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Infuse Teaching with Research Practices:
A pilot project – welcome presentation for 1st-year students on time scales in civil engineering projects

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A challenge for education: concentrate knowledge

- An educational need
  - to counterbalance proliferation of topics: concentrate knowledge (a sustainable goal for education)
    - → **focus on a key topic: time**
- An educational product to address the need
  - a video-presentation (in Greek)
    - → **"Earth, Water, Time and We, the civil engineers"**
- A methodology for developing such products
  - teamwork and peer review of video + slides + script

Educational perspective: *do education as we do research*

- Lee Shulman's (1993) call to **end pedagogical solitude** by following a three-pronged strategy
  - Education connected to the disciplines
    - Civil engineering
  - Quality of education manifested through artifacts
    - Video-presentation
  - Education artifacts undergo peer review
    - Multiple peer reviews

raise education quality

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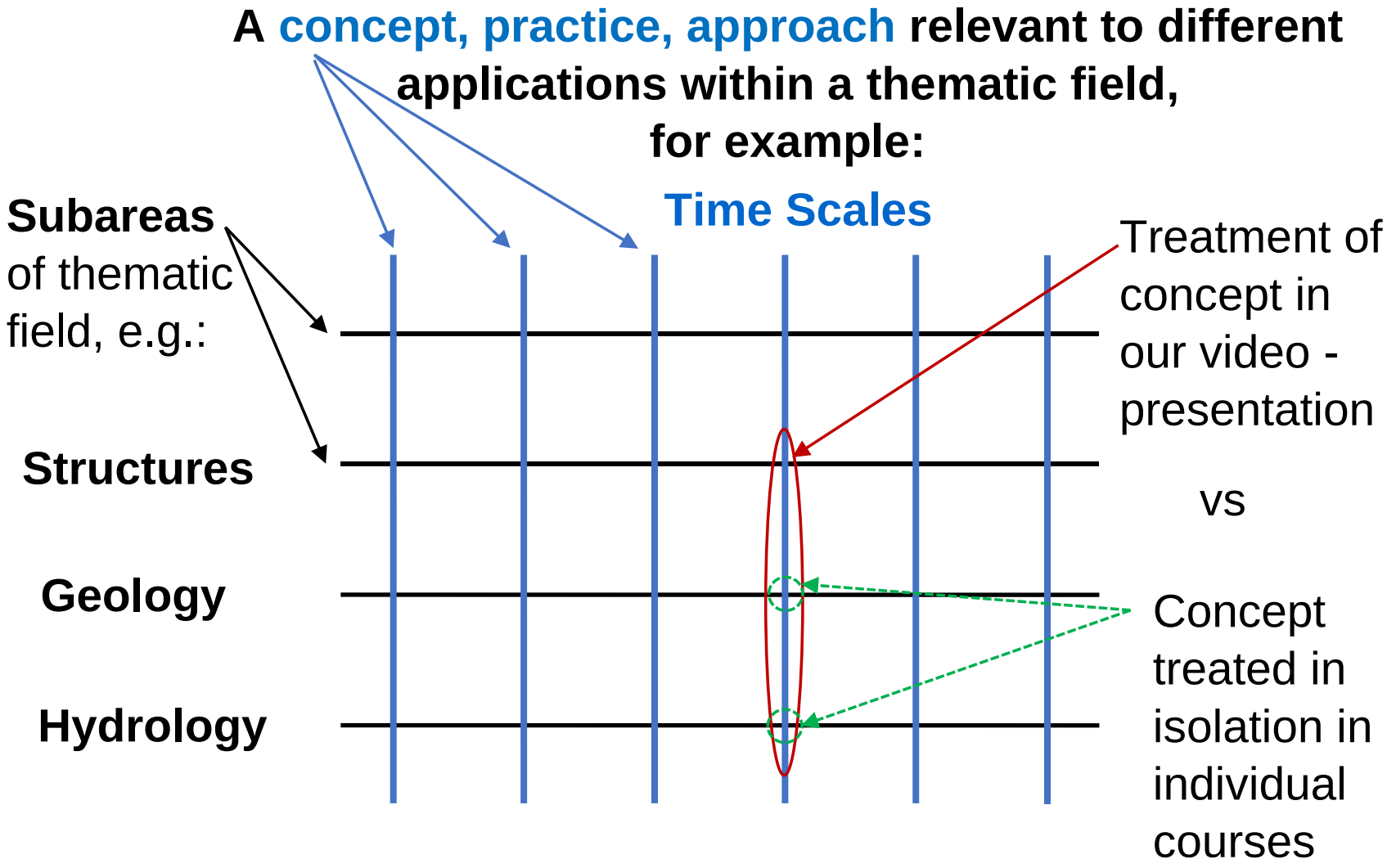
raise education status

Focus on key topics running through the curriculum



Selected key concept: time & time scales in civil engineering

- Theme threads
  - **relationship between time and (perceivable) change**
  - **necessary length of time to study phenomena**

