PROGRAMME 21ST CENTURY SCHOOLS

ENGAGEMENT OF VULNERABLE CHILDREN

FINAL REPORT

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EXECUTIVE SUMMARY

The British Council's '21st Century Schools Programme in the Western Balkans' has been implemented in the six Western Balkan countries with the aim to strengthen learning opportunities for students ages 10 to 15 years through development of core skills and competences, such as critical thinking and problem solving, and digital skills with focus on coding skills. Towards the end of the Programme, the British Council decided to assess the impact of the Programme on vulnerable children, since the feedback from the schools indicated beneficial effects on children with different types of vulnerabilities. The assessment was conducted by a multinational team of experts and the results are presented in this report.

The objective of the assessment was to collect evidence and document the impact that the programme had on vulnerable children attending regular primary schools in the countries where the programme was implemented, and to identify factors and conditions that enabled vulnerable children to benefit from the programme, as well as the barriers to their full participation. Vulnerabilities were defined in line with the OECD's cross-national classification, including children with disabilities or impairment, those with behavioural or emotional disorders, learning difficulties, but also those that are from disadvantaged groups.

The assessment is based on the analysis of 12 cases, two from each country. Four cases focus on the impact of the Programme on individuals, six cases focus on the impact on different groups of children, while two cases focus on the whole school. The cases are also diverse in terms of types of difficulties, and evidence is gathered through interviews with 89 respondents (school teachers, principals, other professionals, parents, children).

The evidence indicates that the impact of the Programme on the vulnerable children is clear and multifaceted:

- **Increased analytical and critical thinking and coding skills of the children**. The effects of the Programme were especially notable among children whose vulnerability comes from a disadvantaged socio-economic position, among girls whose engagement with digital technologies is marginal due to the still prevalent patriarchal norms transferred through socialization, directing girls more towards fields that are related to social services, humanities and arts. The beneficial effects, in terms of knowledge and skills, were more modest among children with various developmental difficulties, particularly those with more severe forms of mental disabilities.
- **Increased motivation for education and school attendance**, particularly among children with more severe learning difficulties and children from very deprived communities whose motivation was previously undermined due to the feeling of exclusion, insecurity and inequality.
- **Using Micro:bit technology in different teaching subjects improved learning of these subjects** and improved children's capacities to create links between different topics.
- **Children developed social sensitivity and empathy for their peers with disabilities** during the joint projects. This also influenced their further participation in initiatives related to supporting their vulnerable peers.
- **Increased self-confidence and educational aspirations among children** due to the acquisition of new skills, and strong sense of progress and success.
- **Increased participation in class, more proactive approach to learning** due to the new teaching methods and more interactive education techniques.

- **Improved emotional and psychological wellbeing of children with learning difficulties** as reported by parents and teachers due to the higher motivation to participate in school activities.
- **The Programme was very useful for teachers as it helped them achieve teaching objectives and made their work more interesting**. The new skills and teaching techniques also increased the motivation of the teachers and their commitment. Teachers started to evaluate their classes more regularly and to listen to students' opinions regarding the tools they had been using.
- **The Programme addressed noticeable rural/urban disparities**, encouraging children from rural areas to engage more actively, develop learning skills and improve self-confidence.

The assessment identified numerous **factors contributing to the success** among vulnerable children, including those related to the programme design (focus on practical knowledge, the novelty of Micro:bit technology, clearly defined processes, supportive role of mentors, freedom given to students to express creativity, support of British Council), factors related to students (selection of motivated students, appreciation of team work), factors related to schools (motivation and commitment of teachers, principals, good teacher-to-student ratio, previous innovation experiences, good equipment), and environmental factors (supportive families, recognition of importance of the Programme in local communities).

Some of the **inhibiting factors** identified were related to the difficulties to include coding in regular curricula in some schools, lack of supporting staff for children with disabilities, short trainings, overcrowded classrooms, lack of equipment, insufficient transfer of new knowledge and skills among teachers, the lack of parental engagement.

