors in the geosciences and related fields who are able to work with other scientists, social scientists, business people, and policy makers to develop viable solutions to current and future environmental and resource challenges." Source and additional information: https://serc.carleton.edu/integrate/.

Jigsaw Activities: "In a jigsaw, the class is divided into several teams, with each team preparing separate but related assignments. When all team members are prepared, the class is re-divided into mixed groups, with one member from each team in each group. Each person in the group teaches the rest of the group what he/she knows, and the group then tackles an assignment together that pulls all of the pieces together to form the full picture, hence the name *jigsaw*." Source and additional information: https://serc.carleton.edu/NAGTWorkshops/teaching_methods/jigsaws/index.html.

Lecture Tutorials: "Lecture Tutorials are short worksheets that students complete in class to make lecture more interactive. They are designed specifically to address misconceptions and other topics with which students have difficulties. They pose questions of increasing conceptual difficulty to the students, cause conflict with alternative conceptions, and help students construct correct scientific ideas. Research shows that Lecture Tutorials increase student learning more than just lecture alone." Source and additional information: https://serc.carleton.edu/NAGTWorkshops/teaching_methods/lecture_tutorials/index.html.

Logic Models: "Logic models are often employed to understand how a program is supposed to work (e.g., McLaughlin and Jordan, 1999), defining the audience for a program and what the program is attempting to achieve. Logic models describe how to translate program resources into near-term results and long-term impacts." Source and additional information: https://serc.carleton.edu/earth_rendezvous/2018/program/afternoon_workshops/w9.html. See also: https://serc.carleton.edu/NAGTWorkshops/departments/degree_programs/logicmodels.html.

NGSS (Next Generation Science Standards): "The Next Generation Science Standards (NGSS) are K–12 science content standards. Standards set the expectations for what students should know and be able to do. The NGSS were developed by states to improve science education for all students. A goal for developing the NGSS was to create a set of research-based, up-to-date K–12 science standards. These standards give local educators the flexibility to design classroom learning experiences that stimulate students' interests in science and prepares them for college, careers, and citizenship." Source and additional information: https://www.nextgenscience.org/ and https://ngss.nsta.org/Default.aspx.

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Ocean Observatories Initiative (OOI): "The National Science Foundation (NSF)-funded OOI, is a networked observatory of science-driven sensor systems that measure the physical, chemical, geological and biological variables of the ocean, seafloor, and near ocean atmosphere. The OOI consists of six arrays located across the North and South Atlantic and Pacific, including one cabled, two coastal, and three global arrays. The OOI infrastructure is made up of 83 platforms, carrying over 830 instruments, providing over 100,000 data products. Greater knowledge of the ocean's interrelated systems is vital for increased understanding of their effects on biodiversity, ocean and coastal ecosystems, ecosystem health and climate change. The OOI puts ocean observing data into the hands of a vast user community of oceanographers, scientists and researchers, educators and the public." Source and additional information: https://oceanobservatories.org/.

On the Cutting Edge: "The NAGT On the Cutting Edge project is a comprehensive, discipline-wide professional development program for current and future geoscience faculty that offers an integrated workshop series, a website with topical collections of teaching resources, and a leadership development program. It aims to develop a geoscience professoriate committed to high-quality instruction based on currency in scientific knowledge, good pedagogic practice, and research on learning with the ultimate goal of improving student learning." Source and additional information: https://serc.carleton.edu/NAGTWorkshops/.

Phenomena (in the context of NGSS): Within the Next Generation Science Standards for K-12 education, the phrase ***anchoring phenomenon*** refers to an overarching problem or theme for a unit that can be explored through a sequence of ***investigative phenomena***. In other words, the latter are subsets of the former. Additional information: https://www.nextgenscience.org/resources/phenomena and https://www.nextgenscience.org/sites/default/files/Using%20Phenomena%20in%20NGSS.pdf.

Program Assessment additional information: https://serc.carleton.edu/NAGTWorkshops/departments/degree_programs/assess.html. See also classroom assessment and evaluation.

Project EDDIE: "Project EDDIE (Environmental Data-Driven Inquiry and Exploration) is a suite of education projects composed of STEM disciplinary and educational researchers. We develop flexible classroom teaching modules using large, publicly available datasets to engage students in STEM and improve their quantitative reasoning. Teaching modules span topics such as ecology, limnology, geology, hydrology, and environmental sciences. EDDIE also helps build the associated professional development needed to ensure effective use of the teaching modules." Source and additional information: https://serc.carleton.edu/eddie/index.html.

Reliability: In the context of educational research, reliability "is the extent to which work can be reproduced consistently. If another person analyzed the study data, would they arrive at the same conclusions? Means of establishing validity and reliability will vary according to the research design (i.e., whether it is qualitative, quantitative, or mixed-method). For further discussion see Creswell and Creswell (2017)". Source: guidelines to authors for preparing Research manuscripts to submit to the Journal of Geoscience Education, https://www.tandf.co.uk//journals/pdf/author/Research-Manuscripts-JGE.pdf. See also discussion of trustworthiness.

