Vertical Gardens – Built Environment Education Tool In Schools In Serbia

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ABSTRACT: Built environment education (BEE) presents an interdisciplinary field of education intended for children and young people. Besides fields of architecture, urban design, art, landscape architecture, etc., it includes different social aspects such as community engagement, culture, and heritage, thus being important not only for future architects but for every citizen. On the other hand, in Education for Sustainable Development (ESD), the main topics of interest are key sustainability issues such as climate change, lack of biodiversity, sustainable consumption, etc. Likewise, promoting critical thinking and decision-making in a collaborative way, ESD coincides with methods in architecture such as participatory design. This research focuses on developing a BEE co-design method with integrated ESD components that can be applied as a learning tool. To answer the main research question of how we can successfully design vertical gardens (VGs) in schools that act as BEE tools for tackling sustainability issues, study first presents a set of educational gamified workshops aiming at the development of co-design method that includes topics of environmental, ecological, and social VG benefits, and second, its evaluation results. The workshops' input was specially developed for the ages of 12, 13, and 14 and later conducted through the collaboration of architects, a pedagogue, teachers, and students in one primary school in Belgrade, Serbia, in April 2023. This study is part of the author's doctoral research, whose related objective is the design of a toolkit for a gamified educational co-design method for VGs that can later be applicable to other schools. Therefore, this paper concludes the tested design process evaluation, suggesting recommendations for its improvement. Finally, this research contributes to filling the previously identified gap in the scientific literature on VGs' educational benefits and the urgent need for education on nature-based solutions in Serbia.

KEYWORDS: vertical gardens' educational benefits, BEE, ESD, co-design method, interdisciplinarity

INTRODUCTION

Our planet is currently experiencing numerous environmental challenges, evidenced by extreme weather conditions and disasters in built environments in recent years. These challenges have directly impacted the quality of life for citizens, necessitating urgent actions across various sectors. In the realms of architecture and urban design, the requirements for action are becoming "rapidly more demanding, complex, and interdisciplinary due to demographic, social, economic, environmental, and technological changes" (Hensel et al. 2020, 1). To address these challenges, several global strategies have been initiated, aiming to enhance environmental protection, social inclusion, and economic growth, thereby improving well-being in built environments. One such initiative is The Sustainable Development Agenda 2030 (Martin n.d.). When it comes to the built environments, a specific goal of Agenda, SDG11, was set to make cities and human settlements inclusive, safe, resistant, and sustainable (Martin, n.d.). However, according to the latest report, measuring progress towards SDG11 in Serbia remains challenging due to limited data, the nature of the indicators, and the absence of significant change. Only one out of ten indicators, namely 11.5.2 (Direct losses caused by disasters as a share of global gross domestic product (GDP)), shows measurable progress (Babović 2023, 8). Conversely, the report highlights setbacks in SDG4 - Quality Education, highlighting the increase in the number of

> students aged 15 who did not reach the minimum fixed level of achievement on the PISA scale for three basic school subjects (Babović 2023, 35)

such as math, reading, and science.

To enhance the achievement of the two mentioned SDGs, an application of educational actions, including BEE and ESD, may be an effective approach. Intersecting youth interdisciplinary education programs like BEE, where space presents an educational object (Brković Dodig, Klepp, and Million 2019) that includes various social dimensions such as community engagement, culture, and heritage, with ESD, which fosters collaborative critical thinking and decision-making while acting on sustainability issues ("What You Need to Know about Education for Sustainable Development | UNESCO," n.d.), could yield significant outcomes across multiple fields. Based on the mentioned facts, the premise of this research is that architectural and urban design processes can serve to teach about sustainable development through curriculum or after-school activities. Seeing architecture "in the service of the natural environment" and integrating "social, cultural, economic, and environmental sustainability criteria" (Hensel et al. 2020, 2), the application of research with an interdisciplinary approach is a promising course of immediate action. Besides, interdisciplinary pedagogies enable not only children and youth in general but also future architects, artists, landscape architects, urban planners, and designers to acknowledge, address, and foresee sustainability issues in the future (Hensel et al. 2020). Moreover, the close attachment of children to their parents leads to the unintentional transfer of knowledge to their parents and other adults (El-Aasar et al. 2018).

