



Article

Interdisciplinary Creation of Teaching Scenarios on Sustainable Development in Croatia

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Abstract

This paper reflects on the project for the creation of teaching scenarios for the curricular Interdisciplinary Topic of Sustainable Development, which addressed a wide variety of subjects in Croatian primary and secondary schools. The paper intends to provide insight into potentially replicable approaches for the creation of teaching resources in similar contexts. The paper aims to identify (1) the project's approaches that stimulated interdisciplinary collaboration during the creation of the teaching scenarios, and (2) the project's approaches that could facilitate the adoption of the teaching scenarios by a wide variety of subject teachers. The approaches are explored through observation and reflection by the author, who was the key expert and development leader for the teaching scenarios. The interdisciplinary creation is found to be stimulated by creating conditions for authors to explore sustainable development with an awareness of their subject's important role in it while paying attention to team relationships, processes, and results, including in online collaboration spaces. The teaching scenarios are found to be more likely to support a multidisciplinary type of implementation than an interdisciplinary one due to teaching activities mostly being not integrated enough to enable team teaching. This, however, allows more enthusiastic individual teachers to use the activities autonomously. The scenario adoption may be supported by the efficient simultaneous addressing of subject outcomes and sustainable development outcomes, by the adaptability of teaching activities, and by the connection between scenario topics and real life, including the life of the school community and wider communities.

Keywords: Education for Sustainable Development, teaching scenario, interdisciplinary collaboration

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Introduction

The curricular context

The project for developing teaching scenarios on Sustainable Development (SD) that this paper is focused on took place during an ongoing period of human-induced climate crisis (IPCC, 2021) and related extreme weather events, biodiversity crisis (WWF, 2020), related food-and-agriculture threats (FAO, 2019), the COVID-19 pandemic, a global recession, rising poverty and inequality (World Bank, 2021), manipulation of information and elections, resource conflicts, and a rise in the number of climate refugees (Institute for Economics & Peace, 2021).

Two years later, in 2023, many of these issues persist. We are living amidst intertwined crises of (un)sustainability, and education is increasingly recognised as a factor in the unsustainable status quo (Wals, 2010, as cited in Howlett et al., 2016). It is also recognised as a factor in changing it: Education for Sustainable Development (ESD) has been entering policies and curricula around the world, starting from international documents such as the Aichi-Nagoya Declaration (UNESCO, 2013) and the Sustainable Development Goals Target 4.7 (United Nations, 2015).

In Croatia, the National Curriculum for primary and secondary schools includes the curricula for seven interdisciplinary topics, one of which is SD (Ministarstvo znanosti i obrazovanja, 2019). SD is not taught as a subject, but teachers are expected to cover its outcomes through their subjects and/or extracurricular programmes. In theory, this has two benefits: (1) It creates opportunities for transforming the silo mentality of separate subjects/professions if they all start to connect with SD topics, and (2) it aims to integrate SD into the subjects/disciplines rather than letting it remain a separate field or an afterthought. In practice, teachers need capacity development and teaching resources to integrate SD into their subjects.

The outcomes in the Croatian SD curriculum are broken down into knowledge, skills, and attitudes, while being structured in three domains (Connection, Action, and Wellbeing) and closely related to sustainability competences as compiled by Rieckmann (2018). This allows for a wide range of ways the outcomes can be addressed in schools. The curriculum explicitly mentions the ecological, social, and economic dimensions of sustainability and addresses them all in its outcomes, which is essential due to the persistent misconception of SD being ecology, i.e. something that can be addressed through little more than recycling and greening projects (Laurie et al., 2016). Importantly, however, the outcomes are not divided into ecology, society, and economics “because that transcended concept is no longer able to fulfil the role of ensuring quality life within the carrying capacity of ecosystems” (Ministarstvo znanosti i obrazovanja, 2019). This shows a strong integrative intention of the SD curriculum.

3 Transformation Sparked by Collaboration

The changes required in education to address SD are not just about content, but about ESD pedagogies, too (Laurie et al., 2016). The Croatian SD curriculum requires teachers to take on the role of guides and moderators within participatory, collaborative, and transformative learning processes to empower students to become active responsible citizens (Ministarstvo znanosti i obrazovanja, 2019). This shift in the teachers' role is an important shift towards a "mature authority of facilitators of student inquiry and problem posing" (Kincheloe, 2008, p. 17) in a system that used to be content-based and teacher-centred. This, too, can benefit from teacher capacity development and appropriate teaching resources.

The project discussed in this paper produced teaching resources for the *Interdisciplinary Topic of Sustainable Development* in the form of teaching scenarios for primary and secondary schools in Croatia. The scenarios were commissioned by a government agency and published online, providing open access to all teachers and everyone else.

The project context

The teaching-scenario project lasted from late 2019 until late 2021. The scenarios covered primary schools from grade 5 to grade 8, and secondary schools of the "gymnasium" (grammar school) type, which prepares students for higher education and covers grades 9 to 12.