Recommendations based on the assessment are grouped in several sets:

Improving curricula and learning methods:

- It is necessary to include Micro:bit systematically in the regular curriculum because Micro:bit enables cross-curricular content connections, supports groupwork, connects students and teachers and enables teachers to achieve teaching objectives with all students; it is important to use its full potential and include it in the curricula.
- The specific methods of implementation of the Programme among vulnerable children should be based on their needs assessment, taking into account the specific type of vulnerability and adjusting methods to this type.

Improving actions towards students

- The implementation of new teaching techniques should be planned in the schools in such a way that it provides optimal dissemination to larger groups of children (inclusion of teachers that lecture multiple classes in different grades), but it should also include better transfer of new methods to other teachers through internal knowledge transfer processes.
- The implementation of programme activities or post-programme continuation of the implementation of same methods and new projects should be planned in such a way that it provides more dynamic peer-to-peer transfer of knowledge between students.
- It would be necessary to change the timeline of the Programme, to allow children to actually learn how to program. As it is now, there is not sufficient time for the students to truly learn how to code.

- It would be beneficial for an assessment of the results to be conducted, i.e. to measure student learning outcomes more precisely.
- The programme can be replicated with younger children.
- Another important area that needs to be further explored and developed is offering more peer-to-peer support when it comes to learning, because children tend to benefit more when working with someone closer to their age and interests, so that they may remain interested in the educational process and improve their integration within the school.
- Promotion of the Programme and specific techniques, as well as Micro:bit and the results achieved so far, in order to increase the interest of other schools.
- Support to girls to increase skills interest and participation in STEM education areas but not in a gender segregated way (focusing only on girls and excluding boys). Both boys and girls should be included in the programme, but the programme should be designed in the way that promotes new views on professional orientation of women, meaning their more massive entrance in STEM areas.

Improving actions towards teachers

- In order to improve the implementation of the new CTPS techniques with vulnerable children – especially those with learning difficulties – it is important to include at least one training module on how to apply these techniques when working with these children, how to address challenges in the application of CTPS techniques, how to engage them in coding, and similar.
- Teachers also pointed out that it is important to organize more trainings on coding in order to increase teachers' coding skills, and to train them how to use digital technology and Micro:bit specifically in different subject classes.
- Teachers also expressed the desire to learn more diverse CTPS techniques.
- Teachers appreciated the mentoring support, but they recommended longer mentoring visits as they felt they needed more support for the implementation of new teaching techniques in their specific subjects or in projects.
- It is necessary to train more teachers in order to achieve large scale implementation of the programme, or to design the tools so the trained teachers can relatively easily, systematically and effectively transfer their knowledge of CTPS and Micro:bit coding to other teachers at the school.
- Pedagogical assistants, special educators should be also included in the trainings in order to provide adequate support to the teachers' work with children with learning difficulties or disabilities.
- The pedagogues should be involved in training and programme activities from the beginning of the Programme.

Improving learning environment

- Findings related to the role of the parents indicate a need to create a more supportive learning environment for children in general, through the inclusion of the parents of children with learning difficulties in training for coding so they would be able to support their children's work at home.

- The positive attitudes of teachers and school principals regarding the implementation of the programme is a good basis for replication and upscaling. It is therefore important to spread information and experiences of good practices among teachers in the region.
- It is necessary to improve the ICT infrastructure of the schools (premises, equipment and internet access, some Micro:bit accessories, such as sensors, etc.)
- The Programme activities and achievements should be promoted in the community by posting information about activities on school websites, Facebook pages, or through other media.

1 | INTRODUCTION

The British Council's '21st Century Schools Programme in Western Balkans' has been implemented in the six Western Balkan countries (Albania, Bosnia and Herzegovina, Kosovo, Montenegro, North Macedonia and Serbia) during 36 months (October 2018 through September 2021) with the aim to strengthen learning opportunities for students of age 10 to 15 years. The Programme's specific approach includes development of core skills and competences, such as critical thinking and problem solving, and digital skills with focus on coding skills. The capacities of teachers and school principals for implementation of new learning approaches and methods have been developed through the Programme. The component that focused on the development of digital skills included the acquisition and distribution of Micro:bits, pocket-sized computing devices suitable for teaching coding to young children.