Relying further on the suggestion that there is a need for educational initiatives to raise awareness about the importance of Nature-based Solutions in Serbia (Radić Sibinović, Brković Dodig, and Million, 2025), the author positions VGs as an educational tool to address sustainability issues in schools within urban environments. Their positive effects can be observed at two levels: building-level benefits (e.g., improved building energy efficiency, internal air quality, air filtration and oxygenation, occupant health, better protection of the building envelope, reduced interior noise, and increased property value) and urban-level benefits (urban heat island effect reduction, air quality improvement, carbon sequestration, aesthetic appeal, psychological impact on urban residents, biodiversity enhancement, natural wildlife habitat creation, and sound attenuation (Safarik and Group 2014). VGs' benefits, such as social and educational, have been confirmed only descriptively (Radić, Brković Dodig, and Auer 2019). Contrarily, VGs have been widely built in schools (in developed countries such as Spain, the United States, Germany, United Kingdom) in recent years as a climate mitigation strategy, a measure for improving biodiversity, producing food, or as a teaching tool. Seeing education as an agent of change, for example, the Barcelona Schools Agenda 21 Program aimed to integrate the principles of sustainability in schools' educational programs, using exactly VGs as tools ("Spain - Barcelona - Educating Sustainable Development," n.d.). However, there is no VGs' design process developed intentionally as a BEE tool to address sustainability challenges, neither in Serbia nor in the developed world. Outcomes of such an interdisciplinary project include:

- educational gamified design process,
- VGs design that answers sustainability issues,
- and the implementation of inclusive activities within the school community.

Therefore, the key aims of this paper are to first introduce the novel developing VGs co-design method that acts as a BEE tool with ESD components and its evaluation step. Finally, the study concludes with recommendations for the method's improvement.

1.0 RESEARCH METHODOLOGY

To answer the research question of how we can successfully design VGs in schools that act as a BEE tool for tackling sustainability issues, this study adopts action research with a participatory approach, emphasizing collaboration, inclusivity, and co-creation of knowledge in one primary school in Belgrade, Serbia, in April 2023. A novel VGs' co-design method was further developed through testing and evaluation steps conducted together with school community members. Data collection was internal to the game (Gundry and Deterding 2019), which in this specific case means done by participants during five gamified process steps. The complete method was tested and evaluated in 3 days, including 12 school classes through the curriculum, one of which lasted 45 minutes according to the educational system in the Republic of Serbia. Additionally, an online qualitative survey was conducted with teachers after the workshops, as well as a semi-structured interview with the pedagogue, aiming at the evaluation. Participants' total number per role in the process is presented in Table 1, as well as the evaluation methods each of them applied.

Table 1: Workshops' participants and applied evaluation methods. Source: (Author 2024)

Participant	*Age*	*Number*	*School community member*	*Process phase*	***Applied evaluation methods***
Student	12	10	✓	Testing **Evaluation**	**Semi-structured group discussion after each step and mapping in Eisenhower Matrix**
Student	13	6	✓	Testing **Evaluation**	**Semi-structured group discussion after each step and mapping in Eisenhower Matrix**
Student	14	1	✓	Testing **Evaluation**	**Semi-structured group discussion after each step and mapping in Eisenhower Matrix**
Teacher	/	3	✓	Development (1 teacher) Testing **Evaluation**	**Semi-structured group discussion after each step and online qualitative survey**
Architect	/	3		Development Testing (2 architects) **Evaluation** (2 architects)	**Semi-structured group discussion after each step**
Pedagogue	/	1		Development **Evaluation**	**Semi-structured interview**
Researcher	/	2		Development Testing (1 researcher) **Evaluation**	**Semi-structured group discussion after each step**
Interviewed	12 - 60	32	✓	Testing	**No evaluation**

/: Not available data; ✓: confirmation sign.

According to one of the latest studies,

> … the discourse around child-framed methodologies needs to extend beyond simply listening to what children have to say, and actually begin to position children as researchers who directly influence the methodology, analysis and outcomes of a given study (Cutter-Mackenzie and Rousell 2019, 5).

A group of up to 25 children, "... which can be explained by logistical, methodological, and ethical reasons" (Shamrova and Cummings 2017, 27) was involved beyond just being a source of data, corresponding to Level 5 ("consulted and informed") of Hart's ladder (Hart 1992). Namely, children were supposed to

> work as consultants for adults in a manner which has great integrity. The project is designed and run by adults, but children understand the process and their opinions are treated seriously (Hart 1992, 12).

