Supplemental Table 2. Areas of knowledge code definitionsand text exemplars.

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| **Area of Knowledge** | **Area of Knowledge Definition** | **Text Example** |
| Agriculture | Process of farming/cultivating crops for food, fuel, and other products (e.g., textiles). Includes animal agriculture (raising cows, pigs, chickens, etc. for human consumption). | From experiment involving a variety of crops, researchers have learned that yields can increase by an average of 14% when windbreaks are used. |
| Architecture | Refers to designing and constructing buildings, including LEED or green design. | The case of Lingang, a planned city in Shanghai’s Pudong district, illustrates typical LEED designs for environmental benefits. |
| Arts & Aesthetics | Expression of ideas through arts and design. Differs from Literature and Language Arts in that the medium is not writing. | “His design is based on deep respect and affection for Hindu mythology, and the power of the image—Each page is a stand-alone painting that can be mounted in a gallery,” Devineni said. |
| Behavioral Social Science | Refers to the study of humans and behavior. | When people think, they generally do not invent concepts but instead they use mental models drawn from their societies and their shared histories. |
| Ecology | Ecology is focused on the interactions between organisms and their environment. | Abundant acorns draw deer into the woods where they browse on small plants and tree seedlings; Ticks drop off the deer and lay eggs in the leaf litter and when the eggs hatch, the larvae attach to mice, and the life cycle of Lyme disease continues. |
| Business Sustainability Practices | Refers to the management and coordination of environmental, social, and financial demands and concerns to ensure responsible, ethical, and ongoing success (focus on the triple bottom line rather than just economic profit). | The answer became Walmart’s [sustainability program](https://corporate.walmart.com/global-responsibility/sustainability/), an ambitious effort to figure out how to get its budget-conscious customers to buy more sustainable products. |
| Climate Change | Includes naturally occurring fluctuations in climate, as well as human influenced climate change caused by fossil fuel emissions. Includes references to greenhouse gas emissions, carbon dioxide, methane, etc.  Includes adaptation and mitigation behaviors, as well as description of climate change impacts (e.g., sea level rise, temperature change, flooding, etc.). | There is considerable evidence for a myriad of anthropogenic climate change impacts, including ice sheet and glacial melting; sea level rise; more frequent hot days and nights over land |
| Conservation | Protecting the environment and species from degradation and extinction. Includes references to protecting/restoring habitats, ecosystem services/functions, and conserving biological diversity. | Healthy ecosystems provide vital goods and services to humans and other organisms. |
| Earth Sciences & Geology | Refers to the branch of science dealing with the physical aspects of the earth and its atmosphere, as well as the science that deals with the earth's physical structure and substance, its history, and geological processes. | According to this principle, past geologic events can be explained by natural processes we observe operating today, such as erosion by running water, volcanism, and the gradual uplift of the Earth’s crust. |
| Economics | Refers to the production, consumption, and transfer of wealth, often monetary resources. Includes macro and micro-scale economics. | For the students who received the graduation intervention (conditional cash transfer), there was a 49 percentage-point increase in enrollment in higher degree programs. |
| Education | Includes discussion of pedagogy, curriculum design, outreach, and methods of teaching. | This is not an argument for ignorance, but rather a statement that the worth of our education must now be measured against the standards of decency and human survival—the issues now looming so large before us. |
| Energy Systems | Supplies, production, transportation, and consumption of energy. May include fossil fuels and renewables. Does not refer to caloric energy needed for organisms to survive, nor does it refer to physical energy (e.g., kinetic, potential, etc.). | Recent events like the Deepwater Horizon oil spill, the death of twenty-nine West Virginia coal miners in the worst mining disaster in twenty-five years, and the crisis at Japan’s Fukushima Daiichi Nuclear Power Plant are salient examples of the health and environmental costs, and economic risks, of our current energy sources. |
| Engineering & Technology | Engineering refers to the systematic and iterative approach to designing objects, processes, and systems to meet human needs and wants. Technology is defined as any modification of the natural or designed world developed to fulfill human needs or desires. | The hog waste from 8,600 hogs is flushed into an in-ground lined and covered anaerobic digester that produces and captures biogas, which is then used to power a 65-kilowatt microturbine with excess beyond this capacity diverting to the System's flare, during times of high biogas production. |
| Environmental Justice | Refers to the fair treatment of people in relation to environmental issues regardless of gender, race, socio-economic status, sexual orientation, etc. Can include discussions of unequal access to benefits/placement of negative consequences (e.g., health issues, proximity to waste dumps, etc.). | To outsiders, it may look like little more than a spat between neighbors, but at heart, it’s a story about poverty and racial inequality, and how those forces play out in a state where the hog industry has emerged as both essential for the economy and an oppressor of poorer communities of color. |