Towards the end of the Programme, the British Council decided to assess the impact of the Programme on vulnerable children, since the feedback from the schools indicated beneficial effects on children with different types of vulnerabilities. The assessment was conducted by a multinational team of experts and the results are presented in this report.

The purpose of the assessment presented in this report was twofold:

- to collect evidence and document the positive impact the programme had on vulnerable children attending regular primary schools in the countries where the programme was implemented; and
- to identify factors and conditions that enabled vulnerable children to benefit from the programme, as well as the barriers to their full participation.

Main objective of the assessment is to document and analyse the impact of the '21st Century Schools' programme **on vulnerable** children, and to **identify the main factors** contributing to the programme's effective implementation in selected cases, and to obtain insights into possible further improvement, replication or upscaling, aimed at achieving more systematic impact on vulnerable children.

For the purposes of this assessment, 'vulnerable children' include children with disabilities, children with difficulties in learning and development, and children belonging to other disadvantaged groups. This definition follows the OECD's cross-national classification[1]:

- *A/Disabilities*: Students with disabilities or impairments viewed in medical terms as organic disorders attributable to organic pathologies (e.g. in relation to sensory, motor or neurological defects). The educational need is considered to arise primarily from problems attributable to these disabilities.

- *B/Difficulties*: Students with behavioural or emotional disorders, or specific difficulties in learning. The educational need is considered to arise primarily from problems in the interaction between the student and the educational context.

- *C/Disadvantages*: Students with disadvantages arising primarily from socio-economic, cultural, and/or linguistic factors. The educational need is to compensate for the disadvantages attributable to these factors.

Scope of the assessment is defined in terms of the geographical scope, number and type of cases:

- The assessment included in total 12 cases, which were based on different unit levels: individual student, a class or other group in the school, the whole school.
- The assessment was conducted in the Western Balkans region, including Albania, Bosnia and Herzegovina, Kosovo, Montenegro, North Macedonia and Serbia.

2 | PROGRAMME DESIGN

The Programme was designed in accordance with the specific socio-economic context of the Western Balkans, which is marked by slow post-conflict recovery and post-socialist transformation, with recent retrograde trends manifested as erosion of democracy, rule of law and media freedom, low economic performance, and fast rising nationalist sentiments. The poor quality and relevance of education for labour market needs is the issue recognized during the last two decades, but only partial and insufficiently effective reforms were implemented, resulting in high unemployment of young people and their higher exposure to poverty risks.

Aiming to assist countries in the region in addressing the challenges of the poor quality of education and the education system that does not prepare children sufficiently for labour market, the British Council implemented the programme, which was focused on building the capacities of teachers, school leaders and policy makers to transform classroom practices across the region and equip primary school students with the skills and knowledge that are suitable to meet 21st century demands. The objective of the programme is to improve the quality of education through the greater incorporation of critical thinking and problem solving (CTPS) and coding in classroom practices at primary schools throughout the Western Balkans. It is expected that by incorporating these skills in the primary education curriculum and teaching, countries in the region will address skills shortages in a sustainable manner, which **will contribute to improved education outcomes for girls and boys and help Western Balkans countries to increase their human capital, which should in turn lead to economic growth and stability**.

The programme well responded to the ongoing education reforms in the Western Balkans countries, particularly corresponding to learning objectives and outcomes that recognize critical thinking and problem solving as transversal skills. The programme was designed to achieve three outcomes:

1. **Outcome 1:** Teachers have improved professional skills and knowledge and apply this to support the development of critical thinking, problem solving and coding skills for girls and boys;
2. **Outcome 2:** School leaders create an environment at the school level for teaching and learning critical thinking, problem solving and coding skills;
3. **Outcome 3:** Relevant decision makers create curriculum and introduce other related policy measures to advance learning of critical thinking and problem solving and coding skills in primary schools.