The project was a part of the longer European-Union-funded project "e-Schools: Development of the System of Digitally Mature Schools," run by the Croatian Academic and Research Network (CARNET), a public institution operating within the Ministry of Science and Education in the field of information and communication technology and its educational application.

The "e-Schools" objective is to increase the digital competences of teachers and students. This has included commissioning teaching scenarios for all subjects and interdisciplinary topics, featuring digital tools and interactive digital learning content for students. In the call for scenarios that formed the basis for this project, CARNET specified that each activity in a scenario for an interdisciplinary topic should simultaneously fulfil at least one subject outcome and at least one interdisciplinary-topic outcome.

Fifty scenarios were developed for SD by fifty teams of authors (teachers), covering all 37 SD-curriculum outcomes for grades 5-12. Each scenario had a unifying topic, developed through 3 to 5 activities. Each activity belonged to a specific subject or (less frequently) to an extracurricular activity and included an extension for students who want to learn more and support procedures to address special needs.

CARNET specified pedagogical criteria for the activities, which can be summed up as the following check-list that the development leader for the SD scenarios created for the activity authors:

- Are students active and motivated? Are we grounded in their interests and competences?
- Are we encouraging collaboration among students?
- Is the content linked to situations (and problem-solving) from everyday life?
- Is there an element of upbringing?
- Are we using contemporary pedagogical methods?
- Are our activities creative, innovative (and modular)?
- Are all students involved?
- Are teachers of various Information-and-Communication-Technologies (ICT) competence levels covered?
- Is the ICT use purposeful?

The following subjects were represented in SD scenarios: Biology, Chemistry, Croatian language, English language, Geography, German language, History, Informatics, Mathematics, Musical art/culture, Nature, Physical and health culture, Physics, Psychology, Technical culture, and Visual art/culture. This covers most of the subjects in Croatian primary and grammar schools and aligns with international research that identifies the need to integrate ESD into all subjects and address it across curricula (Laurie et al., 2016).

The scenarios and the digital content were delivered by a tender-winning publishing company, which hired the SD-scenario development leader (key expert for SD), experts for the implementation of digital technologies in the scenarios, and teachers of different subjects as authors of scenario activities. The project flow was defined by the project manager, but the development leader was free to design the scenario topics and lead the scenario co-creation.

The scenarios were reviewed by expert reviewers for the interdisciplinary, subject-related, and support aspects. They also passed internal quality control by CARNET. After review-based editing, they were published open-access by CARNET in its online database Edutorij (CARNET, 2021a). Appendix A in this paper includes the SD-curriculum outcomes, short descriptions and summaries for two teaching scenarios, as well as examples of one teaching activity from each scenario, all translated from Croatian. Links to all teaching scenarios (in Croatian) are available in Appendix B.

No further scenarios were made in the project, and scenario implementation in schools was not a part of the project. Importantly, the teachers who were activity authors may or may not use the scenarios themselves, and they come from various Croatian schools. Teachers around the country are free to use the scenarios, but not obliged to do so.

Research aims

This paper intends to provide insight into potentially replicable approaches for the creation of teaching resources in similar contexts, along with an awareness of the limitations of this project. Given that SD is an interdisciplinary topic in the Croatian curriculum, the paper aims to identify the project's approaches that stimulated interdisciplinary collaboration during the creation of the teaching scenarios (research aim 1).

5 Transformation Sparked by Collaboration

Given that the authors who collaborated to make the teaching scenarios are not necessarily the users of the scenarios, and that Croatian teachers are not obliged to use the scenarios, the paper aims to identify the project's approaches that could facilitate the adoption of the teaching scenarios by a wide variety of subject teachers (research aim 2).

Discussions on multi/inter/transdisciplinarity will be based on the following definitions by Toš (2021, p. 69):

Multidisciplinarity (multidisciplinary collaboration) is a problem-solving procedure which engages, parallelly and separately, all relevant practical professions and scientific disciplines with their specific skills and methods, without the exchange of specific information, ideas, theoretical and practical skills, techniques or methods, without interacting, without permeating or integrating their individual contributions.

Interdisciplinarity (interdisciplinary collaboration) is a procedure of joint, collaborative and interactive explanation of phenomena, solving of problems, creation of products or introducing new questions which, from the very start of the process, engages all relevant practical professions or scientific disciplines with their specific skills and methods, by integrating specific information, concepts, theoretical knowledge, techniques and methods, with the aim to advance the thorough and comprehensive understanding or solving of problems whose solutions, due to their complexity, fall beyond the reach of a single discipline or research-practice field.

Transdisciplinarity (transdisciplinary collaboration) is a procedure of joint, collaborative and interactive elucidation of phenomena, solving of problems, creation of products or introducing new questions which, from the very start of the process, engages all relevant practical professions or scientific disciplines with their specific skills and methods, as well as all relevant and interested participants from various fields of society, by employing interaction and the exchange of information and knowledge between all relevant participants, with the aim to reach deeper and more comprehensive solutions to problems in specific problem areas.