| Environmental Sustainability | Refers to meeting the natural resource and ecosystem service needs of current and future human generations without compromising the health of the ecosystems that provide them or future generations' ability to meet their needs. | In ecology, sustainability describes how biological systems remain diverse and productive over time, a necessary precondition for human well-being. |
| Food Systems | The processes and infrastructure needed to feed the population. Differs from agriculture in that it's more broad than growing food/raising livestock. | Likewise, over 97 percent of the food eaten by residents of Arizona and New Mexico is currently imported, even when the same food commodity could ideally be made available from in-state sources. |
| Geography | Broadly concerned with patterns and processes of the human and natural environment. For our purposes, there needs to be a spatial element to narrow the focus of this code, such as references to distributions of resources or locations. | Not to be confused with ecological refugees — people forced to abandon their homelands as a result of unbearable heat, drought, desertification, flooding, disease, or other consequences of climate chaos — conservation refugees are removed from their lands involuntarily, either forcibly or through a variety of less coercive measures. |
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| Green Materials Design | Materials that are non-toxic, improve occupancy health, lower cost, and conserve products. Non-toxic materials are materials that do not cause harm to the environment, to the users of the material or to the producers of the material. This focuses on the materials used, rather than infrastructure or management systems. | The upholstery fabric Climex Lifecycle is a blend of pesticide-residue-free wool and organically grown ramie, dyed and processed with entirely nontoxic chemicals. |
| History | The study of the past. Actions/events must have concluded to qualify. | The Wilderness Society was founded in the 1930s; among its founders were two early opponents of predator control, the biologists Olaus Murie and Aldo Leopold, and the emphasis of this movement gradually shifted from preserving spectacular natural scenery to providing recreation opportunities in primitive areas, and to a belief in the intrinsic value of self-willed nature. |
| Human Health | Physical, social, and mental wellbeing absent from disease or injury. | Malaria occurs primarily in tropical and some subtropical regions of Africa, Central and South America, Asia, and Oceania. |
| Inorganic Chemistry | Refers to the branch of chemistry that involves inorganic molecules. | Fortunately, a potassium-argon clock is one of the easiest to understand because 40Ar, the decay product of 40K, is a noble gas and does not form chemical bonds with other ions in mineral structures. |
| Language Arts | Structure, meaning, and metaphor. The focus is on the usage of words and how things are talked about. Differs from Literature in that we're looking at the rules and structure of language rather than the aesthetic value of the piece. Differs from Arts and Aesthetics in that we're confined to written works. | Ernst Haeckel, a 19th-Century scientist, developed the concept of **ecology** and names it—*eco* from the Greek word for “house” and *logy* from the Greek word for “study.” |
| Literature | Classic environmental, expression of ideas through literature. Limited to the written word. | Given a description such as this one tends to look next for the King, mounted on a splendid stallion and surrounded by his noble knights. |
| Natural Resource Management | How humans manage resources for use of human populations, present and future. Includes consumptive (e.g., timber, mined resources, fish) and non-consumptive uses (e.g., outdoor recreation, aesthetic value, etc.) | Uranium production advocates contend that new [“environmentally friendly” mills](http://www.telluridenews.com/the_watch/news/article_a2195dcf-fe4f-5039-bc80-cd52b67ebbf8.html) and [current federal regulations](https://www.csis.org/analysis/governing-uranium-united-states) will adequately protect public health and the environment, but they offer little evidence to counter White Mesa Mill’s poor record. |
| Organic Chemistry | Study of the structure, properties, composition, reactions, and preparation of carbon-containing compounds. | Th e two elements most important to the study of MDNs are nitrogen and carbon, both of which have two stable isotopes—14N and 15N, 12C and 13C (the superscripted number refers to the atomic weight of the isotope). |
| Other Life Sciences | Contains anything not coded under Biology, Ecology, or Organic Chemistry. May include fields like zoology, botany, mycology, and microbiology. | A lamella, or gill, is a papery hymenophore rib under the cap of some mushroom species, most often but not always agarics. (Mycology) |
| Other Physical Sciences | Anything that does not fit under Physics, Inorganic Chemistry, Earth Sciences & Geology. Examples include oceanography, atmospheric sciences, and astronomy. Cycles involving atmospheric and geological elements will be coded under Earth Sciences & Geology, NOT here. | Differences in atmospheric pressure circulate the air and create our winds, which cycle water from the oceans to the landmasses. |
