

0. Intro

This report is prepared as part of the work of Ecosystem Europe Association on the Intellectual Output 1 – State-of-the-art review on urban science.

The report is based on information from an overview of the study plans and programmes of the Ministry of Education in Bulgaria, face-to-face interviews with teachers during school visits, online questionnaire filled by with 17 respondents (all Bulgarian teachers).

This is a shorter version of the report prepared in English language for the purpose of having a general overview of differences and similarities in all partner countries and to be used as a guideline in preparing the Urban Science Pedagogy Framework. More detailed version with links to the curriculum is available in Bulgarian language.

1. Curriculum overview

Subjects suitable for Urban Science

“The (natural) sciences are the perfect area where students could acquire competences for linking knowledge and skills to solving human challenges in the capitalist driven world. However, the opportunities for linking scientific inquiry and research with the necessary condition for a healthy life are not existing in the study plans and programmes.”

Teacher’s Quote

According to teachers that took part in the online questionnaire, the subjects that are suitable for Urban Science are:

7th grade: ‘Biology and Human Health’, ‘Chemistry and Environmental Protection’, ‘Geography and Economy’, ‘Mathematics’;

6th grade: ‘Man and Nature’; ‘Geography and Economy’, ‘Mathematics’, ‘Information Technologies’.

5th grade: ‘Man and Nature’; ‘Geography and Economy’, ‘Mathematics’, ‘Information Technologies’.

According to Ecosystem Europe Association links can also be established with the subject ‘Physics and Astronomy’ in 7th grade. Links will be also established with ‘Arts’ and ‘Technology and Entrepreneurship’ in all grades (5th to 7th).

One problem with fitting Urban Science into the curriculum is coming from the quote in the begging of this section. Study plans and programme do not include education content that investigates the connection between a separate practical activity and its broader meaning on a system level (e.g. pH of soil sample and urban gardening).

Another problem is that the practical activities are limited to isolated content from the curriculum with little available time for carrying them during lesson hours. For instance, only 6 hours for the entire school year (7th grade ‘Biology and Human Health’).

Urban Science could be offered as *extra curriculum classes* (out-of-the-classroom, out-of-the-school, and out-of-the-compulsory-curriculum). Those represent virtually all schools' project based learning (PBL) work that is taking place outside the *compulsory curriculum classes* (all subject being taught as part of the study plans and programmes developed according to the Law on Education).

Examples for activities performed in class today

- Investigating luminescent animals and plants in order to supply light without electricity;
- Investigating the plant biodiversity and living patterns depending on climate and landscape;
- Comparison of bottled water quality – sensory vs. characteristics from label;
- Students projects as presentations on the subject of electricity – safety when working with electric power, electrical circuits with different consumers.

2. Barriers for Urban Science in schools

- Curriculum is not fitted to make links between what is being learnt in school and its practical application (in solving the environmental, social or economic challenges ahead);
- Culture and psychology of students during field trips; often the trips are interpreted more like a walk around instead of serious connection with the outdoor learning environment;
- Lack of quality methodologies for teachers;
- Limited time available to teachers to prepare out-of-the-classroom scientific inquiry and research activities;
- Huge administrative burden to organize out-of-the-classroom activities;
- Lack in teachers' initiative;
- Lack of technical equipment;
- Lack in teachers' experience;
- Aging, unmotivated teachers;
- Lack of funding for school PBL work.

3. Opportunities for Urban Science in schools

Asked about whether they deliver PBL and / or scientific inquiry and research as part of their school work, 48% of teachers responded they do, while 22% responded that they would like to. That is an overall of 70% implementation potential for Urban Science Learning Packs (LPs) in the school practice.

Results in detail:

- 47% of the respondents deliver PBL as part of the compulsory curriculum classes, while 40% would like to do so.
- 53% of the respondents deliver PBL as part of the *extra curriculum classes*, while 18% would like to do so.

- 44% of the respondents deliver scientific inquiry and research as part of PBL, while 19% would like to do so.
- 47% of the respondents deliver scientific inquiry and research but not as part of PBL, while 13% would like to do so.

Asked about whether they deliver out-of-the-classroom activities, 38% of the teachers responded they do, but not related to scientific inquiry and research. Further 31% of teachers responded they do, while 19% responded that they would like to. That is an overall of 88% implementation potential for out-of-the-classroom scientific inquiry and research activities offered by Urban Science.

4. Characteristics of successful Urban Science

- LPs need to integrate Urban Science PBL methodology into the compulsory curriculum content;
- LPs need to link scientific inquiry and research activities into the compulsory curriculum content;
- LPs need to include detailed learning objectives, teaching methodology, and, assessment and evaluation tools;
- LPs need to have clear activities/tasks cascading knowledge;
- LPs need to be interactive and practically orientated;
- LPs need to be directly applicable to PBL work; to include ideas for out-of-the-classroom activities;
- LPs need to be written in clear and comprehensive language;
- LPs need to include numerous worksheets for out-of-the-classroom activities;
- LPs need to include health and safety measures;
- Outputs of activities need to ignite curiosity;
- Activities need to include 'peculiar' questions that bend the usual way of thinking and information intake; and, factsheets with unusual information;
- Activities need to provoke creativity and teamwork;
- LPs need to include clear images;
- Learning with mobile applications;
- LPs should include complex research tasks that require 1 school term to complete;
- LPs should provide activities that could be used independently from the complete methodology;
- LPs should offer content not only for the urban population but also for students in rural areas;
- Inquiry and research equipment to be easily accessible/affordable.

5. Teacher's awareness of topics addressed by Urban Science

Respondents were asked to assess their familiarity with the following concepts: circular economy, system thinking, biomimicry, systems science, and, citizen science. When asked to what extent they use those concepts in teaching the answer was 13% for system thinking, 7% biomimicry and system science, 0% circular economy and citizen science.

6. Conclusions

The preparation of students in Bulgarian school is not matching the needs of our society if we are to develop healthy livelihoods in the 21st century. The focus in school is put on broadening the intellectual capacity of students without linking it to practical applications for finding solutions to the environmental, societal and economic challenges ahead.

Urban Science (US) needs to deliver methodology and content that will enable the Bulgarian schools to move away from this status-quo and into teaching that prepares students for the future.

In doing so US will need to be closely linked to the curriculum where opportunities for alternative methodology and content are scared and scattered. The US will, therefore, need to create one learning pack (LP1) that includes activities that fit to the *compulsory curriculum classes* by making connections, where they don't exist, between the different parts of the study plans and programmes. Those activities will also need to direct students to a higher order of thinking and allow them to 'see' beyond what is expected from them by the plan and programme.

The US will also need to create a second learning pack (LP2) that is suitable for *extra curriculum classes*. This LP will include activities that allow for PBL independently from the requirements of the study plans and programmes.

Modern day concepts, referred to in point 5, are largely unknown to Bulgarian teachers, and, where respondents happen to know more about those concepts it doesn't mean they use them in the teaching practice. Much effort will be needed in the preparation of the teachers training materials. We expect to need to do a training in the training where we have a large introduction to topics of interest to Urban Science and where we translate those topics as a teaching methodology and content ready to use by the Bulgarian teachers.