Method

The approaches that this paper aims to identify are identified through observation and reflection by the author of this paper, who participated in the project as the key expert on SD and the development leader for the SD scenarios. The development leader's duties were to:

- devise 50 scenario topics covering the SD curricular outcomes
- present them to the pool of teachers/authors, who could choose which scenarios they would co-create
- lead 50 teams of 3-5 teachers/authors through the scenario co-creation process, including online meetings and collaboration in shared online documents
- lead the editing of the activities so that the scenarios conformed to CARNET guidelines
- communicate with reviewers (anonymously) within a 3-step review process that included editing the activities
- collaborate with digital-content experts to ensure the quality integration of digital content into each activity
- participate in the creation of interactive digital learning content
- report to the project manager and attend meetings with other development leaders and CARNET.

The development leader was thus thoroughly acquainted with the SD curriculum, the project requirements,

including pedagogical criteria, and the entire process of teaching-scenario creation from ideation to publishing. By facilitating collaborative work and by leading the editing, the development leader could closely observe the process the activity authors went through and gain an understanding of the context in which teachers operate and in which the teaching scenarios would be used.

Results

The project's approaches that stimulated interdisciplinary collaboration during the creation of the teaching scenarios

In the early stages of the project, the development leader presented the topic of SD as a local and global movement important for the survival and wellbeing of our species and life as we know it, and encouraged the pool of activity authors to trust they have an important role in this movement whatever subject they taught. The activity authors were presented with short summaries of the scenario topics and they could, to a large extent, choose which topics they would work on (if any). This approach tapped into their interests and intrinsic motivation, and contributed to the diversity of subjects represented in SD scenarios, rather than revolving around the ones usually associated with SD (Biology, Chemistry, Geography, Nature).

When teams of 3-5 activity authors were formed for each of the 50 topics, the development leader gave them more information about their respective scenario topics: about 200 words and links to videos and/or further reading. This encouraged them towards a culture of researchers (Kincheloe, 2008) while each of them was coming up with an activity idea that would simultaneously address the scenario topic (and therefore an SD curricular outcome) and a curricular outcome for their subject. As a result, the authors could be based on the solid ground of their expertise, while being prepared to collaborate in a common interdisciplinary direction.

The activity authors came together for an online team meeting facilitated by the development leader. The meeting comprised the following:

- check-in round ("Please introduce yourself and tell us how you've been doing today.")
- presentation of the agenda and communication guidelines, including hand signals
- recap of the scenario topic
- presentation of activity ideas by the authors
- initial feedback on the ideas by the development leader and the ICT experts
- fine-tuning the ideas through communication between everyone in the meeting until all authors had enough clarity to put their first drafts in the shared online document, and all the ideas comprised a coherent scenario whole
- check-out round with quick feedback ("How was this meeting for you?").

For many teachers, this was their first encounter with meeting facilitation, hand signals for communication, and the explicit attention given to the psychological safety of team members. Among other things, the

check-in round served to relax the authors into a rather informal atmosphere and to encourage them to speak as early as possible during the meeting, so that they would feel less nervous when presenting their ideas. It also helped them overcome the usual awkwardness of using hand signals for the first time. The hand signals were useful in making sure everyone's voice was heard while keeping the focus on the topic during the fine-tuning phase. The fine-tuning sometimes revealed opportunities for some activities to be combined into team teaching, which the development leader readily supported, but that was an exception rather than the rule. The development leader tried to be supportive and precise when giving both positive and constructive feedback, so that the authors could easily use the feedback in their subsequent work, with an awareness that the authors were not SD experts. In some meetings, there would be an author who had had a hard time coming up with an idea that worked well with their subject's curricular outcomes while remaining linked to the scenario's SD topic, but they would usually get inspired when hearing others' ideas or through a quick impromptu brainstorming session facilitated by the development leader, using collective intelligence even though the authors came from different disciplines. It was therefore important that the check-out round, in addition to providing closure and being a useful piece of feedback for the development leader, created space for the participants' appreciation for the group support. All of the above encouraged the authors towards a culture of collaboration that paid attention to relationships, processes, and results, which paved the ground for the subsequent collaboration phase:

The activity authors wrote their activities in a shared online document. The editing took place both before and after external reviews. The development leader applied a soft editing approach by asking questions and proposing changes in comments, along with positive and constructive feedback, rather than implementing changes. In a few cases, however, the development leader needed to respectfully suggest entire paragraphs to authors who were struggling with the activity text within the rather tight deadlines. The activity authors also used the opportunity to give each other positive feedback and learn from each other as they all had different levels of experience in writing scenario activities. To encourage the culture of feedback, the development leader decided to send the activity authors anonymous feedback questionnaires about the collaboration even though it was not required by the project workflow. The majority responded, with overwhelmingly positive feedback and a desire to deepen their involvement with ESD. The responses were used by the development leader to tweak the workflow but were not formally or statistically analysed.