- Title: “Earth, Water, Time and We, the civil engineers”
  - Subtitle: “Time scales in civil engineering projects and their relevance in Geology for Engineers (1st semester) and Engineering Hydrology (5th semester)”

Scope & intended audience

- Scope: **a cohesive preview (trailer) of civil engineering studies**
- Primary audience: freshmen at the School of Civil Engineering at NTUA
- Also: high school students contemplating studies in Civil Engineering

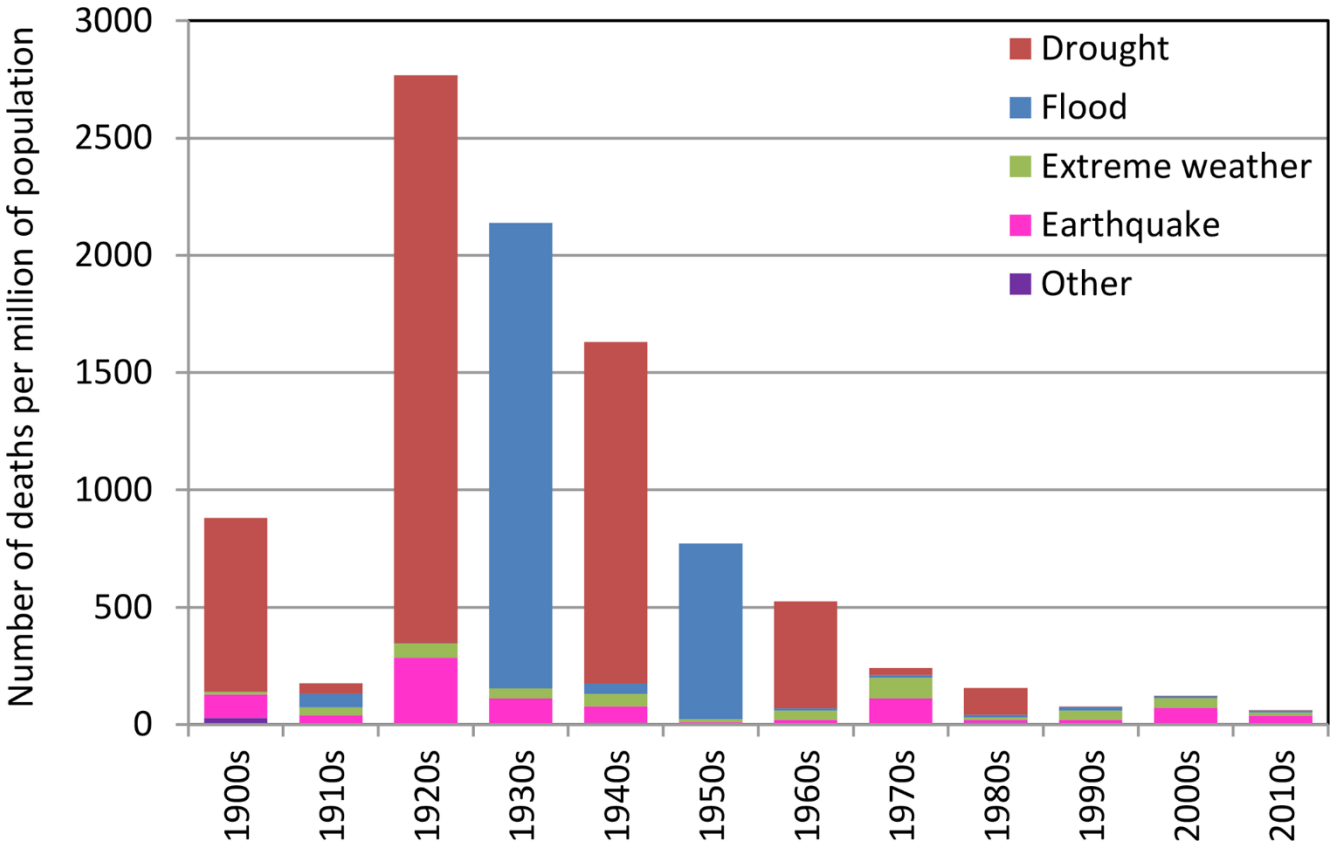
Proposed methodology: from core idea to video-presentation

- Agree upon theme, title and audience
- Four team members contribute ideas → create plot in four segments
- Plot → storyboard (slide by slide content)
- **Internal reviews**
- Revised storyboard → full script
- **1st delivery of talk → external & internal reviews**
- Revise storyboard/ppt/script (invite a 5th team member) → record final four video segments → video-presentation

Structure of video-presentation on time & time scales

- Age of contemporary civil engineering works
- The earth is alive – the geological environment and its changes through time
- Civil engineering works and their dynamic relationship with geologic time
- We study the past to predict the future
- Different trends of temperature-sea level & rainfall at different time scales
- Epilogue – Sanctus (Epinikion) for engineers

Sanctus (epinikion) for engineers: reduce risk, give hope



Koutsoyiannis (2020)

When considering a suitably long time frame, we can see that engineers reduced risk