The Programme was designed with the aim to develop the following skills among children ages 10 to 15 years:

- Critical thinking & problem solving: Self-directed thinking that produces new and innovative ideas and solves problems. Reflecting critically on learning experiences and processes and making effective decisions.
- Coding skills: Teachers and children are introduced to programming using Micro:bit, a pocket-sized codeable computer that was designed with the aim to inspire young people to become creative with digital and develop core skills in science, technology and engineering[2]. Children will have the opportunity to learn programming using block-based coding, HTML and Python by creating games, animations and websites in regular ICT classes and after-school Coding Clubs.

In addition, it was expected that students would develop additional skills, such as **collaboration skills**: working in diverse teams, learning from and contributing to the learning of others, assuming shared responsibility, cooperating, leading, delegating and compromising to produce new and innovative ideas and solutions; **creativity & imagination skills**: economic and social entrepreneurialism, imagining and pursuing novel ideas, judging value, developing innovation and curiosity. One of the key added values of the project was the **increased interest, engagement and empowerment of girls to engage in ICT** activities and consequently become more interested in future schooling and a career in this field, or at least to learn that acquiring digital skills is an essential part of their education and future career.

The Programme was implemented in different varieties across the schools selected for the assessment. There are differences in the number of trained teachers, which impacted later the implementation and effects of the Programme[3]. At the school in Sinanballaj (Albania) only one teacher was trained, while at the school in Prishtina (Kosovo) 12 teachers were trained. At some schools CTPS and coding activities were integrated in the regular classes – as techniques used in regular curricula. In other cases, activities were conducted as extracurricular activities, as there was no space to include them in the regular curricula, such as in the cases of the schools in Albania. The coding club was one of the main mode schools applied to implement the coding component of the programme. The clubs were founded by trained teachers and included a between ten and 15 children. The activities of the clubs often developed around a specific project. Some schools even participated in competitions and won awards based on their good results.

3 ANALYTICAL FRAMEWORK AND ASSESSMENT METHODOLOGY

The assessment was implemented in four phases:

1. Development of methodology for a multiple case study analysis
2. Selection of cases for the case study
3. Data collection
4. Analysis and reporting

Development of methodology		Selection of cases
	Phase 1:	Phase 2:
Analysis and reporting	Phase 3:	Phase 4:
		Data collection
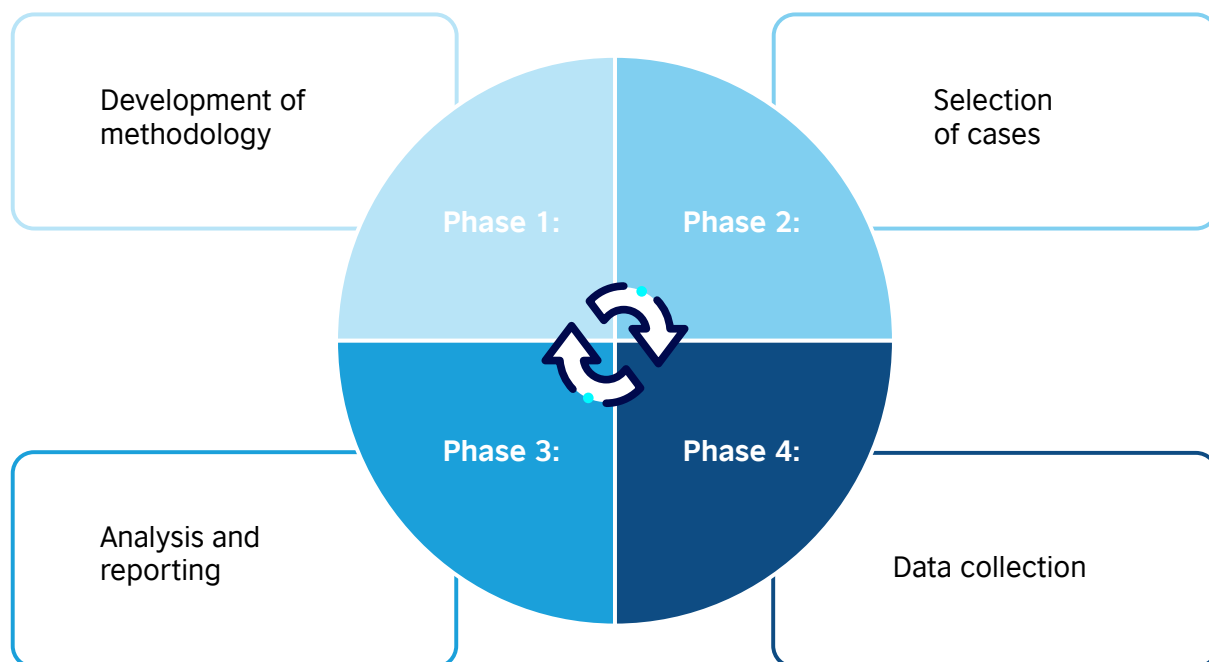
The analytical framework of the assessment was developed during the first stage (presented in Annex 1), focusing on three aspects:

