

**Supplement:** Pantazidou, M. & Calvello, M., What kinds of educational material are useful for and desired by university instructors? The case of Geotechnical Engineering

**Table S1.** Questionnaire: Questions and Answers with percentages

ID	Question Answers & percentages	Total Answers
<b>Section A – Your Educational Material</b>		
Q1	Have you ever developed shareable educational material yourself? Yes (40%) / No (60%)	<b>[Fig. 2]</b> 62
Q2	If you answered "yes" to Question 1, please give examples and sources if you have made this material publicly available (e.g. give URLs, references of papers) Open-ended	<b>[Table S2]</b> 24
Q3	Are you satisfied with the educational material you currently use in your teaching? Not really (7%) / Moderately (45%) / Adequately (45%) / Fully (3%)	<b>[Fig. 4a]</b> 62
Q4	If you answered "Fully" to Question 3, please provide sources (e.g. books, URLs, references of papers) of the material used in your teaching, including subject and course/module. Open-ended	0
<b>Section B – Searching for Educational Material</b>		
Q5	Have you ever searched for educational material to augment what you have/use? Yes (87%) / No (13%)	<b>[Fig. 3]</b> 61
Q6	If you answered "yes" to Question 5 (= have you searched), for which geotechnical engineering topic(s) have you searched? Soil identification and classification (57%) / Groundwater flow (49%) / Consolidation (43%) / Soil constitutive modelling (e.g. stress distribution, shear strength) (51%) / Foundations (e.g. bearing capacity, settlements) (58%) / Retaining walls (38%) / Slope stability (51%) / Laboratory testing (60%) / Field testing (58%) / Other (please specify) (23%)	<b>[Fig. S1]</b> 53
Q7	If you answered "yes" to Question 5 (= have you searched), where/how have you searched? Additional textbooks (72%) / Scholarly papers (journals) (77%) / Scholarly papers (conferences) (51%) / Blogs - webpages with educational material (53%) / Asked recommendations from colleagues (28%) / Other (please specify) (32%)	<b>[Fig. S2]</b> 53
Q8	Were you satisfied with any material found? Yes (55%) / No (45%)	<b>[Fig. 4b]</b> 53
Q9	If you were satisfied with some of the material found ("yes" in 8), please give examples, sources (e.g. URLs, references of papers) and a brief description of how you incorporated the material in your teaching, including subject and course/module. Open-ended	<b>[Table S3]</b> 24
Q10	If you were not satisfied with some of the material found (answered either "yes" or "no" to Question 8), in what way was the material inappropriate? The material was not adaptable (31%) / The material would take a lot of time to adapt it (62%) / The material did not have adequate documentation (e.g. you could not understand it well enough to teach it, you could not understand its educational goal, some data were missing) (46%) / The material did not come with a reuse permit, such as Creative Commons (28%) / Other (please specify) (21%)	<b>[Fig. 5]</b> 39

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### Section C – Your “wish list” of Educational Materials

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Q11	<p>Please imagine and describe the "educational material of your dreams", regardless of whether you believe there exists or that someone might produce it. Assume that there is a "Santa Claus for Geotechnical Engineering Instructors" who delivers all year round. Please describe what you would ask Santa, including subject and course/module where you would use the material.</p> <p>[NOTE Respondents were given the option to answer this question with the materials (a) they have developed and described in Question 2, (b) they use and have described in Question 4, or (c) they have found and described in Question 9.]</p> <p>Open-ended</p>	<p><b>[Table S4: excerpts from selected answers]</b></p> <p>47</p>
Q12	<p>What might make it difficult for you to develop the "educational material of your dreams"?</p> <p>Insufficient communal content knowledge (15%) / Insufficient personal content knowledge (15%) / Insufficient knowledge of numerical analysis (18%) / Insufficient knowledge of IT (e.g. video production) (46%) / Insufficient soil data (20%) / Insufficient time (80%) / Insufficient support (e.g. by a graduate student) (38%) / Insufficient recognition for the ultimate product (38%) / Other (please specify) (18%)</p>	<p><b>[Fig. 6]</b></p> <p>61</p>

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### Section D – Demographic Data