The project's approaches that could facilitate the adoption of the teaching scenarios by a wide variety of subject teachers

By simultaneously addressing outcomes from the subject curriculum and the SD curriculum, scenario

activities help teachers address SD within the time they would use to teach their subject anyway. Instead of being seen as yet another requirement for the same meagre pay and as something imposed or in conflict with other priorities, which happens in various countries (Laurie et al., 2016), SD might be more easily addressed by teachers of various subjects, and not just by the teachers who already have the motivation to lead SD-related extracurricular activities (typically ecological projects).

The scenario used by various teachers may be further facilitated by the fact that the activities were written as lean proposals for the flow of learning situations rather than strict lesson plans. The duration in minutes or lessons was not specified so that teachers would feel freer to adapt them to their context and their students: perhaps do just a part of the activity or extend it into a semester-long project. This activity format was stipulated by CARNET.

The development leader aimed to create scenario topics that are rooted in areas of real-life experiences, rather than being traditional areas of SD such as renewable energy, biodiversity, social equality, etc. For example, the SD outcome “The student notices interactions and interdependence in nature” was addressed by the scenario “The Living Being I Walk On,” (CARNET, 2021d), where teachers and students are invited to wonder about the soil they walk on and then get to know it and do something good for/with it. Through the Mathematics, Visual culture, and extra-curricular activities created by activity authors, students have the opportunity to apply creative, practical, and theoretical ways to become familiar with soil organisms and the way they are crucial for the health of plants and people and the state of the climate and the environment. Along with being in line with the intentions of the SD curriculum and the pedagogical criteria for the project, addressing SD outcomes through everyday-life issues and experiences may make SD more relatable, which has the potential to spark teachers’ and students’ interests and intrinsic motivation in a wide variety of subjects.

Many activities in the scenarios use students’ work to engage the school, e.g. through festivals, exhibitions, websites, and projects like creating sustainable gardens, places of exchange for used things, and school currencies. Furthermore, many activities in the scenarios encourage students to design and implement projects in, for, and with the local community and wider communities (national or global outreach and/or activism). These kinds of activities have the potential to not only draw together the perspectives of various subjects and teachers when working on common problems but also draw together the engagement of relevant and interested participants from various fields of society, which is a key element of a transdisciplinary approach (Toš, 2021).

Discussion

The results reveal a contrast between the interdisciplinary process of creating the teaching scenarios and

the multidisciplinary results it produced. As described in the paragraph about the online team meeting in the Results chapter, the activities in a scenario were rarely designed as components of team teaching that would happen within learning experiences that simultaneously engage different subjects to work on a common problem. The activities do address the scenario topic through multiple perspectives, but the students would mostly experience those perspectives in separate classes and separate moments during the same school year (or two). So, on the one hand, the process of creating the teaching scenarios was interdisciplinary due to the joint, collaborative, and interactive engagement of various relevant disciplines (Toš, 2021). On the other hand, the application of the scenarios in practice will likely be a multidisciplinary process that engages multiple relevant disciplines separately (Toš, 2021). This is a shortcoming of the project as interdisciplinarity is a more integrative catalyst for SD than multidisciplinary.

At the same time, the relative autonomy of activities in a scenario has an advantage in the Croatian context where, despite the online availability of the scenarios, it is not a given that all relevant teachers in a particular school would use them. The fact that the scenario design allows teachers to use the scenario activity for their subject even if their colleagues are not interested in using the other activities allows them to include SD into their teaching independently of others' choices and priorities. This application of Raymond Loewy's MAYA (Most Advanced, Yet Acceptable) principle (Estate of Raymond Loewy, 2023) to the Croatian context allows enthusiastic teachers to try an activity, encourage their colleagues to try the other activities, and subsequently even find ways to integrate their respective activities more closely and deliver them in collaboration.

Ideally, new scenarios and activities would be continuously created by an ever-growing number of teachers through programmes such as the Sustainability Backpack in Norway, where scenarios are made by teachers who work in the same school, and scenarios comprise learning experiences that are collaborative interdisciplinary projects for solving a shared problem (Munkebye et al., 2020). Such strongly interdisciplinary programmes should ideally rapidly spread to all schools and teachers, with every school's scenarios published online for everyone else to use. This should include vocational secondary schools whose subjects were unfortunately missing from this project.

The actual adoption of the teaching scenarios depends on many factors, including the following: Will the scenarios be successfully disseminated by the government beyond being present online? Will the dissemination manage to motivate teachers who do not yet see the connection of their subjects with SD? Will teachers who are not used to participatory and collaborative methods receive professional development that will make them readier to implement the scenario activities? Will schools invest time and other resources into developing collaborative practices and capacities, and even whole-school approaches

to SD?