| Philosophy & Ethics | Discussion of worldviews, the nature of knowledge/knowing, the nature of reality/realities. | As the list of endangered animals worldwide grows longer, society may soon be faced with an impossible decision: which ones to take off life support. |
| Physics | Refers to the branch of science concerned with the nature and properties of matter and energy. The subject matter of physics, distinguished from that of chemistry and biology, includes mechanics, heat, light and other radiation, sound, electricity, magnetism, and the structure of atoms. | When the term “motion” occurs in Aristotelian physics, it refers to a change of position of the physical body. |
| Planning & Built Environment | Refers to human altered environments (built environment) and things like urban planning and land use planning. Differs from Conservation and Natural Resource Management in that we have to be in a predominantly human system (like a city or agricultural landscape rather than a forest). | Communities of all sizes across the country are using creative strategies to develop in ways that preserve natural lands and critical environmental areas, protect water and air quality, and reuse already-developed land. |
| Policy & Public Administration | Refers to a course or principle of action adopted or proposed by a government, party, business, or individual, as well as the process for developing that course of action and implementing it. | The program was wildly popular with the public and helped build strong urban support for future watershed protection efforts by New York City. |
| Political Science | Refers to systems of government and the analysis of political activity and behavior. |  |
| Commissions created during the Rio conference were established and national action planning processes set in train for a global reporting system against agreed objectives. |
| Religion | Refers to belief in spiritual beings or divine elements on the universe. Can refer to individual spirituality or systems of belief in organized religion. Also includes the study of God/gods and the search for religious truths. We should also be cognizant that this includes Western, Eastern, and indigenous views of religion and spirituality. | In Hopi belief, the Katsinam, spiritual guides and helpers of crucial importance to the world, reside here. |
| Research Design & Ethics | Refers to protecting the rights of human and animal subjects, as well as with planning, executing, and reporting research. | More comprehensive and alternative frameworks are being proposed to help stakeholders evaluate the numerous, complex questions embedded within each of these three categories. |
| Social Sustainability | Refers to the ability of a social system, such as a country, to function at a defined level of social wellbeing indefinitely without compromising the ability of future generations to meet their needs. Often referred to as social sustainable development. Often deals with issues of poverty, gender equality, access to education, and other sustainable development goals. | Sustainable development goal 1: end poverty in all its forms everywhere. |
| Sustainability General Concepts | Refers to discussion about characteristics, definitions, and indicators for sustainability, broadly speaking. Differs from other sustainability codes in that the focus is specifically on improving/altering our understanding of what sustainability means and how to measure it. | As a contribution to this ongoing refinement of the sustainability concept, I recently formulated five axioms (self-evident truths) of sustainability. |
| Sustainability Science | Refers to technological developments/solutions to achieve sustainability (environmental, social, business, etc.). Differs from codes like Green Materials Design and Architecture because specific to advancing sustainability goals, while the previously mentioned codes may not be tied specifically to sustainability. | If a reduction in emissions or other pollutants can be obtained without a reduction in consumption of non-renewable resources—for example, by using technological means to capture polluting substances and sequester them harmlessly, or by curtailing the production of certain industrial chemicals—then a reduction in consumption of such resources need only occur at the depletion rate in order to achieve sustainability. |
| Sustainability Governance | Governance is the way rules, norms and actions are structured, sustained, regulated, and held accountable. Sustainable governance refers to making sure people/groups live up to sustainability goals/practices. | Allowing parallel self-organized governance regimes to engage in extensive trial-and-error learning does not reduce the probability of error for any one resource, but greatly reduces the probability of disastrous errors for all resources in a region. |
| Waste & Pollution in Natural Environments | Refers to waste and pollution entering the natural environment (e.g., trash, littering, point and non-point source pollution, individual and industrial pollution, etc.). | It’s clear that waste ends up in marine habitats from many different sources, from inefficient industrial waste management to [plastic microfibers washed out of our clothing](https://www.theguardian.com/environment/2016/jun/20/microfibers-plastic-pollution-oceans-patagonia-synthetic-clothes-microbeads). |
| Water Systems | Water supply network, from source (e.g., precipitation, glaciers, groundwater), flows (e.g., rivers), to transportation to human populations. Also refers to phenomena/systems located in water (such as oceans, streams, lakes). | But, she said, "every day the water is reducing. We drilled two new boreholes a few weeks ago and one has already failed." |