A laboratory in environmental geochemistry

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Discussion

This laboratory compliments the lecture portion of an environmental geochemistry course and offers students field and laboratory experiences that include data collection, analysis, and interpretation. The field experience introduces students to methods of environmental sampling, field measurements, and sample handling. Laboratory experiences include wet chemistry and computer modelling (e.g., Stella [1], PHREEQC [2]). Students make chemical measurements using spectroscopic, specific ion electrode and titration techniques. Computer work includes modelling of biogeochemical cycles (systems), water chemistry (equilibrium), subsurface chemical transport, and interpretation of X-Y graphics, statistical analysis, and hypothesis testing. Features of the laboratory are the semester monitoring 1) of chemicals in a river to introduction biogeochemical cycling and contaminant transport in watersheds and 2) of Winogradsky microcosms to observe and explore the role of microbial processes in biogeochemical cycling. At the end of the semester students a) combine the chemical data with river discharge and precipitation data to study flow and transport in the stream and calculate chemical and water mass balances, and b) compare how different treatments (e.g., light, no light, high P-K-N, low Fe) affect microbial processes in the columns as well as measure redox sensitive species (e.g., Fe^{2+}) and a biological active chemical (e.g., SiO_2) in surface and porewater.

References

[1] ISSEE Systems (2005) http://www.iseesystems.com

[2] Parkhurst, D.L. and Appelo, C.A.J. (1999) User's guide to PHREEQC (version 2)--A computer program for speciation, batch-reaction, one-dimensional transport, and inverse geochemical calculations: U.S. Geological Survey Water-Resources Investigations Report 99-4259, 312 p

Retention of visual-kinesthetic activities in geochemical syllabi

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Students learn in a variety ways. In any specific class, a student may have learning style preferences that differ vastly from other students. A strong preference may isolate a student from the learning environment because they are either unable to compensate for that preference or the strong preference is not catered for by the learning experiences given in class. In order to avoid learning isolation in a junior mineralogy class, students were assessed for learning style preferences in the semester prior to enrolment in *mineralogy*. With this information, the course syllabus was tailored to be inclusive for the full range of learning style preferences present in the class.

Learning style preferences were assessed using the Felder-Silverman model while enrolled in an introductory *rocks and minerals* course prior to *mineralogy*. There were 19 respondents (of 21). All but one student has a moderate to strong learning preference. Students with poor final grades (F to C–) in the *rocks and minerals* course all have a strong visual preference. Failing and passing students that have a strong visual preference tend to also have moderate to strong sensing and active (kinesthetic) preferences. Students with a strong visual-kinesthetic preference tend to be marginalized in courses because teaching styles typically cater for those with moderate verbal and sequential preferences. Armed with knowledge of the learning style preferences of in-coming *mineralogy* students, the course syllabus was tailored to be inclusive for all by selecting topics that require visual-kinesthetic learning. These topics include symmetry and crystallography where learning proceeds by interaction with wooden crystal models, sketching of geometry and symmetry, and use of CD-ROMs to illustrate 3-dimensional translational symmetry. Such visual-kinesthetic topics are taught early in the topic sequence so all students are engaged from the start. Retention of these "traditional" elements of mineralogy in a broad mineralogy-geochemistry curriculum provides students with foundational knowledge and evidence shows that similar approaches affect increased student achievement (Hoskin, 2004). A more inclusive learning environment should impact on student retention in mineralogy-geochemistry.

Reference

Hoskin, P.W.O. (2004) *E-Jour Instruct Sci Techn* **7(2)**.