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Q13	<p>Country of the University where you teach</p> <p>29 different countries: higher number of responses from France, Turkey and UK (6 responses each)</p>	<p>61</p>
Q14	<p>Instructional experience</p> <p>PhD Candidate – Graduate Student Teaching Assistant (5%) / New Instructor –Professor with experience &lt; 1 year (5%) / Instructor – Professor with experience between 1 – 5 years (15%) / 5 – 15 years (29%) / &gt; 15 years (46%)</p>	<p><b>[Fig. 1]</b></p> <p>61</p>
Q15	<p>Professional experience</p> <p>Registered engineer (61%) / Little or no professional experience (13%) / Independent geotechnical engineering consultant &lt; 5 years (16%) / &gt; 5 years (23%) / Experience in geotechnical engineering consulting company &lt; 5 years (15%) / &gt; 5 years (18%) / Other (please specify) (13%)</p>	<p>61</p>
Q16	<p>Have you had any formal training in Education?</p> <p>NOTE Formal training may range from one short course to certificate-granting programs offered by a university teaching and learning center or a state agency.</p> <p>Yes (67%) / No (33%)</p>	<p>63</p>
Q17	<p>Please write your name and e-mail if we have your permission to contact you and ask further elaboration on your answers to Questions 2 (material developed), 9 (material found) and 11 (dream material). You may also leave us comments in the same box.</p>	<p>25</p>

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**Table S2.** Shareable educational material developed by respondents (Question 2). The answers consisted of the links, the descriptions were added by the authors.

No	Description of educational material	Embedded link
1	A compilation of resources for teaching geotechnical engineering produced for a Teaching Strategies & Resources Workshop organized by the United States Universities Council on Geotechnical Education and Research (USUCGER), which includes a collection of <a href="#">mechanical models</a> , including <a href="#">models for soils</a>	<a href="#">[link]</a>
2	A collection of geotechnical learning modules consisting of mini lectures, lecture transcripts, videos of test demonstrations and interactive software for simulating laboratory tests (soil classification, shear stress, compaction, consolidation, seepage)	<a href="#">[link]</a>
3	An album with high quality photographs of the common geotechnical laboratory tests (sieve, hydrometer, liquid limit – Casagrande & fall cone, plastic limit, compaction, consolidation, specific gravity, specimen preparation for coarse grained soil)	<a href="#">[link]</a>
4	Conference paper on a slope stability case study developed for instruction	<a href="#">[paper]</a>
	Conference paper on an embankment case study developed for instruction	<a href="#">[online supplement]</a>
		<a href="#">[paper]</a>
		<a href="#">[online supplement]</a>
5	YouTube channel with a collection of lectures <sup>1</sup> in Soil Mechanics and another specialized course	<a href="#">[link]</a>

<sup>1</sup> “Shareable” in the narrow sense (mainly shareable with students)

**Table S3.** Satisfactory educational material found by respondents (Question 9). The answers consisted mainly of the links, the description were added by the authors. Footnote<sup>1</sup> includes as a counter example a reference too broad to be reviewed for relevance to geotechnical engineering.

No	Description of educational material	Embedded link
1	The Teaching Aids collection of the United States Universities Council on Geotechnical Education and Research (USUCGER)	<a href="#">[link]</a>
2	Groundwater flow demonstration model with thoughtful commentary and Spanish subtitles	<a href="#">[link]</a>
3	From Professor Ralph Peck’s legacy website <a href="https://peck.geoengineer.org/">https://peck.geoengineer.org/</a> video “ <a href="#">Learning from the Ground</a> ”	<a href="#">[link]</a>
4	Dave’s landslide blog, which provides a commentary on landslide events occurring worldwide	<a href="#">[link]</a>
5	A YouTube video produced by a consulting company on Shelby tube sampling	<a href="#">[link]</a>
6	Reference to the seepage mini lecture of educational material No 2 in Table S2	<a href="#">[link]</a>
7	A collection of videos on topics from civil and structural engineering. Includes videos by Professor Burland highlighted in a <a href="#">TC306 news item</a>	<a href="#">[link]</a>
8	The textbook by Abramson, L.W., Lee, T.S., Sharma, S., & Boyce, G.M. (2001). Slope Stability and Stabilization Methods, 2 <sup>nd</sup> Edition (1 <sup>st</sup> Edition 1995), Wiley	<a href="#">[link]</a>

<sup>1</sup> A repository of science activities for all education levels: <https://serc.carleton.edu/index.html>

**Table S4.** Excerpts from descriptions of educational materials of the respondents' dreams (Question 11) with examples of coding category [*VISUAL AND CONCEPTUAL UNDERSTANDING*]

