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GEOLOGICAL GASTRONOMY - A POSSIBLE WAY OF EXPLAINING GEOLOGICAL PROCESSES FOR CIVIL ENGINEERING STUDENTS

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Abstract. Geology is a crucial and integral part of the curriculum in the study of civil engineering. Geology is essential for civil engineering projects, for example, to understand rock mechanics for the purposes of tunnelling, soil mechanics for the design of building foundations or to assess geological hazards for the safe construction and future use of buildings. However, in general, high school graduates do not come with sufficient basic knowledge of geology, and studies show that they consider it a boring and uninteresting subject in high school that they do not see the relevance to everyday life. Therefore, it is the lecturer's fundamental task to change the mindset of the student majority and prove the need for knowledge of geology in civil engineering. Many teaching methods can be used for this purpose, such as the use of technology and interactive tools, hands-on activities, collaborative learning, etc. However, without exciting the interest of the students, these methods are not effective as such. Therefore, the presented paper discusses methods to primarily engage students' interest in the individual topics discussed and possible methods to explain geological processes by linking them to everyday activities, making complex scientific concepts more accessible and understandable. Furthermore, students will remember and recall information more likely if it is linked to something they already know and understand. Using simple methods, a teacher can tell students an engaging story from the world of geology in which they can easily find connections to the civil engineer's practice.

1 INTRODUCTION

As long as humans build on Earth, underground, or use natural materials for their structures, knowledge of geology and its basic principles will be an essential part of a civil engineer's education. Every structure interacts with its subsoil, and it depends not only on the type of construction and the method of its foundation, but also on the geological conditions of the site. Throughout history, there are many examples where disrespect for geological conditions has led not only to great material damage, but also to the loss of many lives. Of course, we can mention the Vajont dam disaster, where more than 2,000 people lost their lives in a moment due to human negligence in ignoring unfavourable geological conditions, e.g. [1]. Fortunately, not every instance of disregard or insufficient understanding of geological conditions leads to such a disaster, but we encounter the influence of geological conditions on construction and the necessary subsequent measures daily (Fig. 1). Geology is therefore a very useful subject in the study of civil engineering. However, high school graduates generally lack sufficient basic knowledge of geology, and studies show that they consider it a boring and uninteresting subject

that they perceive as irrelevant to everyday life, e.g. [2]. Findings of this study of 1,641 fourth-year high school students in Spain showed that participants generally express more negative attitudes toward geology than toward other scientific disciplines. Although they do not consider it to be a difficult subject, they find it boring and uninteresting. Demographic factors, school type, or gender do not explain these attitudes. The fundamental task of university lecturers is therefore to change the mindset of most students and demonstrate that knowledge of geology is essential in civil engineering.

Figure 1: Landslide in Žiželice, main scarp is approximately one meter away from the Baroque chapel.

There are many teaching methods that can be used for this purpose, such as the use of technology and interactive tools, practical activities, cooperative learning, etc., but without attracting students' interest, these methods alone cannot be effective. For this reason, the article focuses on possible ways and methods to get students excited about the topics being discussed and how to explain geological processes by linking them to everyday activities, making scientific concepts more accessible and understandable. In addition, students remember and recall information better when it is linked to something they already know and understand. Using simple methods, teachers can tell students an engaging story from the world of geology, in which they can easily find connections to the practice of civil engineering.

2 TEACHING GENERATION Z

Generation Z is a generation that has grown up in a world of advanced information and communication technologies and in a digitalized world. Modern information and communication technologies are natural everyday tools for this group of young people, shaping their understanding of the world around them, their way of learning and communicating, and influencing their values and priorities. Due to their relationship with modern technologies, Generation Z is perceived as different from previous generations, which is also reflected in their different study habits. Generation Z can be characterized as self-confident, technically proficient, bright, and globally connected e.g. [3]. They are skilled at using social networks and media and move naturally in the virtual environment. Students of this generation are used to obtaining information quickly and easily, which leads to rapid development of their thinking [4, 5]. However, based on other studies e.g. [3, 6], some Generation Z students have problems reading longer and more complex texts, and their attention span is short. They are used to brief and well-structured texts. They are good at gathering information, but often miss the context in which it should be interpreted.