Accordingly, 17 students divided into 4 groups, had an important role in both phases of the VGS design process - testing and evaluation. Except for completing tasks, they were supposed to highlight all positive and negative aspects they experienced during the process after each step and to suggest ideas for improvement, thus influencing process development. When it comes to the teachers' participation, "Educating educators for sustainable development may be the starting point for further steps in Serbia" (Milutinović and Nikolić 2014, 107). Together with students, one biology and two technical education teachers were involved in the testing and evaluation of the VGS co-design process, which was especially important in analyzing the educational benefits of the complete process. Two architects and technical education teachers were in charge of providing participants with spatial, constructional, and design explanations when needed. The author of this paper, as a main project researcher, had the role of moderator and participant who collaborates with children and teachers in the co-creation of VGS design by encouraging constructive discussion with open-ended questions in decision-making moments. The process was additionally evaluated by the pedagogue, identifying challenges and recommending improvements. The final step of the testing phase included 32 interviewed school community members of different ages and roles, which was of great importance for developing future scenarios, so that the operation of VGS can be optimized, maintenance costs reduced, and its existence in the school sustainable.

According to Chukwudozie et al. (2015), one of the main challenges of the participatory approach is to record, store, and analyze qualitative data. For this reason, a research diary with short notes was kept as a way of storing data and recording key analysis. Children explained to a researcher their answers, digital photos, and sound recordings of children's key messages were taken, and each workshop ended by reflecting on research findings. Process evaluation was done by all participants using different methods presented in Table 1. Finally, to develop recommendations for the design process improvement, all data were coded thematically, which reflects the typical qualitative data analysis method (Stapleton 2021).

2.0 RESULTS

2.1 Introduction to the VGs' co-design method

To initiate the project, one primary school in Belgrade, Serbia, was selected based on the following set of criteria developed from two perspectives, spatial and educational:

- location in a central urban area
- high building density around the school
- proximity to existing VGs in open public spaces
- lack of vegetation within the schoolyard
- the school's recognition of the need to address sustainability issues and its ongoing work toward sustainable development
- the school's interest in research activities participation, as well as potential future collaboration (e.g., VGs installation process, development of guidelines for VGS maintenance, and post-project evaluation)
- the school's ability to allocate time for students and teachers to participate and engage in this research through the classes of technical education, biology, and/or ecological section activities.

After the school selection, teachers of biology and technical education were contacted and informed about the project idea and goals. Upon their acceptance to participate, consent forms were delivered to them. Thereafter, teachers enclosed project information letters and consent forms to selected students and their parents, inviting them to participate in the protocol.

Upon determining the participants, students, teachers, and other interested school community members joined forces with a researcher and architects to identify local sustainability challenges, then explore VGs' design possibilities, and finally plan its future use to act as a formal, non-formal, and informal learning tool (Million et al. 2019) in their school spaces. This co-design method was conducted through 3 days of workshops within a technical education classroom. Developed to lead participants through five different design steps (Figure 1), workshops cover topics of environmental, ecological, and social benefits of VGs, thus including components of ESD. The novelty lies in the context of Serbia with the action-oriented approach to ESD, thus including the practical application of knowledge and skills in real-life contexts, aimed at addressing and preventing sustainability challenges and promoting sustainable lifestyles (Veinović 2017).

A complete process was developed specifically to be primary school age-appropriate, aiming for children to co-design VGs. Young participants were supported in extending their inquiries through a creative set of gamified tasks as a particularly valuable data collection tool that enhances problem-solving abilities, communications, cooperation, responsibility, and imagination, and supports creativity (Brković 2013). For instance, a shuffle cards game was developed to assist children in learning about the various VGS construction types and the degree to which they impact sustainability issues. Additionally, participants employed additional decks of cards as an interactive means of learning about the different advantages of vegetation and sustainability challenges through the workshop activities. Extensions of the methodology through the children's use of their school maps also stimulate their BEE by enhancing spatial awareness and environmental perception.

> Such a participatory approach to architectural design rests on a democratic premise that everyone concerned by a design should be involved in its creation and the evaluation of its quality ("Convention on the Rights of the Child | UNICEF," n.d.).

