Modular Curriculum for Hydrologic Advancement (MOCHA)

Thorsten Wagener
Water and Environmental Engineering

It takes a village to raise a child …

‘Hydrologic science is, by its very nature, interdisciplinary’
(Eagleson et al., 1991)

... who does it take to educate a hydrologist who can solve today’s and tomorrow’s problems?
In this talk we’ll discuss our view on hydrology education

1. Shifting baseline for hydrology education

2. Current hydrology education

3. Future hydrology education

SHIFTING BASELINE FOR HYDROLOGY EDUCATION
The present structure of hydrological education, generally tailored to the needs of specialized non-hydrological disciplines, is ill-fitted to cope with present and future requirements.

One urgent educational problem, which has reached crisis proportions in many universities, is the lack of field and laboratory experience.

A changing world requires different hydrological approaches in science and practice

“Panta Rhei—Everything Flows”: Change in hydrology and society—The IAHS Scientific Decade 2013–2022

The shifting baseline of a changing world needs to translate into differences in education

- How will the hydrologic system respond to, and evolve under, natural and human induced changes in climate and the environment?
- How are natural, managed and engineered processes manifested in the various freshwater services that nature provides?
- How can hydrologic systems be managed towards sustainability?

Answering these questions requires a strong scientific basis of engineering, and societal needs demand a science capable of making quantitative predictions.

The future of hydrology: An evolving science for a changing world

Thorsten Wagener,1 Murugesu Sivapalan,2,3,4 Peter A. Troch,5 Brian L. McGlynn,6 Ciaran J. Harman,7 Hoshin V. Gupta,8 Praveen Kumar,9 P. Suresh C. Rao,9 Nandita B. Basu,9 and Jennifer S. Wilson7

CURRENT HYDROLOGY EDUCATION
Conclusions

... while an education with a common basis is desirable, it is clearly not available at the moment. Hydrology educators are challenged to identify common principles, core knowledge, and approaches that should be included, in addition to areas where clear consensus is lacking.
Most of us spend many hours preparing lectures

We use a wide range of textbooks

While ~40% used no textbook at all, all participants used a wide range of material to create their lectures, and 68% of the participants, who use a primary textbook, took 50% or less of their material from this primary text.

McMartin (1999) found that faculty have difficulty using internet resources in their teaching, specifically because of: lack of time to learn about the material, difficulties of finding usable material, and lack of training on how to use the material.
It takes a community to raise a hydrologist: the Modular Curriculum for Hydrologic Advancement (MOCHA)

How can we create an online faculty learning community?

FUTURE HYDROLOGY EDUCATION

The Modular Curriculum for Hydrologic Advancement (MOCHA) is

... establishing an online faculty learning community for hydrology education and a modular hydrology curriculum based on modern pedagogical standards. Hence attempting to answer the following questions:

How good could a watershed hydrology course be if all aspects of the course would be covered by ‘topical’ specialists?

How holistic would the approach to hydrology education be if both scientists and engineers jointly develop the material?

How much improvement would be possible if basic pedagogical guidelines would be followed throughout a course?
The science / engineering separation mentioned by Eagleson et al. has not gone away.

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We introduce other ideas:

(a) Use of control volume approach for consistency.
(b) The ABCD of lesson design.
(c) Teaching notes to share experience.

Example from infiltration module: Prompt class to discuss how the infiltration curve of a gravel soil would be different than a clay soil, and to identify why these differences exist.
MOCHA has attracted over 220 members from 40 countries so far!
Some statements for discussion are:

1. The best teaching is when students learn by themselves (e.g. guided discussions in small groups).

2. Common material can become a way of capturing our state of knowledge. How can we do this globally?

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A historical baseline for hydrology education can be derived from …


Eagleson et al. (1990) discussed opportunities in hydrology, including those regarding education.

"Hydrology moved from engineering to science departments as well."

"Research topics come from societal needs as much as they come from the flow of scientific ideas and technological breakthroughs."

"Faculty with strong interest in hydrology are found in a diverse array of departments."

"Because of the multidisciplinary nature of the hydrologic sciences, students from widely different backgrounds are likely to be attracted to the discipline."

MOCHA is based on modules, each covering ~3 hours of in-class teaching material:

- A common look and feel
- Pedagogically-guided structure
- Teaching notes providing guidance on how to teach the material
- A common control volume approach
- In-depth slides that focus on higher level material
- Categorization of each slide with respect to spatial scale and topic addressed

... seamless connectivity through a common template!
Ensure good pedagogy by following the **ABCD** of creating a lesson

- **A**: Planning the lesson
- **B**: Beginning the lesson
- **C**: During the lesson
- **D**: Ending the lesson

In-class learning activity where students solve a small problem in teams