Generation Z is also characterized by a tendency to learn things on their own, which is reflected in the number of online learning programs [6] and has a learning style specific to online platforms [7]. When teaching Generation Z university students, it is generally crucial to focus on an interactive, participatory, and creative approach that meets their expectations and learning preferences. These students want to be seen as adult partners in education, not passive recipients of information, and they appreciate teaching that is based on collaboration, discussion, and reflection. Teaching should be inspiring and provide space for critical thinking, independent decision-making, and practical application of knowledge, for example through team projects, case studies, or real-world problem solving.

Research shows that students enjoy being actively involved in teaching, but often lack sufficient interaction with teachers, which can reduce their motivation and engagement. It is therefore important to create a socially and intellectually stimulating environment that promotes open communication, mutual trust, and the development of personal responsibility for learning [8]. In the context of teaching geology to Generation Z civil engineering students, it is essential to go beyond traditional teaching approaches and recognize the influence of disciplinary culture on teaching and learning. Academics often identify most closely with their discipline, and effective pedagogy must reflect this identity [9].

Although it may seem that face-to-face teaching is no longer so important for Generation Z, it is still indispensable. Face-to-face lectures at universities still make sense and offer unique advantages that online teaching materials alone often cannot fully replace. According to Jõgi et al. [8], students appreciate the interactive, relational, and participatory learning environment that is more naturally created through personal contact. The study found that students often perceive current teaching practices as too focused on one-way knowledge transfer, while they want cooperative, reflective, and discussion-based learning – elements that are more effectively supported in face-to-face settings. This is confirmed by a comparative study by Arias et al. [10], which found that students in face-to-face courses had statistically significantly higher test scores and greater improvement on instructor-specific questions in the post-test compared to their online counterparts. However, a broader review study by Stevens et al. [11], revealed mixed results: while 41% of studies preferred online teaching, another 41% found no significant

difference, and only 18% preferred face-to-face teaching. This suggests that the effectiveness of each of these teaching methods depends mostly on the context, course structure, and student engagement strategies.

Overall, while online materials offer flexibility and accessibility, face-to-face presentations remain valuable for supporting deeper engagement, critical thinking, and social interaction, particularly when teaching complex or practice-oriented subjects such as geology in civil engineering. By combining creative and engaging teaching strategies – from interactive simulations to digital storytelling from the field – educators can better engage students and improve learning outcomes.

3 EXAMPLES OF OUR PRACTICE

Based on the above, it's clear that Generation Z students have very different expectations of teaching than many of us did. Because today's students are so used to getting information at the click of a button, they can't and don't want to wait until the end of a lecture to get the important information. Today's students want to spend their time efficiently; many of them work while studying and therefore do not want to waste time on something that does not interest them and which they consider useless. We know from our own experience that if a lecturer does not capture the students' attention in the first few minutes of a lecture, they will usually lose their attention and the lesson becomes ineffective. At the same time, it is essential to actively engage students throughout the lesson, ask them questions, ask for their opinions and solutions, include quizzes, etc. It is also very useful to use examples from everyday life, even seemingly unrelated ones, to make lessons more attractive and effective. According to Chiaravalloti [12], incorporating visualization techniques – such as encouraging students to create vivid mental images or linking abstract concepts to visual stimuli – can significantly increase the depth of information encoding. This approach is particularly effective when integrated into storytelling or contextualized learning scenarios, as it helps students anchoring new knowledge in a meaningful and memorable way. Some practices that have proven successful in our case are listed below.

3.1 Change in established procedure for teaching

From our experience teaching geological subjects at our faculty, we know that it is necessary to rethink the approach to teaching. The once preferred teaching style, where certain topics were covered by first introducing students to the basics of the subject matter and then gradually developing the topic until a practical example was given at the end, no longer works today. This method is not attractive enough; students do not see the usefulness of the material being taught right from the start and lose interest and attention. This method mostly copies the study materials available online, and today's students have no reason to attend lectures if they feel that they will not learn anything new that they cannot find on the internet. It is therefore more appropriate to take the opposite approach – to give a specific example of a phenomenon ideally directly related to construction practice and analyze it to get to the basics (Fig. 2). If students see the usefulness of a topic right from the start, they are more willing to listen and discuss, which helps them to learn and, above all, understand the material better. Students should be actively involved in the analysis of the issue, whether through discussion prompted by appropriate questions from the teacher or using modern applications such as Slido [13] or

Kahoot [14].