Therefore, Table 2 presents the co-design method's components, such as gamified analysis and decision-making tools. It also lists educational components through the method's five steps in chronological order, as well as each step's output in the context of the specific primary school where the method was tested.

Figure 1: Schematic representation of the co-design steps. Source: (Author 2024)

Table 2: VGs' co-design and education components. Source: (Author 2024)

Step	*(BEE) Analysis tool*	*Decision-making tool*	*Step outputs*	*BEE and ESD topics*
1 Identify	*16 cards* each card presents sustainability issue that VGs can address	*1 table, red and green stickers* to evaluate and identify priority sustainability issues	Identified 6 "urgent" and 3 "less urgent" sustainability issues that VGs design must answer	*ESD:* sustainability issues that VGs can address - thermal comfort, energy saving, air quality, noise, water saving, water retention, health, safety, aesthetics of space, education, biodiversity preservation, responsible use of materials, façade existence, healthy diet, participation, inclusion
2 Locate	*1 school map and red stickers* to locate issues and identify priority zones according to the number of issues		Suggested zone 2 for possible VGs locations	*BEE:* good spatial orientation and use of 2D school building and yards plan for identifying specific school places with sustainability issues and defining spatial zones
3 Compare	*13 cards* each card presents different VGs construction type and their benefits	*1 table and checkmark symbol cards* to compare and evaluate VGs constructions	Suggested VGs construction types to answer identified sustainability issues in zone 2	*BEE:* technical aspects of VGs construction type variations: materials, size, weight, maintenance, etc. influencing VGs sustainability benefits *ESD:* nature contribution to the sustainable development at the local level
4 Define	*16 cards* each presents different outdoor plant appropriate for VGs	*1 table* for the selected plants discussion and presentation	Suggested plants that answer VGs construction type, orientation, and local sustainability issues	*BEE:* link between the built environments, nature, and art *ESD:* importance of specific plants in relation to sustainability issues
5 Plan	*Interviews and future scenarios questions* for social issues group discussions	*1 table* for the suggestions summarization	Suggested future use of VG based on social aspects: education, inclusion, participation, health, and safety	*BEE:* architecture as a creative intellectual task consisted of research and design, draws on humanity, culture, heritage, nature, and society *ESD:* basis on participatory teaching and learning methods that motivate and empower learners to change their habits and act for sustainable development

BEE: Built Environment Education; ESD: Education for Sustainable Development.

Each of the five educational VGs' co-design process steps uses a specially developed gamified analysis tool and a complementary decision-making tool. In steps 1, 3, and 4, gamified analysis tools are illustrative cards with specific questions that initiate and further support understanding of unfamiliar terms and relate them through divergent thinking to the specific spatial context of their school spaces. Questions for *Step 1 Identify* have been developed through the collaboration between the architect/researcher together with the pedagogue, to be specific age appropriate. This step was developed relying primarily on VGs' benefits mapped by the literature review by Radić, Brković Dodig, and Auer (2019). For the *Step 3 Compare*, 13 different cards have been designed to present different VGs construction types and how well each of them answers sustainability issues, based on the most comprehensive VGs construction typology developed by Radić, Brković Dodig, and Auer (2019) and empirically confirmed data. For *Step 4 Define*, 16 cards with different plants have been designed through collaboration between the architect/researcher and the biology teacher. The goal was to offer participants a variety of plant species appropriate for VGs according to their characteristics such as orientation, maintenance, and watering demands, flowering period, and interesting facts about each plant. In *Step 2 Locate,* participants use a school map and red stickers as both together, analysis and decision-making tools, aiming to discover different vulnerable spaces in the school areas, thus defining potential locations for VGs. The only step that applies two design tools is the *Step 5 Plan*. As the aim is to imagine and plan future scenarios related to VGs' sustainable use, participants had to express their wishes on the topics of VGs' inclusion, participation, health, and safety, and present and discuss them together. Moreover, students conducted short semi-structured interviews with other school community members, such as teachers, students, janitors, cooks, cleaners, librarians, members of the choir, and parliament. They used three sets of pre-prepared questions to interview and later share and discuss results, thus defining VGs' educational and maintenance possibilities.