(addressing students) by choosing to study **civil engineering**, ***you*** continue this great tradition of reducing risk

Good practices

- Short segments (< 10 min, total: 42 min)
- Quiz questions (guessing questions, followed by a pause before the answer is given), e.g.
  - Guess whether the surface of Greece has a) more/ b) less rock than soil or c) about the same?
  - What is the rate of increase of the average temperature of earth during the last decades a) 0.1-0.2 °C/decade, b) 1-2 °C/decade, c) 10-20 °C/decade

Lessons learned

- Quality education materials produced collaboratively require significant production and coordination time
- The focus on time highlights a perennial difficulty of the human brain to perceive time
  - students have incorrect understandings about fundamental concepts, particularly those that involve very large or very small temporal and spatial scales (NRC, 2012)
  - Aristotle: “without change, there is no time”

"οὐκ ἔστιν ἄνευ κινήσεως καὶ μεταβολῆς χρόνος", Physics, Book 4, [218b - 219a]

Concluding remarks

- Proposed an **alternative way to choose content**: follow threads running through the entire curriculum
- Demonstrated the practice of **peer review for the development of educational material**
- Proved the **feasibility of teamwork for the production of quality educational material without extra funding**

Ultimate conclusion

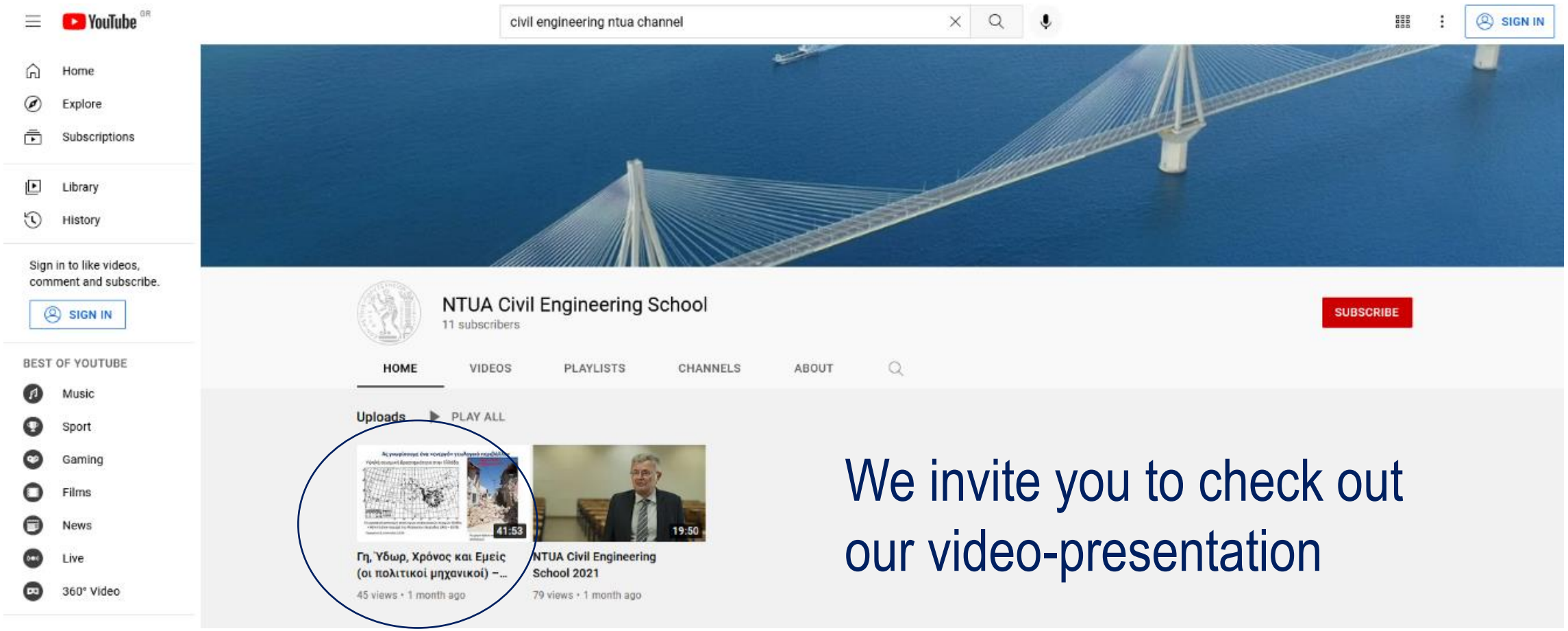
- **Raise education quality = Raise education status**

- **To raise education status, *do education as we do research***

References

- Koutsoyiannis, D. (2020). Revisiting global hydrological cycle: Is it intensifying?, Hydrology and Earth System Sciences, 24:3899–3932.
- National Research Council (NRC) (2012). Discipline-based education research: Understanding and improving learning in undergraduate science and engineering, National Academy Press, Washington, DC.
- Shulman, L. (1993). Putting an End to Pedagogical Solitude, Change, 25:6:6-7.

Thank you for attending



We invite you to check out our video-presentation