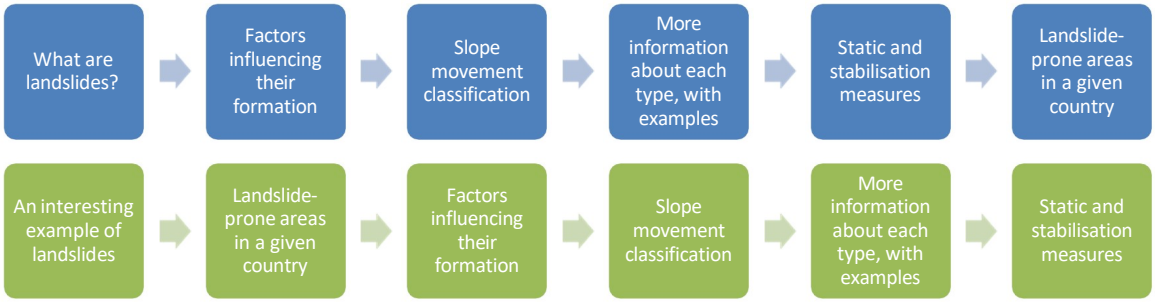

Figure 2: Simplified schematic procedure for a typical lecture on the topic of "slope deformation" (blue), simplified schematic lecture procedure more suitable for attracting attention (green).

Using the commonly discussed topic of "slope movements" (Fig. 2) as an example, we can demonstrate the differences between the traditional way of teaching the topic and a modified approach designed to increase student engagement. In a standard lecture, the material is presented in the order in which it is usually structured in textbooks, i.e., from defining what slope movements are, through the factors that cause them, to possible solutions. Unfortunately, in most cases, this approach does not capture the student's attention at the beginning of the lecture, and the student becomes bored, leaves early, or, in the best case, "sees the light" at the end of the lecture when they finally see an engaging example. In practice, we have found it useful to reverse the procedure and grab students' attention at the beginning with either a catastrophic landslide (e.g., Vajont) or a landslide that was interesting for some reason (e.g., the rescue mission of thousands of pieces of Parma ham). Various communication ways at the beginning of the lecture are very useful in helping to establish a connection with students. The lecture itself can be introduced, for example, with a personal story related to a landslide, an interesting fact or statistic, a quote, a rhetorical question, etc. It is also useful to show statistics on how many landslides occur each year in a given country or worldwide. There are online tools suitable for this purpose e.g., Statista [15] (Fig. 3). It is then appropriate to show that this issue also affects your country. Once students understand the importance of the topic at the beginning, you can continue with the more "boring" parts of the lecture, such as the classification of landslides, a description of individual types, etc. In geology, it is a great advantage that many geological phenomena can be shown to students on video, simulations, etc., so the entire lecture can be interspersed with these. All these tools increase the attractiveness of the topic and, at the same time, the likelihood that students will be willing to understand and remember it.