As students' active participation in decision-making is crucial for ensuring they have a voice in design processes and for adults to consider their contributions (El-Aasar et al. 2018), specially developed participatory decision-making tools were incorporated into each step to aid specific outputs, as well as to provide inputs for the following steps. Such tools were used after small group discussions to further evaluate results together with teachers, architects, and a researcher. Except for Step 2 Locate, each step includes the use of unique tables that enable results summarization, emphasizing what is crucial and what needs more investigation.
So far, VGs have been globally recognized as a school teaching tool for biology or art classes (Hop and Hiemstra 2013), able to inspire real-world thinking related to science, technology, engineering, and mathematics fields (McCullough, Martin, and Sajady 2018). Considering the suggestion that

> the next generation needs to learn about the environmental concerns of today and how we are addressing them (Sheweka and Magdy 2011, 599),

the newly developing VGs' co-design method could be the appropriate tool. It covers BEE and ESD subjects in two steps, while one education field is handled in three steps. Overall, they are both equally involved in the design process of VGs. When it comes to BEE, good spatial orientation and understanding and reading school building and yards maps are mandatory for the successful zoning of sustainability issues. By introducing various VG construction types and their technical, technological, and vegetation requirements—all of which have variable degrees of impact on reducing sustainability issues—students can learn about architecture, engineering, technology, art, and landscape architecture. When it comes to ESD, participants can primarily learn what are current sustainability issues and how they can recognize them in their environment. Also, they can learn about the importance of nature-based solutions in urban areas, and how nature contributes to their life quality, so as to sustainable development. Furthermore, they develop participatory skills and learn to address issues through interdisciplinary collaborative work. Finally, some of them develop a sense of belonging to the community and are motivated and empowered to further educate and act for sustainable development.

2.2 Evaluation of the VGs' co-design method - educational topics novelty

An important initial evaluation was conducted by students who were instructed to use Post-it notes with their school class and place them in their respective positions on the axis. The educational value and interest level in co-design were assessed using the Eisenhower Matrix. The results, depicted in Figure 2, revealed that students aged 12 demonstrated a higher level of knowledge on BEE and ESD topics compared to students aged 13. Participating teachers clarified that educational topics included in the VGs co-design process are not covered in the school curriculum. Therefore, it depends on the willingness of various teachers teaching the same subjects to educate children outside of the curriculum.

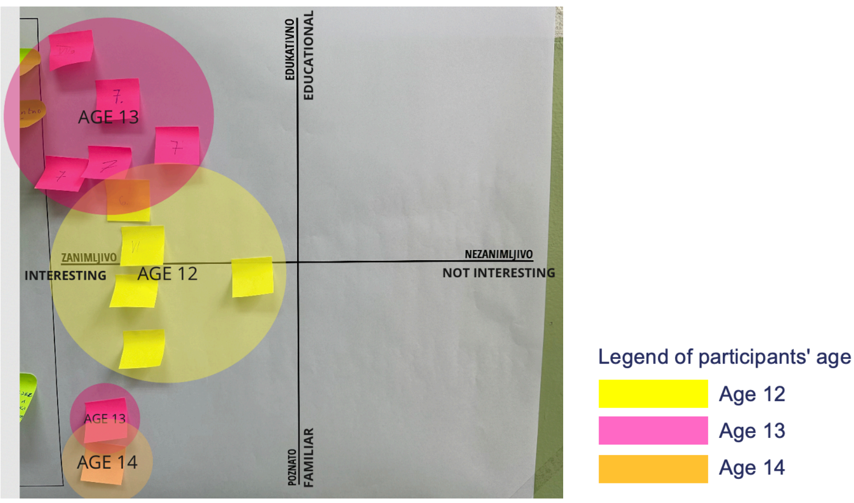

Figure 2: Students' evaluation results. Source: (Author 2024)

When children and teachers were asked to comment on the VGs' co-design process using one word, most of them described the process as interdisciplinary, interactive, innovative, interesting, and educative. Additionally, some noted that it was an excellent opportunity to form new friendships. One participant remarked,

> I like a lot all the workshops, and I would like to do them again. It was very interesting. We learned a lot of new things (Student Participant 2023).

Besides the ESD topics, the biggest novelty in the learning process for the students was the use of different BEE tools, such school map, the selection of VGs construction type based on the local sustainability issues and school needs, as well as interviewing other school community members.