1) identification of specific benefits of the Programme for the children observed at different unit levels: individuals, a specific group of children, a whole class or the whole school; the benefits are observed in different forms, as child motoric and cognitive development, learning skills, as subjective feelings of achievement, as improved social relations, gender equality, changed relation between children and teachers, participation in other learning activities, extracurricular activities, functionality within the family, relations with others, etc.;

2) identification of the factors contributing to the observed changes, including factors related to the Programme specific components, methodology of the Programme, as well as factors related to the teachers' modes of applying the Programme, factors related to the classroom and school environment, broader social factors, such as family support, social networks and circumstantial factors, namely threats posed by the Covid-19 pandemic to engagement of vulnerable children.

3) identification of possibilities for further improvement, upscaling or replication of the model.

The methodology was developed based on the analytical framework and assessment objectives, discussed within the team and finalized during the first week of November, and the data collection instruments were prepared. The assessment is based on the qualitative method of multiple-case study that enables the understanding of the similarities and differences between the cases, to draw conclusions on the impact of the Programme on vulnerable children. The cases are defined at different levels, as already indicated: individual children, group/class of children or the whole school. As case studies rely on data triangulation methods, the data collection methods were designed to gather information from multiple sources: Programme documents, vulnerable children, teachers, school psychologists/pedagogists, pedagogical assistants, school directors, parents, peers of vulnerable children. The data was collected through individual and group interviews, using semi-structured interview guides developed specifically for different groups of informants. Due to the Covid-19 pandemic all interviews were conducted online using different mobile phone applications and internet platforms, as convenient.

The assessment is based on the analysis of 12 cases, two in each country. Four cases focus on the impact of the Programme on individuals, six cases focus on the impact on different groups of children, while two cases focus on the whole school. The cases are also diverse in terms of types of difficulties, as presented in Table 1. A more detailed list of cases is presented in Annex 2. In total, 89 persons was interviewed during the data collection phase.

Table 1: Description of cases

Country	Type of difficulty	
Albania	B – Down Syndrome	individual
	B – various difficulties	school
Bosnia and Herzegovina	C – position of Roma	group of children from households with low socioeconomic status, including Roma students
	A – sensory disability (deaf-mute)	group of children
Kosovo	C – low socioeconomic status	individual
	B & C – various disabilities and low socioeconomic status	school
Montenegro	B & C – children with disabilities, children from families with low socioeconomic status, girls from disadvantaged families	group of children
	C – girls from rural areas	group of children
North Macedonia	B – hearing impairment	individual
	C – children from marginalized groups (low socioeconomic position, Roma and other minorities)	group of children
Serbia	B & C – children with difficulties in learning and development, children from low socioeconomic status, children without parental care, in alternative care, Roma children, other ethnic minority children	group of children
	C – socio-economic disadvantages	group of children (girls)

4 | KEY FINDINGS

This chapter summarizes key the findings based on 12 case studies, while full case studies presented in Chapter 6.