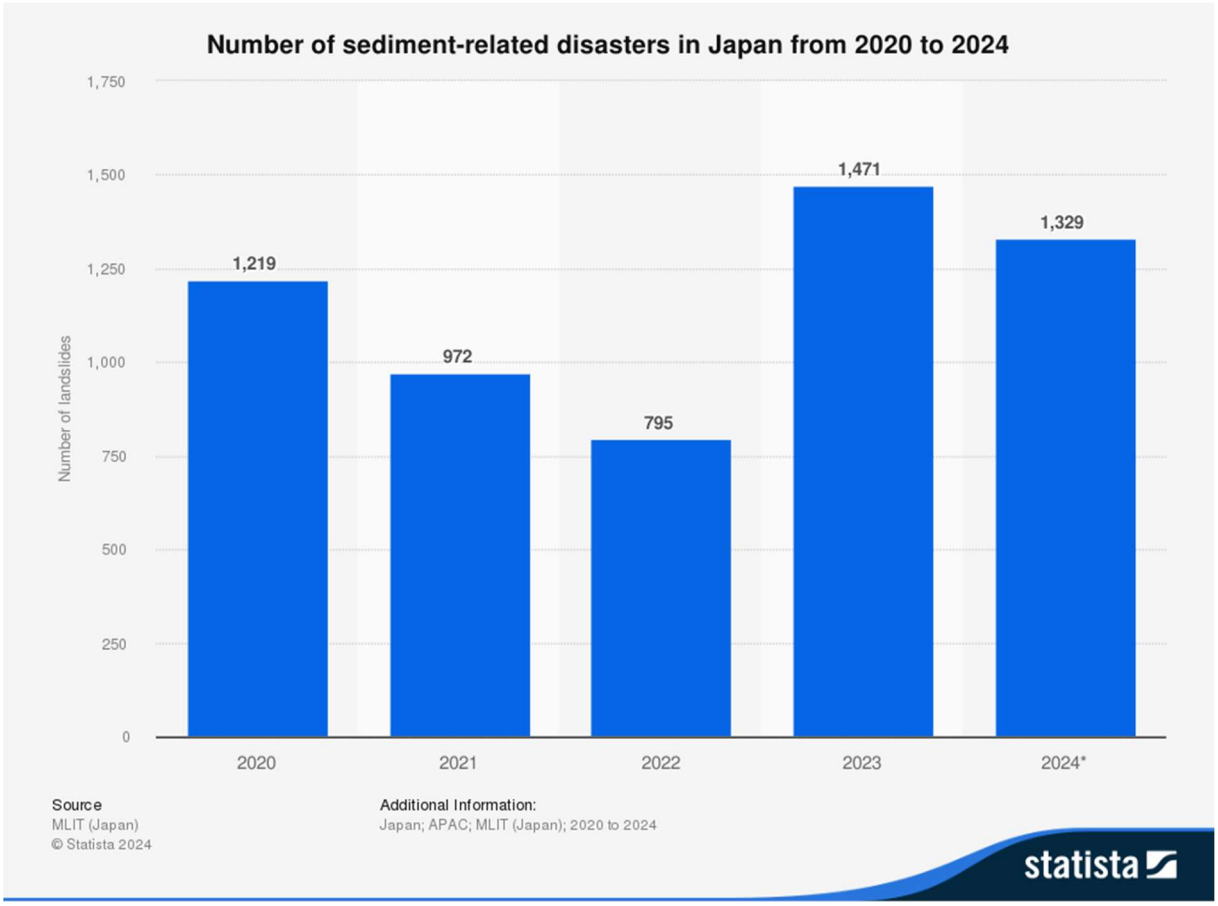

Figure 3: Number of landslides in Japan in years 2020 – 2024 generated by [15].

3.2 Geological gastronomy

It may be surprising that examples from everyday life, such as food and drink, can be used in teaching geology. The use of food and drink analogies can be considered effective mnemonic devices that help students remember the material being covered. The suitability of mnemonic devices in science education is also highlighted in a study by Jurowski et al. [16], which shows that mnemonic devices are effective memory strategies that significantly aid in the memorization of complex or abstract information. In addition, their use increases test success, but also boosts students' self-confidence. Suitable types of mnemonics for geology include visual associations, storytelling techniques, the loci method, and acronyms.

One possible mnemonic tool for practical teaching of geology, petrography, is comparing rock structures to food. Using the example of the porphyritic structure of igneous rocks, we can demonstrate a simple mnemonic technique using an raw dessert: the porphyritic structure of plutonic rocks (Fig. 4) can be compared to the bottom layer of the dessert, i.e., crushed nuts with large pieces of nuts; the middle layer, i.e. the porphyritic structure of intrusive rocks (Fig. 5), can be compared to chia pudding with large pieces of nuts remaining, and the top layer, i.e. the porphyritic structure of extrusive rocks (Fig. 6), can be compared to chocolate topping with coconut or sprinkles. In addition, the preparation of such a dish can be offered to students as “optional homework,” which often attracts attention (Fig. 7).