According to the post-evaluation survey completed by participating teachers, VGs' co-design method could be implemented through specific after-school activities. In their opinion, those could be organized by thematic sections for students interested in caring for common school spaces and elements. Furthermore, teachers observed that students gained substantial knowledge about VGs, their significance, and the different types of VG construction throughout the design process. Notably, only those students recognized as the most active participants by teachers received the highest grades in biology and technical education.

2.3 Evaluation of the VGs' co-design method - technical difficulties

Issues with the tools' design were identified in two steps. In *Step 1 Identify*, participants used Post-it notes of different colors more times, which made the evaluation process difficult. The same colors visually indicated a connection between incompatible comments, thus hindering data analysis. Further challenges existed with the cards' design in *Step 4 Define*, because they had much more text compared to cards used in Steps 1 and 3, where data were presented in a more illustrative way. Another problem arose when participants were supposed to define the location of VGs. The map became less readable and the boundaries between zones were blurred due to the extensive usage of shading layers and colors to map the issues and identify spatial zones (Figure 3).

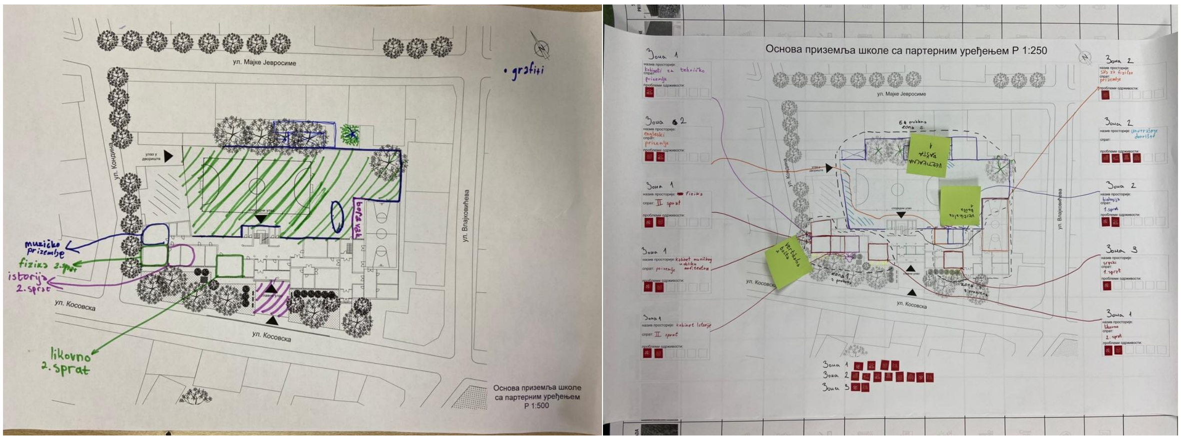

Figure 3: Results of the Step 2 Locate. Source: (Author 2024)

Teachers emphasized how demanding the preliminary procedure was. More specifically, they explained it as an extremely tedious and time-consuming procedure that involved them personally enclosing consent forms and project information letters to each student and parent involved. Moreover, the signed forms were delivered at the last minute since some of the children were used to forgetting to tell their parents about the project.

Another technical challenge was the lack of participants educated in architecture. The researcher was assigned several complex assignments that overlapped in time. It was demanding to moderate the project, guide participants through each step, act as an expert in architecture, search for process obstacles, respond to further inquiries from participants, and take notes. This allowed omission in the researcher's work. Teachers were also unable to take on specific tasks since they occasionally had to leave workshops to attend unplanned class events.

2.4 Evaluation of the VGs' co-design method - interviews as a tool with the greatest participation interest

When asked to interview other school community members to explore VGs' potential for formal, non-formal, and informal learning (Million et al., 2019), all students were enthusiastic and showed significant interest in the task. Many students found this co-design step to be the most engaging. This may be explained by the fact that the Step 5 Plan calls for the only "physical" activity in the entire VGs co-design process. Students were required to leave the classroom and interview appropriate members of the school community. Additionally, there was notable interest from the school community members interviewed, most of whom were teachers (50%). Students comprised 31% of the interviewees, primarily those involved in school sections or organizations, while the remaining 19% were school employees. A substantial majority (88%) expressed interest in the educational use of VGs, suggesting various ways to integrate VGs into the curriculum. Surprisingly, 63% indicated they would also use VGs for after-school activities and during holidays. However, as a procedural issue related to the conduction of the interviews, the researcher states an undefined duration for the task and an unspecified number of necessary interviews. Moreover, no analysis of collected data from the interviews was done by the participants, thus no reflection on the findings.