Within those limiting factors, the structure of the teaching activities that allows teachers to adapt them to their needs and to address SD outcomes simultaneously with subject outcomes, along with the fact that the activities are related to areas of real-life experiences (including the community life of a school), seems likely to support the adoption of SD scenarios by teachers of various subjects and in various contexts. However, the actual implementation of the scenarios has yet to be studied. Only then could any hypotheses about what facilitates the scenarios' adoption be truly tested.

Limitations

Despite the value of the direct experience of the author of this paper as the development leader for the SD scenarios, the reporting from that perspective is necessarily subjective and biased. Ideally, the voices of other participants in the project would be heard for a more complete picture. In particular, the activity authors could be surveyed about the elements of interdisciplinary collaboration.

In addition to the need to study the factors that contribute to the adoption of the SD scenarios, as mentioned in the Discussion, further studies are necessary to support the paper's intention to provide insight into potentially replicable approaches for the creation of teaching resources in similar contexts. Impact studies for the implementation of the teaching scenarios, and comparative analyses that examine other teaching-scenario-creation approaches, would be essential for creating evidence-based guidelines for making interdisciplinary teaching scenarios on SD.

Conclusion

The project for the development of teaching scenarios on SD for primary and secondary schools in Croatia delivered multi/interdisciplinary scenarios with activities for a much wider range of subjects than are usually associated with SD. Fifty scenarios were made, each of them with 3-5 activities belonging to different subjects (and extracurricular activities) while tackling the same scenario topic. The scenarios are much needed resources for teachers to incorporate SD into teaching their subjects, as required by the curriculum for the *Interdisciplinary Topic of Sustainable Development*.

The interdisciplinary nature of the collaborative creation of the teaching scenarios was stimulated by the following approaches:

- communicating the importance of every subject for achieving the overarching goals of SD
- creating conditions for activity authors to explore SD and connect it with their subject
- nurturing a culture of collaboration that pays attention to team relationships, processes, and results
- using online collaboration spaces in line with such a culture of collaboration.

The resulting teaching scenarios are more likely to support a multidisciplinary type of implementation than an interdisciplinary one due to teaching activities mostly being not integrated enough to enable team teaching. This, however, allows more enthusiastic individual teachers to use the activities autonomously. The project's approaches that may be useful in encouraging a wide variety of teachers to try the activities include:

- addressing subject outcomes and SD outcomes simultaneously
- structuring activities as adaptable flows, rather than strict lesson plans
- creating scenario topics that are related to areas of real life.

Additionally, many activities use students' work to engage the whole school and the wider community, creating the basis for a transdisciplinary implementation of SD.

Ideally, new scenarios would be made and implemented by a growing number of teachers who work in the same school, so that the scenarios create learning experiences that are collaborative interdisciplinary projects for solving a shared problem. Such strongly interdisciplinary programmes should ideally rapidly spread to all schools and teachers, with every school's scenarios published online for everyone else to use.

Declaration of competing interest

The author declares that he was hired as the development leader for SD teaching scenarios by the publishing company that was commissioned by CARNET to deliver the teaching scenarios. The author's contract ended with the end of the project and the author currently has no competing financial interests that could have appeared to influence this report.

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Appendix A: Two examples of teaching scenarios and activities

Primary school scenario

Scenario title: "What can fit in my street?"

Grade: 5 (2nd cycle)

SD curriculum domain: Wellbeing

SD curriculum outcome: C.2.2. Differentiates personal from general wellbeing

Scenario website: <https://edutorij-admin-api.carnet.hr/storage/extracted/1cf683f3-e873-4007-b8b1-396b3ab4a6a4/index.html>

Scenario summary: The scenario for the 5th grade of primary school (age 10) called “What can fit in my street?” (CARNET, 2021c) addresses the curricular outcome “Differentiates personal from general wellbeing” by guiding students to get to know their streets and design their ideal street and events in it. In the subject of Music culture, students design a street festival whose programme is adapted to various demographic groups. In Mathematics, they use geometric patterns to show the floor plan of a “green” street. In German language, they go through a participatory process of street design. In Geography, they map and critically examine the existing uses in their own street. In Visual culture, they create an upcycled model of the transformation of an existing street. Bearing in mind that the activities in this project are very different from one another, for purposes of clarity here is a translation of the Mathematics activity:

I Want the Shade and the Sun

Mathematics outcomes: C.5.1. (Describes sets of points in a plane and analyses and applies their properties and relationships), C.5.2. (Describes and draws/constructs geometric shapes and creates motifs based on them)

Activity text:

Encourage students to talk about the importance of vegetation in their streets. Talk about why it is important to have plentiful vegetation. It is useful for repose, recreation and relaxation. Ask them if they know what a smart bench is and what solar panels are, and what their purposes are. Point out the importance of using solar energy and ask them to form pairs and explore photographs of smart benches and solar panels online.

