

## Appendix

### Guide for Using Learner-Generated Questions

This document is intended to be a flexible guide for developing an initial account of learner understanding of a science topic using existing online learner-generated questions. The depth of exploration can be as short as a few hours or much longer depending on goals and time.

It is suggested that the following sections be conducted as a sequence with the scope and specificity changing to meet your research needs.

#### 1. Initial Theme Generation: People Also Ask (PAA) Data

Sources: [www.Google.com](http://www.Google.com), [www.Bing.com](http://www.Bing.com)

As an initial source PAA data can suggest themes based on the type and frequency of search terms used by people.

Initial PAA Questions for the Search Query “isotopes”

People also ask	
What is an isotope short definition?	▼
What is an isotope in chemistry?	▼
Why do isotopes form?	▼
In what way are isotopes of a given element always different?	▼

*Feedback*

Upon selecting a question, a link, and other related PAA questions will be generated. From many topics you will encounter a PPA Black Hole where you can continually select suggested questions seemingly without end. This is of value to deeply explore the topic, connections between ideas, and variations in how questions are posed.

#### 2. Questions Asked in Response to Videos

Sources: [www.KhanAcademy.org](http://www.KhanAcademy.org), [www.YouTube.org](http://www.YouTube.org)

As a second step, viewing questions asked in response to specific resource, such as a video, provide questions that can be viewed the context of the video content. Often unrelated, but important, ideas will emerge from this context.

Khan Academy is by far the most useful, often with several years of data that is curated with extraneous comments removed, unlike YouTube. In addition questions receive thoughtful and timely responses, encouraging learners to ask.

YouTube has a wider range of videos, but the comments tend to contain fewer actual questions about the topic (most are thanking the creator of the video).

### 3. Question and Answer Websites

Sources: [www.Quora.com](http://www.Quora.com) , <https://answers.yahoo.com/>, [www.StackExchange.com](http://www.StackExchange.com), <http://www.madsci.org/>, [www.Socratic.org](http://www.Socratic.org), etc.

A number of Q&A websites exist and varying in the types of and depth of questions. Questions are not related to any one educational resource and are accessed by sorting on keywords and keyword phrases. Themes emerging in PAA and video comment analysis can guide keyword decisions.

There are a number of technical challenges to consider with Q&A websites. These include:

- The sorting algorithm used to find questions based on keywords entered. How the algorithm considers what is relevant is not fully known. The relevance and usefulness of questions can decrease rapidly further into the search results.
- How the questions returned from the sort are displayed and how easy it is to collect and organize for analysis.
- The legal terms for using the data in publications (if you plan to do so). The terms of use can be helpful.

A final concern is why the user is asking. Sometimes it is apparent such as when the question is taken verbatim from a learner's homework. Often it is not. Special attention should be paid to theoretically generative questions for use in instrumentation development.

### 4. Forums

Discussion forums can be another valuable source of learner-generate questions and are often specific to a scientific discipline. Several examples are:

- [Chemistry Forum](#)
- [SciForums.net](#)
- [Physics Forums](#)
- [HS chem Help forum](#) but need to register
- [Reddit.com](#) (subreddits for specific disciplines, searching across website)

### Other Useful Sources of Initial Data

The following can be helpful to gain some context of where learners may be hearing terms and ideas in everyday life.

- Search Engine Autocomplete: type in the beginning of a phrase into the search box and view suggested relevant searches.

Questions or Comments: [wbreslyn@umd.edu](mailto:wbreslyn@umd.edu) or [waynebreslyn@gmail.com](mailto:waynebreslyn@gmail.com)