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RTOP (Reformed Teaching Observation Protocol): "RTOP provides a standardized means for detecting the degree to which classroom instruction uses student-centered, engaged learning practice (see Lawson and others, 2002; MacIsaac and Falconer, 2002; Sawada and others, 2002)." Source and additional information: https://serc.carleton.edu/NAGTWorkshops/certop/reformed_teaching.html. The acronym is sometimes spoken like a single word, pronounced "r-top".

SAGE 2YC (Supporting and Advancing Geoscience Education at Two-Year Colleges): "The Supporting and Advancing Geoscience Education at Two-Year Colleges (SAGE 2YC) project and website helps two-year college geoscience faculty implement high-impact, evidence-based instructional and co-curricular practices at their own institutions that will lead to improved STEM learning, broadened participation, and a more robust STEM workforce." Source and additional information: https://serc.carleton.edu/sage2yc/.

Scholarship of Teaching and Learning (SOTL): "The goal of SoTL is to improve one's own teaching practice through innovations in pedagogy and curriculum and to serve as a model for others. SoTL studies are typically descriptive, and focus on innovations that addresses learning goals. Scholars systematically gather data that lead to self-reflection, improved teaching practices, and improved student learning. SoTL studies are often specific to a course and the instructor's personal context, but conclusions must be supported by evidence and have broader applications so as to serve as a potential model for other instructors and at other institutions." Source and additional information: https://nagt.org/nagt/geoedresearch/toolbox/publishing/sotl_dber.html. The acronym is sometimes spoken like a single word, pronounced "so-tul". For comparison, see also Discipline-Based Education Research (DBER).

Science and Engineering Practices (SEPs): Within the Next Generation Science Standards, science and engineering practices are one of the three central components of each standard. "The practices describe behaviors that scientists engage in as they investigate and build models and theories about the natural world and the key set of engineering practices that engineers use as they design and build models and systems. The NRC uses the term practices instead of a term like "skills" to emphasize that engaging in scientific investigation requires not only skill but also knowledge that is specific to each practice." Source and additional information: https://www.nextgenscience.org/three-dimensions and http://www.nap.edu/openbook.php?record_id=13165&page=41.

Teacher Education Division (TED): TED is one of the three divisions of NAGT and its mission is "to improve geoscience teaching by improving teacher content and pedagogical knowledge and by encouraging research on best teaching practices." The acronym is often pronounced like the name, Ted. Source and additional information: https://nagt.org/nagt/divisions/ted/.

Think-Pair-Share: "Think-Pair-Share activities pose a question to students that they must consider alone and then discuss with a neighbor before settling on a final answer. This is a great way to motivate students and promote higher-level thinking." Source and additional information: https://serc.carleton.edu/introgeo/interactive/tpshare.html.

Trustworthiness: In the context of educational research, trustworthiness "considers the extent to which research findings are worth notice and consideration. For example, Lincoln and Guba (1985) suggest that reflection about credibility, transferability, dependability, and confirmability can establish the

trustworthiness of a study". Source: guidelines to authors for preparing Research manuscripts to submit to the Journal of Geoscience Education, https://www.tandf.co.uk//journals/pdf/author/Research-Manuscripts-JGE.pdf. See also discussion of reliability.
Two-Year College Division: See GEO 2YC.

Understanding by Design (UBD): **"**Understanding by Design is a book written by Grant Wiggins and Jay McTighe that offers a framework for designing courses and content units called "Backward Design." Instructors typically approach course design in a "forward design" manner, meaning they consider the learning activities (how to teach the content), develop assessments around their learning activities, then attempt to draw connections to the learning goals of the course. In contrast, the backward design approach has instructors consider the learning goals of the course first." Source and additional information: https://cft.vanderbilt.edu/guides-sub-pages/understanding-by-design/. See also http://www.ascd.org/research-a-topic/understanding-by-design-resources.aspx. The acronym is sometimes spoken by articulating each letter i.e. "U-B-D".

Virtual Field Trips/Experiences (VFT or VFE): Virtual field trips enable immersive experiences when time, resources, or students' needs may otherwise make an excursion to an outdoor location difficult or impractical. Additional information:
https://serc.carleton.edu/earth_rendezvous/2019/program/morning_workshops/w8/index.html
For a perspective on field experiences in general:
https://serc.carleton.edu/NAGTWorkshops/field/design.html
Finally, the following references may also be useful:

- Dolphin, G., Dutchak, A., Karchewski, B., & Cooper, J. (2019). Virtual field experiences in introductory geology: Addressing a capacity problem, but finding a pedagogical one. *Journal of Geoscience Education*, *67*(2), 114-130.
- Mead, C., Buxner, S., Bruce, G., Taylor, W., Semken, S., & Anbar, A. D. (2019). Immersive, interactive virtual field trips promote science learning. *Journal of Geoscience Education*, 1-12.