Use a tool such as a quiz to remind students of squares, triangles, rectangles, circles, circle segments, sectors and arcs. Encourage them to think about how they could make a model of a “green” street on a sheet of paper using those geometric forms: What would you like to have in your street? What could you do in your street if it were different?

Point out the importance of the efficient use of solar energy by means of solar benches. Before making the model, let them think about how they would place playgrounds or other objects in relation to the sun and let them think about where shade will be throughout the day. Ask them where the sunlight will come from and if they prefer playing in the sun or the shade. Ask them about the relevance of sun and shade for other people, for example babies and elderly people.

Let the students pair up and ask them to create their own green street by using the geometric forms. Let them make a legend to explain their meaning. For example, they can represent trees by circles, smart benches by squares, playgrounds by rectangles, flower beds by arcs...

The pairs can present their green-street models and comment on them with other students, and all the models can be placed on the wall of the Wakelet tool. Let the students peer-evaluate the models based on criteria such as the quantity of vegetation, number of geometric forms, balance of sun and shade, creativity and so on.

Support procedures

While guiding students into the activity and talking about smart benches and solar panels, show the students their photographs and briefly and simply explain how they work. This will be particularly useful to students with intellectual difficulties, students with autism-spectrum disorders and students with visual impairments who might find these terms unfamiliar and abstract. Visually impaired students will require additional descriptions of their appearance and the places where they are positioned.

While doing the recap of geometric forms, provide students with special needs with a summary containing the names and visual representations of each form. The students will use it as a reminder for further activities and will be able to work with greater autonomy.

Show an example of a model of a street made of geometric forms to students with intellectual difficulties and those with autism-spectrum disorders. First you can show them a simple graphic representation of a street with all the elements one should use (a few houses, a tree, a smart bench, a playground), and then a geometric-form model based on the image. Show and demonstrate how every part of the image represents a geometric form and check if the students understood what they should do.

Based on the example you showed them, make a visual legend explaining what each form represents. Instead of making a legend on their own at the end of the task, let the students with difficulties have the legend earlier and use it as a guide and template while creating the green street.

Provide physical support, as needed, to students with motor difficulties and visual impairment. If they cannot work independently even with all the adjustments, let them participate by giving proposals and instructions on where to place the forms.

For students who want to know more

Encourage the students to think back to the unbearable heat in their place of residence and ask them what they think the difference is, in degrees Celsius, in the air temperature in the shade of a tree, the shade of a building, the sun near a tree and the sun near a building. Let them explore this where they live. The students can measure the temperature with Labdisc interactive measuring tools in different parts of the area. They will notice the difference in temperatures of a “bare” and “forested” street. Let them explore the influence of the environment on temperature and present the conclusions during one of the following sessions.

Secondary school scenario

Scenario title: “Do you have to have an apartment and a car?”

Grade: 11-12 (5th cycle)

SD curriculum domain: Connection

SD curriculum outcome: A.5.1. Critically examines the connection of one’s lifestyle with the influence on the environment and people

Scenario website: <https://edutorij-admin-api.carnet.hr/storage/extracted/069f63b5-d1e9-41e0-9311-6e25028fef76/index.html>

Scenario summary: The scenario for the 3rd and 4th grade of secondary school (ages 16-18) called “Do you have to have an apartment and a car?” (CARNET, 2021b) addresses the curricular outcome “Critically examines the connection of one’s lifestyle with the influence on the environment and people.” In Mathematics, students calculate the optimal position and number of photovoltaic solar panels for a co-

housing building. In German language, they explore sustainable options for university-students' housing, such as co-housing, co-living and tiny houses. In Visual art, they use the example of the Versailles Palace to examine the difference between real and representational needs. In two Geography activities, they critically examine options of sustainable mobility, smart cities and off-grid communities. Here is a translation of the German language activity:

A Modern Age Student

German language outcomes: A.4.2. The student produces long spoken texts of medium complexity. A.4.3. The student participates in long spoken interaction of medium complexity. B.4.1. The student draws conclusions about similarities and differences between regional and social groups and youth cultures in their own culture and cultures related to German language and describes the influence of personal attitudes and values on perceiving one's own culture and other cultures. C.4.2. The student finds, compares and critically evaluates information from various German language sources

Activity text:

In order to motivate the students and introduce them to the topic, make a survey about their plans for university studies. You can ask them about what they want to study, where they want to study, different possibilities for dwelling while studying and what kind of dwelling they would choose if they studied away from home. You can create and execute the survey using a tool for online surveys, such as Google Forms.

Display the survey results and encourage a quick discussion based on the results. Encourage the students to discuss them by asking about the pros and cons of the big number of students in big cities, about residence capacities (student residences, subsidised dwellings) and private residences (owned or rented apartments).