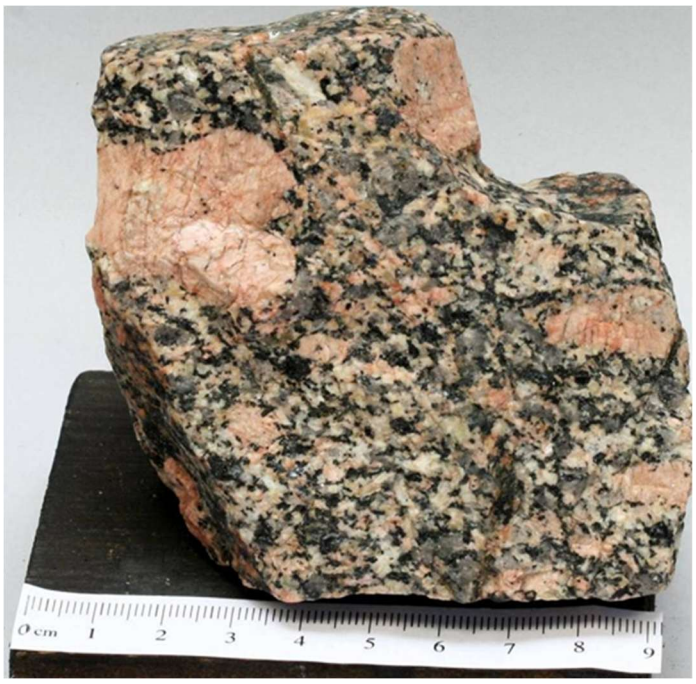

Figure 4: Porphyritic structure of plutonic igneous rocks (granite).

Figure 5: Porphyritic structure of intrusive igneous rocks (granite porphyry).

Figure 6: Porphyritic structure of extrusive igneous rocks (basalt).

Figure 7: Optional homework, raw porphyritic dessert (students' photo by Květa Kerhartová).

Similarly, marble breccia can be compared to "tlačenka" (Czech "soft" salami, see Fig. 8). Already during lessons in which we use these mnemonic devices, we observe an increase in students' interest in the topic being discussed at that moment. At the same time, it can be stated that during the practical part of the exam, which involves identifying rocks, students often mention the connection "That's the 'tlačenka'!", "That's chia pudding!".

Figure 8: Marble breccia in the metro station Můstek, Prgaue (left), duryňská „tlačenka“ (right, taken from [17]).

As a third gastronomic example, now involving beverages, we can mention a mnemonic device to help remember that “as the temperature of water increases, its solubility increases”, a phenomenon that affects the chemical weathering of rocks, which prevails in tropical humid regions over physical processes. This process can be associated with the preparation of a mojito, a drink typically consumed on hot summer days, in which the low drink temperature causes ice crystals to remain for a long time, whereas in winter, when we prefer to drink warm mint tea in our climate, the sugar does not remain in crystalline form. The simplicity of these analogies and the ease with which they can be imagined help students to remember and learn the topics covered. Moreover, students usually appreciate the preparation of the drink's cold version as optional homework.

CONCLUSIONS

- Teaching geology at civil engineering faculties in the context of Generation Z requires a fundamental change in approaches that reflect the specific needs and expectations of today's students. A key feature of effective teaching is the ability of the teacher to engage students at the beginning of the lecture, actively involve them, and use methods that promote their attention, motivation, and deeper understanding. It appears that traditional linear teaching from theory to practice is not very attractive to today's students, while the reverse approach – starting with a concrete example from practice – increases their interest and willingness to learn. Mnemonic devices also play an important role, including comparisons of geological phenomena to everyday experiences such as food and drink, which help students remember and connect the topic to the real world. Although online teaching offers flexibility, personal contact remains irreplaceable for the development of critical thinking, discussion, and social interaction. Successful teaching of geology thus lies in a combination of inspiring content, interactive methods, and the ability to connect professional knowledge with the everyday reality of students.

11 FORMAT OF REFERENCES

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