No	Excerpts from responses to prompt for describing the “Educational material of your dreams”
1	For each topic addressed in a course, I would like to have educational material, both as written text (e.g. chapters of textbook) and in video format (e.g. short presentations with audio commentary), for each one of the following items - <i>definition of terms</i> [ <i>CONCEPTUAL UNDERSTANDING</i> ] - theoretical explanations (including governing equations) - practical significance - real world applications (i.e. case studies with data) - connections with the other topics of the course. To promote the active involvement of the class, for each topic addressed in a course I would like to have - tutorials designed for single students and for group activities - simple online numerical software to 'play with' (e.g. solving tutorials, <i>visualizing results</i> [ <i>VISUAL UNDERSTANDING</i> ] based on different values of input parameters) - self-assessment tests
2	<ul style="list-style-type: none"> <li>• A selection of videos (YouTube channel) that contains real problems showing in quick time <i>how key concepts are used</i> [<i>CONCEPTUAL UNDERSTANDING</i>] in solving geotechnical problems, and the role of engineers in solving these.</li> <li>• A catalogue of real geotechnical problems. Site investigation data, assumed soil parameters, solution adopted. Engineer's commentary describing the challenges and their approach.</li> </ul>
3	My dream would be something like a website, where topics would be described with expandable assignments/examples along the text and including hyperlink references to guide the reading experience. Clear reference to the scientific papers which the concepts are based on is essential (ideally the papers are also freely available on the website and used actively in the text). [...] Throughout the text reference to relevant cases where the knowledge was successfully used in "real life" and/or how to set up a kitchen table experiment showing the concept should be generally available.
4	I would dream of developing more real-world examples, including successful practices and failed practices. Especially, the compilation of failed practices would be very educational, highlighting a critical thinking in a way of geotechnical engineering.
5	A comprehensive universal repository of geotechnical case histories that has all the information needed for back analysis available under Creative Commons license.
6	<ul style="list-style-type: none"> <li>• I would like to <i>see stresses and displacements</i> [<i>VISUAL UNDERSTANDING</i>] (like Figure 6.9 by Potts and Zdravkovic, 2012)<sup>1</sup> produced numerically for bearing capacity problems. I would like to see side by side, for the same soil, (i) the input parameters of the numerical model and (ii) the input parameters used for calculating separately by hand bearing capacity.</li> <li>• I would like to have a <i>visualization aid</i> [<i>VISUAL UNDERSTANDING</i>] for stress distribution under loaded areas. In lieu of the “stress bulbs”, I would like to have diagrams depicting <math>\sigma_1</math>, <math>\sigma_3</math>, at closely-spaced selected locations, with arrows (correct magnitude and orientation). At the very least, I would like to see color diagrams for <math>\sigma_z</math> instead of bulbs. I would also like to see in the same manner <math>\sigma_z</math>, <math>\sigma_y</math>, <math>\tau</math> (correct magnitude and orientation). Ideally, I would like to have something interactive: I would like to move the mouse on the screen, perhaps on a color diagram for <math>\sigma_z</math> and click on locations to see these stresses.</li> </ul>
7	Library of homework problems with "real world" data (e.g., boring logs, lab test results, field test results)
8	My dream material must be descriptive at first. Then, it should give theoretical background for each subject it contains along with sketches and real situation photos where it is possible. It should precisely describe one or several ways how to deal with such problem and it should be followed by calculations. At the end it should contain resolved real life example.
9	My dream material would cover all the relevant subjects on soil mechanics with a single 'benchmark' case, exploring the field response, the effect of seepage, consolidation, and its constitutive modeling
10	An app for students to <i>see videos/simulations of basic failure types</i> [ <i>VISUAL UNDERSTANDING</i> ] in geotechnical engineering
11	I would REALLY like to find online simulations of common soil laboratory tests such as: shear box, direct simple shear, oedometer, Rowe-Barden cell, and triaxial testing. The simulation

should provide realistic results (with bumps and jumps) and should also allow me to make mistakes

- 12 A book that would be the ultimate digest of all that has been published for the last 300 years
  - 13 the "ideal" material should be a box containing Text, image, simulation and procedure movie
    - Short *animations/videos describing fundamental concepts* (effective stress, consolidation, bearing, deformation, etc.) [*CONCEPTUAL UNDERSTANDING*]
    - Interactive-short questions to query student understanding of basic concepts
  - 14 *Simulations / spreadsheets to illustrate the influence of certain parameters on geotechnical calculations* [*VISUAL UNDERSTANDING*] (e.g. bearing capacity below a foundation)
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<sup>1</sup> Potts, D. and L. Zdravkovic (2012). Computer Analysis Principles in Geotechnical Engineering, in: Burland, J., Chapman, T., Skinner, H. and Brown, M., Eds. (2012). Institution of Civil Engineers (ICE) Manual of Geotechnical Engineering, Vol. I, Chapter 6, ICE publishing, London, UK.