Split the students into groups and assign them the role of experts for solving dwelling issues of students. Point them to the web to explore the dwelling opportunities for students in German-speaking countries, as well as the dwelling type they most commonly choose and why that is so. Explain to them how to use the gathered information to compare the dwelling opportunities for Croatian students and the students in German-speaking countries, with the emphasis on financial and ecological aspects. You can propose to them to put the gathered information into one of the collaboration tools such as Popplet.

Start a discussion and encourage the students to name the similarities and differences they noticed and to name examples of student dwelling types that would be easily applied in Croatia, as well as to express their own opinions.

Guide the students to continue onto the next step of working in groups as experts for solving student dwelling issues by exploring alternate dwelling models, using keywords such as sustainability, intentional communities, co-housing, co-living, communes, tiny houses, and so on.

Tell them it is their task to come up with and offer their own alternate dwelling solutions for students in big cities and to elaborate on their choices. You can propose to them to present their solutions as infographics in a digital tool such as Piktochart. Organise a fair of concepts in your class and encourage the students to pick the best ones.

Support procedures

In order for them to search online, give students clear and concrete guidelines and links which will help them get to the required information more easily, especially to students with attention difficulties and autism-spectrum disorders. You can make a checklist with activity steps, i.e. questions for which they need to find answers in order to encompass all the key information. It is important to explain more thoroughly new words, foreign-language words, and words that are abstract and unclear to some students (co-housing, co-living,

communes). Supplement them, where possible, with everyday life examples.

Check if the assistive technology for visually impaired students supports all proposed digital tools and ensure there is peer support and work in pairs where needed.

While working in a group, take care that students with difficulties actively participate in all activities and do not let them be passive observers. Have them do tasks that match their capabilities and that they can do successfully. It is crucial that they feel successful in the group and that they get the opportunity to develop a positive self-image, social and emotional skills and motivation for further participation in group work.

For students who want to know more

Encourage the students who are particularly motivated to autonomously perform additional online research and make a guide for sustainable student living in a big city, which you can publish on the school website. Give them guidelines for doing the research and list the aspects which should be represented in the guide, such as financial accessibility, ecological sustainability, social arrangements, useful websites, practical solutions and so on.

Appendix B: Links to all teaching scenarios

The scenarios (in Croatian) can be accessed via the following links:

1. <https://edutorij-admin-api.carnet.hr/storage/extracted/1a6b84d8-1f50-4aee-b3f1-0038559339ea/index.html>
2. <https://edutorij-admin-api.carnet.hr/storage/extracted/366dd25c-2628-4add-8670-b14e2d7ed68a/index.html>
3. <https://edutorij-admin-api.carnet.hr/storage/extracted/726dd761-9629-45de-8d73-042d4933b0de/index.html>
4. <https://edutorij-admin-api.carnet.hr/storage/extracted/29c7e62b-913d-44cc-951b-fbe7cc9379d8/index.html>
5. <https://edutorij-admin-api.carnet.hr/storage/extracted/e5f7e8a6-e3dd-481b-9b72-0ee65455fc6b/index.html>
6. <https://edutorij-admin-api.carnet.hr/storage/extracted/bf4dc6fa-a04f-456f-9386-5f121d7f2b53/index.html>
7. <https://edutorij-admin-api.carnet.hr/storage/extracted/4b321432-bf03-46a6-b969-ae35989fe58b/index.html>
8. <https://edutorij-admin-api.carnet.hr/storage/extracted/eefead04-b7d8-4545-ac4a-ad2fa5a7127b/index.html>
9. <https://edutorij-admin-api.carnet.hr/storage/extracted/96467f04-2ba2-4b88-9798-1b29db1b3338/index.html>
10. <https://edutorij-admin-api.carnet.hr/storage/extracted/c4443268-e655-4622-99bc-7ae950111dd9/index.html>
11. <https://edutorij-admin-api.carnet.hr/storage/extracted/a7613883-8b9a-4beb-a1cf-6526c1ca1194/index.html>
12. <https://edutorij-admin-api.carnet.hr/storage/extracted/1cf683f3-e873-4007-b8b1-396b3ab4a6a4/index.html>
13. <https://edutorij-admin-api.carnet.hr/storage/extracted/1fad3571-100f-4efe-bfa7-dc3e0aab878d/index.html>
14. <https://edutorij-admin-api.carnet.hr/storage/extracted/4a505aab-ba10-4cb0-a553-528d02c8e596/index.html>
15. <https://edutorij-admin-api.carnet.hr/storage/extracted/8b470acb-39cb-4eda-a08c-cd3bf0f74a54/index.html>
16. <https://edutorij-admin-api.carnet.hr/storage/extracted/27217624-6d14-49a0-a3a3-0345fc2ce858/index.html>
17. <https://edutorij-admin-api.carnet.hr/storage/extracted/39eba663-7da5-47bf-8688-59c0ed269728/index.html>
18. <https://edutorij-admin-api.carnet.hr/storage/extracted/c76a4e28-8865-4869-90df-487b676701a0/index.html>
19. <https://edutorij-admin-api.carnet.hr/storage/extracted/1f1919b7-7810-45ba-8cfc-2a0b1b0770a9/index.html>