2.5 Evaluation of the VGs' co-design method – a sense of belonging and responsibility

The Step 5 Plan developed a wide range of recommendations, regardless of whether participants used their imagination, creativity, and wishes, or whether other school community members in interviews expressed their ideas for the use of VGs. Considering social issues such as safety, inclusion, health, participation, and education, most students developed a personal connection and responsibility to the VGs they have designed. Straightening their voices through group discussions, students suggested sustainable ways for their VGs to function in all three aspects – economic, ecological, and social. Teachers noted that a few months after the workshops concluded, some students frequently inquired about the construction timeline for their VGs. The primary challenge students sought to address was ensuring the safety of the VGs, as they feared potential damage. They viewed the schoolyard space near the VGs as their own but also envisioned it as a shared space where others could equally enjoy the surroundings for relaxation between classes. Providing additional VGs furniture such as speakers for relaxing music during school breaks between classes, an information table with rules of VGs use, benches, and a soft rubber paving would, in their opinion, provide them child-friendly school environment,

> a place where children like to spend time and play, a place where their physical, social, and emotional development takes place (Nordström 2017, 151).

3.0 CONCLUSION AND SUGGESTIONS

One uncommon case of action research with a participatory approach conducted in a Serbian primary school involves the development of a BEE co-design method for VGs, incorporating topics of ESD. This five-step process calls at a large number of individuals in the school community who are interested in subjects that this interdisciplinary process covers. Beyond serving as an architectural tool for co-design, this method is a formal learning tool with potential as non-formal and informal. This VGs' co-design method was created as a BEE tool to address sustainability issues through a biology and technical education curriculum in primary school in Serbia, spanning 12 school classes in total. Given the challenge of curriculum changes, the same procedure can be implemented through after-school activities in various school sections, such as ecology, art, science, and other related subjects. Furthermore, if any of the intended steps have already been completed through other school-related activities, the design process may proceed more quickly. For instance, STE(A)M projects carried out in one school in Serbia during the 2022–2023 school year led to the identification of local ecological issues ("STEM – Project Report" 2023), thus allowing the method's adaptability through the exclusion of Step 1 *Identify*. Additionally, such a gamified process can act as an effective instrument for encouraging youngsters to express their needs through dialogue and group decision-making regarding sustainability and their school environment. Applied activities can also be seen as catalysts of change, empowering young generations to play a more active part in spatial and ecological changes, as well as a way of transferring gained knowledge to their parents.

Finally, this study proposes suggestions for enhancing the novel VGs co-design method. Suggestions are based on the evaluation of data collected through semi-structured group discussions after each step conducted with students, as well as individual reflections by teachers, architects, and one pedagogue after completing the process:

- More Outdoor Tasks: Incorporate field activities, such as observing potential locations for VGs.
- Sensory Engagement: Include tasks that encourage participants to engage their sense of touch and smell, such as providing samples of plants or creating miniature VGs mock-ups.
- Educational Aspects Extension: Introduce new steps in the design process to cover educational topics like water treatment, considering that the current process does not include selecting a VGs' irrigation system.
- Development of Evaluation Tool for Interview Data: Create and implement an evaluation tool to analyze data collected from interviews with other school members. This tool should provide a framework for the future educational use of VGs.
- Continued Engagement: Assign homework when workshops are not held consecutively to ensure students' continued engagement and retention of the topics covered during the design process.
- Integration of Technology: Consider incorporating technological devices such as cell phones or computers to enhance learning. This could involve students using these devices to access more images and information about VGs, thereby deepening their understanding of new concepts and VG features.
- Further Testing and Review: Conduct additional testing and reflection on the method by professionals such as researchers, architects, and educators in various urban areas across Serbia.
- Adaptation to Different Contexts: Develop recommendations for adapting the VGs co-design method to different educational contexts outside of Serbia.

All the proposed suggestions seek to refine and extend the VGs' co-design method, enhancing its effectiveness in addressing sustainability challenges and improving learning outcomes. Furthermore, the study highlights avenues for further research, including additional testing rounds and post-project evaluations to assess the method's potential long-term impacts and scalability. Finally, a detailed comparison is required to evaluate the extent to which the method aligns with and complements the existing curriculum in Serbia.

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