

Content Advisor Feedback

Ronald Wetherington, 3/24/2021

On draft recommendations for the science Texas Essential Knowledge and Skills (TEKS) for grades K-8.

GUIDING QUESTIONS

1. Does each grade level follow a complete and logical development of science concepts presented? If not, what suggestions do you have for improvement? **Yes; great improvements have been made in vertical alignment in the elementary TEKS.**
2. Do the standards for the grade(s) adequately address scientific concepts? If not, please give examples of how the standards might be improved. **For the most part, yes. I have made recommendations for improvement in specific TEKS in the attached pages.**
3. Is the level of rigor appropriate for each grade level? If not, please provide suggestions for areas where improvements are needed. **Yes.**
4. Are the TEKS aligned horizontally and vertically? If not, what gaps or concepts are missing that should be addressed? **Biodiversity needs conceptual clarification (Grades 6-7); Human affects on climate change have received more attention (Grades 7-8) but have shortcomings. See attached.**
5. Does each grade level include sufficient standards focused on classroom and outdoor investigations? **Yes**
6. Are the student expectations clear and specific? If not, please give examples of how the language might be improved. **I have made some specific recommendations where SEs are pretzel-shaped (Grades 3-5, b.3.B.; Grade 6, 11.A.; Grade 7, 11.B.)**
7. Are there student expectations that are not essential or unnecessarily duplicative and can be eliminated? If so, please identify by grade level and student expectation number, e.g., 1.7.B (Grade 1, student expectation (7)(B)). **No.**
8. Do you have any other suggestions for ways in which the elementary and middle school TEKS can be improved? **See specific comments.**

Feedback on Science TEKS Work Group E

Ronald Wetherington, 3/22/2021

The Work Group really rolled up its sleeves here, resulting in a significant improvement in the K-5 trajectory. I commend the more explicit wording in both the KS and SE statements, helping teachers to make better lesson plans. I'm also impressed with the general pattern of moving more expectations to the earlier grades from the later ones. The "deeper dives" have been long overdue. One can quibble with a few decisions (I would have reversed the emphasis on animals in Grade 3 and plants in Grade 4), but the overall result is pedagogical progress.

There is one curious phrase suture that occurs in the transition from grade 2 to grade 3, carried forward into grades 4 and 5. This occurs in b.3.B.

In grade 2, this reads: **"communicate explanations and solutions individually and collaboratively in a variety of formats;"**

In grades 3-5, this becomes: **"communicate individually and collaboratively valid conclusions to determine explanations from both direct and indirect evidence;"**

This should properly read **"communicate valid explanations and conclusions individually and collaboratively, from both direct and indirect evidence;"**

Feedback on Science TEKS Work Group C

Ronald Wetherington, 3/15/2021

My comments on the proposals by Work Group C on the science TEKS for Grades 6, 7 and 8 will be confined to my areas of expertise in biology and related areas of earth science. The detailed vertical alignment side-by-side comparisons were extremely helpful and indicates the concern the group has, both with maintaining a grade-appropriate level of study and integrating a progressive depth of student understanding.

Grade 6

(11)(A) This is a welcome revision but is also somewhat misleading and confusing: **"identify that organisms are composed of cells, which come from pre-existing cells and are the basic unit of structure and function as explained by cell theory;"**

Here are a few observations:

- Prokaryotes and protozoa, for example, are not **"composed of cells"**: rather, they are solitary cells (11.C.). The original wording, "composed of one or more cells" is more appropriate.
- **"which come from preexisting cells"** is a non-sequitur in this SE. Furthermore, cell division has not yet been introduced. I recommend removing this phrase.
- **"as explained by cell theory"** suggests that cell theory will be introduced here (or "its foundational components" as the group states). Is it not appropriate here, then, to at least introduce some of the history of cell discovery? Students might benefit in knowing how technology played a vital role in this discovery—via the microscope of Robt. Hooke, leading the way (with improvements in optics and intervening observations) to Schwann's theory. This is a fascinating two-century voyage of

discovery and scientific maturation. It could be inserted before this SE. (Compare, e.g., 9.A. in grade 7, where historical context is inserted).

- While I recognize that this addition will increase instructional time, I believe it important for all work groups to give more attention to the historical antecedents to scientific progress.

(12) While this KS, and the corresponding one in grades 7 and 8, explicitly focus on variation **within** a *population/species/gene pool*, the final KS (13) relates to biodiversity, which depends on understanding the corresponding variation within the *ecosystem*—or variation **between** populations/species/gene pools. This latter variation, however, is not explicitly recognized or addressed *per se* and the absence is a missed opportunity. Addressing this directly in an SE might actually simplify teacher instruction and student comprehension: differences *within* (species, populations, etc.) can provide parallel construction to differences *between*, making comparison and contrast in terms of competition, survival, and natural selection easier and more intuitive.

Grade 7

(11)(B) “**compare the results of uniform or diverse offspring from asexual or sexual reproduction in plants and animals.**” This statement needs surgery:

- What does “results of...offspring” mean?
- Define “uniform or diverse” when describing offspring.
- The conjunction “**or**” is too permissive, and the conjunction “**and**” specifies comparing reproduction in plants and animals, not among plants or among animals. So, in one interpretation, this could mean “*compare uniform offspring from asexual reproduction in plants with that in animals*”. Iterations abound. This all makes little pedagogical sense, especially in view of the KS statement (11) itself.
- The comment that “7.11.B was revised to limit the amount of content and reduce instructional time required” is erroneous: the original has no relevance to this topic, and was simply “deleted”, not “revised”.

(13)(B) and (C) introduce the important term “biodiversity”. I can find no place where the student is asked to understand or give examples of biodiversity, which means different things at the levels of genetic variation (differences within the individual), species variation (among members of a species), and ecosystem variation (among species in a habitat).

Grade 8

(10)(A) “**describe how volcanic eruptions, meteor impacts, abrupt changes in ocean currents and the release and absorption of greenhouse gases influence climate.**” This is a textbook example of the *false equivalence fallacy* in at least three ways:

First, all of these occur in nature without human impact, but the last, greenhouse gases, importantly involves human causation disproportionately to natural causation. To include the human factor along with the rest is to give an equivalence where none exists.

Second, these each have such different frequency-driven impacts that placing them together creates a false sense of equal importance: meteor impacts have not affected climate in the human era; “abrupt” changes in the North Atlantic conveyor current last occurred, by most reckoning,

13,000 years ago; and volcanic eruptions of a magnitude to effect global climate are rare. But greenhouse gases from natural and human causation are ubiquitous. None of these are mutually equivalent.

Third, the SE lumps together affects *over which humans have no control* with those over which they certainly do! This creates, in the mind of a non-discerning listener, a comparability that falsely equates the latter with the former.

All of these should be decoupled. The work group must decide, among the several SEs generated from such dissociation, what the exact learning objectives are, or ought to be.

(10)(B) “**research and describe how human actions can affect climate change.**” While I appreciate that “*A and B were added in response to content advisors’ recommendation*”, I would hope that teachers were given a bit more direct guidance than an open-ended SE that provides none whatsoever. This should include expecting students to examine scientific evidence and historical records on human impact, and to compare causes of ancient global changes (e.g., the Pleistocene) to more recent global trends.

Why not: “**describe scientific evidence concerning the human activities and natural processes that have caused the rise in global temperatures over the past century.**”