Active learning in mineral chemistry promoted by apps

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Static images of mineral structures and phase diagrams make it challenging to promote deep conceptual learning in mineral chemistry. Therefore in a quest to increase active hands on learning, especially of 3D structures, I turned to apps. The objective is to enhance learning in mineral chemistry with interactive digital learning. Here I share my approach and consider the benefits to learning.

I teach igneous mineral chemistry in a course on Mineralogy and Petrology at Uppsala University. The course is part of our international MSc programme in Earth Science with specialisation in geology. Approximately half of the students have a BSc Earth Science from Uppsala and the other half are international MSc students plus a few exchange students. The class size is typically 8 to 10 students.

After briefly introducing the mineral structures for olivine, pyroxene, amphibole and feldspar, I set the students the task of investigating the mineral structures themselves using the Mineral Database® app. I provide general questions to guide their investigation and help them to search for the important attributes. This gives them the opportunity to explore the structures in 3D and identify the basic building blocks and cation sites.

For teaching phase equilibria of olivine, pyroxene and plagioclase, I employ the app Explain Everything®. This app allows me to annotate phase diagrams in real time together with the students. Hence the phase diagram develops and it is much easier to stimulate the students to participate in the process. The annotated phase diagrams can be uploaded to the student portal either as images or videos so that the students can access them later.

In order to apply their conceptual understanding, we collect mineral chemistry data by EPMA and calculate parameters such as Fo, An and Mg#. I encourage the students to make interpretations based on their conceptual learning. Thus tying together analytical data with 3D representations of the mineral structures and phase equilibria.

Observation and interaction with the students during these active learning sessions suggests that the approach increases the students learning of concepts in mineral chemistry. The discussion will consider essential steps towards evidence based assessment of the benefits to student learning.