<sup>2</sup> Selections of answers and excerpts were made by each of the two authors independently of the other. **Answers in red bold numbers** were selected by both authors.

**Table S5.** Excerpts from answers to Question 11: descriptions of educational materials of the respondents' dreams that make reference to case studies

No	Excerpt from answers to Question 11
1	I would dream of developing more <i>real-world examples</i> , including successful practices and failed practices. [...] It would be useful for the instructors using such <i>failure cases as a case study</i> , over the different levels of geotechnical classes (from Intro. to Geotech, Foundation Eng., to Geotechnical Design). <b>[Answer No 4 in Table S4]</b>
2	For each topic addressed in a course, I would like to have [...] real world applications (i.e. <i>case studies with data</i> ) <b>[Answer No 1 in Table S4]</b>
3	<i>Videos including case histories</i> delivering the Soil Mechanics information and concepts in a step by step manner.
4	Good photographs and <i>case studies</i> are the most useful thing.
5	A catalogue of <i>real geotechnical problems</i> . SI data, assumed soil parameters, solution adopted. Engineer commentary describing the challenges and their approach. <b>[Answer No 2 in Table S4]</b>
6	My dream would be something like a website, where topics would be described with expandable assignments/examples along the text [...] Throughout the text <i>reference to relevant cases</i> where the knowledge was successfully used in "real life" <b>[Answer No 3 in Table S4]</b>
7	A comprehensive universal <i>repository of geotechnical case histories</i> that has all the information needed for back analysis <b>[Answer No 5 in Table S4]</b>
8	<i>Videos-Files Case Histories</i> - Including technical aspects and details and not simply lay-person level documentary style material
9	My dream material must be descriptive at first. Then, it should give theoretical background for each subject [...] At the end it should contain resolved real life example and also additional <i>case study</i> with offered solution. <b>[Answer No 8 in Table S4]</b>
10	Picture/video <i>database for case studies</i> (sorted by topic)
11	Example projects, soil profiles or data that can be issued to students to use for coursework. <i>Actual projects</i> with layouts and constraints that affect the choice of construction methodology and therefore impact on the design.
12	<i>Case histories</i> that students can use.
13	Includes adequately visual and conceptual information. Simple but effective. Should include <i>field cases</i> . Could define the basic mechanism that lies beneath the topic [NOTE The final phrase was interpreted to mean that we should locate case studies that demonstrate the basic mechanism of each geotechnical engineering topic taught.]
14	Library of homework problems with <i>real world data</i> (e.g., boring logs, lab test results, field test results) <b>[Answer No 7 in Table S4]</b>
15	Short video tours of <i>engineering projects</i> - i.e. 5 minute video tours of deep foundations being installed, various stages of top down construction of retaining walls, etc.

Figure S1. Answers to Question 6 “If you answered ‘yes’ to Question 5 (=have you searched for educational materials) for which geotechnical engineering topics have you searched?”

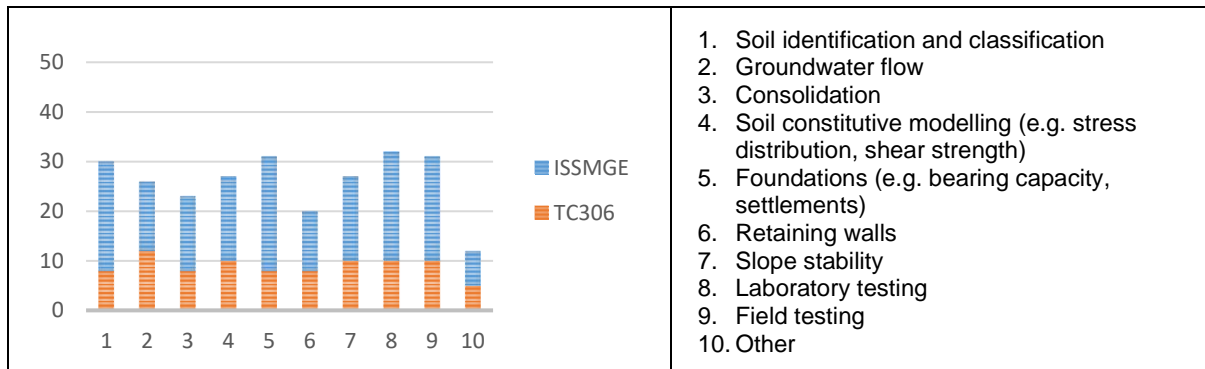


Figure S2. Answers to Question 7 “If you answered ‘yes’ to Question 5 (=have you searched for educational materials) where/how have you searched?”