20. <https://edutorij-admin-api.carnet.hr/storage/extracted/a49382aa-2c2a-49d7-b3a2-8344cbe755bd/index.html>
21. <https://edutorij-admin-api.carnet.hr/storage/extracted/d71e5aaa-0db6-4b30-84f8-cd07d0208211/index.html>
22. <https://edutorij-admin-api.carnet.hr/storage/extracted/3603e21a-9a05-488a-9efe-f8c566936741/index.html>
23. <https://edutorij-admin-api.carnet.hr/storage/extracted/ca92e21b-98b4-4b3d-b7f7-23a2ff296877/index.html>
24. <https://edutorij-admin-api.carnet.hr/storage/extracted/75a22612-b4cd-444d-b927-a4470447c131/index.html>
25. <https://edutorij-admin-api.carnet.hr/storage/extracted/2a88c7d1-f10b-4c72-9348-5d1c526ff8fc/index.html>
26. <https://edutorij-admin-api.carnet.hr/storage/extracted/9a5e9d2c-3ec8-4df7-8dc6-96d1e34828ee/index.html>
27. <https://edutorij-admin-api.carnet.hr/storage/extracted/01398583-1f0f-4750-b30d-ab34c1e2efec/index.html>
28. <https://edutorij-admin-api.carnet.hr/storage/extracted/f9f689c8-9092-46ea-93a5-2125321988f2/index.html>
29. <https://edutorij-admin-api.carnet.hr/storage/extracted/6c1df2fb-00e7-40a4-9be4-4304b2b580e5/index.html>
30. <https://edutorij-admin-api.carnet.hr/storage/extracted/75846c55-bcb3-42da-910e-a1dfebbb9a47/index.html>
31. <https://edutorij-admin-api.carnet.hr/storage/extracted/9a0835ed-19df-41db-b14b-6f7b99bcd03a/index.html>
32. <https://edutorij-admin-api.carnet.hr/storage/extracted/dcbf4f9a-8221-4b6a-8d7a-08911aad59c4/index.html>
33. <https://edutorij-admin-api.carnet.hr/storage/extracted/8ff599ca-c5a6-47b7-8487-f32c0ab84b50/index.html>
34. <https://edutorij-admin-api.carnet.hr/storage/extracted/9e9c9092-73af-4a60-8848-c37a0b1ba5f6/index.html>
35. <https://edutorij-admin-api.carnet.hr/storage/extracted/7116728d-8de9-46de-95e7-5902b3035154/index.html>
36. <https://edutorij-admin-api.carnet.hr/storage/extracted/74dfdd03-c487-4a39-baaa-1d62986b20ce/index.html>
37. <https://edutorij-admin-api.carnet.hr/storage/extracted/6b69a188-4f1c-43fd-a9a3-00a062c54576/index.html>
38. <https://edutorij-admin-api.carnet.hr/storage/extracted/607381d4-1ca4-490a-bd89-4e0ae705469a/index.html>
39. <https://edutorij-admin-api.carnet.hr/storage/extracted/bbb652df-cfab-44d7-90b5-c7183793340b/index.html>
40. <https://edutorij-admin-api.carnet.hr/storage/extracted/4286e207-e08f-4df2-a0bf-c1a088c98d87/index.html>
41. <https://edutorij-admin-api.carnet.hr/storage/extracted/af8e4624-34ec-44d5-b9e8-b8ab064c734f/index.html>
42. <https://edutorij-admin-api.carnet.hr/storage/extracted/f6a207c8-344a-444b-b656-0b7d6d1a643c/index.html>
43. <https://edutorij-admin-api.carnet.hr/storage/extracted/069f63b5-d1e9-41e0-9311-6e25028fef76/index.html>
44. <https://edutorij-admin-api.carnet.hr/storage/extracted/f6d8590b-5521-418b-a9d6-a89ff8d3cf5c/index.html>
45. <https://edutorij-admin-api.carnet.hr/storage/extracted/f10e1009-3483-44a5-a73d-a1c3f27071f1/index.html>
46. <https://edutorij-admin-api.carnet.hr/storage/extracted/12fbdb0d-dd16-4a8d-bf02-af6f012dc93e/index.html>
47. <https://edutorij-admin-api.carnet.hr/storage/extracted/494ddd72-4132-4eb5-9fd2-2ac288d813c5/index.html>
48. <https://edutorij-admin-api.carnet.hr/storage/extracted/7ddb46fb-7f68-4c33-b449-22f021beaf4f/index.html>
49. <https://edutorij-admin-api.carnet.hr/storage/extracted/4fe95791-4df2-41be-9bb5-07773ea23ff9/index.html>
50. <https://edutorij-admin-api.carnet.hr/storage/extracted/93d579ba-2681-4e3c-9206-1aba2efc43d7/index.html>