The evidence provided in the case studies indicates that the impact of the Programme on the vulnerable children is clear and multifaceted, despite the fact that Programme was not designed specifically to benefit different groups of vulnerable children. The impact identified by the case studies varied depending on the type of vulnerability, as did a number of factors including: the way how the programme was implemented in particular school, factors related to the micro-environment in which children participate in education (the teachers, curricula, methods used, social relations between students, students and teachers, presence or absence of special assistance (in case of children with disabilities), technical and logistical factors), and broader environment (particularly family support, the local environment, social inclusion of children, but also their entire communities, such as in the case of schools from rural and remote areas, or with children from groups facing severe challenges in social inclusion). Therefore, the following sections summarize the findings by the types of impact on individuals, groups of children, teachers and schools, keeping in mind the different types of vulnerabilities, as well as factors contributing to or inhibiting a more effective impact by the programme.

4.1. IMPACT OF THE PROGRAMME ON VULNERABLE CHILDREN AND THEIR SCHOOLS

'Education is on the margins of society and a school on the margins of the city is on the margins of the margins. That is why this project was a great success.'
Teacher, Kreka Primary School, Tuzla, BH

The case studies indicate various positive changes among children from different vulnerable groups, their school peers and school environment in general.

Increased knowledge and skills. This is the central intended impact of the Programme, and the evidence indicates that programme succeeded increasing analytical and critical thinking, and the coding skills of the children. Although the narratives provided by various respondents about the effects of the Programme more often emphasizes the benefits of digital skills and coding, it should be kept in mind that critical thinking and problem solving are less visible transversal skills that are often considered 'background' skills necessary for other skills, particularly coding and use of digital technology (such as the Micro:bit) in highly heterogenous forms of problem solving. The narratives reflect a certain fascination with the Micro:bit device, but when respondents talk about the benefits of technology and coding, they also point out the benefits of the development of critical thinking and problem solving skills that are embedded in innovations generated using that technology.

The effects of the Programme were especially notable among children whose vulnerability comes from a disadvantaged socio-economic position, among girls whose engagement with digital technologies is marginal due to the still prevalent patriarchal norms transferred through socialization, directing girls more towards fields that are related to social services, humanities and arts. The beneficial effects, in terms of knowledge and skills, were more modest among children with various developmental difficulties, particularly those with more severe forms of mental disabilities. However, other forms of benefits of the Programme for these children are recognizable and important and will be further discussed later.

Teachers working with children from vulnerable socio-economic status families have indicated that improvement of ICT skills was particularly significant for these children as they

usually lack the digital technology at home. Through activities supported by the Programme they gained the opportunity to learn and use these technologies at school.

According to some testimonies, the development of digital skills was particularly useful when the pandemic broke out because schooling was transferred into the virtual space and the new skills were very helpful to many children, particularly those from vulnerable groups.

Different case studies point to limitations of the learning achievements among children with more prominent learning difficulties. In some cases these children were unable to learn coding, but they were nevertheless happy to participate in the coding clubs and to observe other children working or to be involved in some of the activities. The example in the Special School in Shkoder (Albania)[4] shows that children were happy to use Micro:bit to do simple coding exercises, such as writing their names, creating shapes using LED icons and similar, but were not able to create new coding projects. Therefore, the impact was greater in other aspects than in merely developing coding skills: improved socialization of children through exchanges during work, learning from each other, observing others and presenting their own work to others. This could be greatly attributed to the moderate-to-high severity of difficulties among these children, hence complex learning – such as coding of more complex tasks – is more difficult to achieve. However, in case of other children with learning difficulties the learning process was more successful.

'She (girl of Roma background with learning difficulties) is quite good at following instructions, and she notices the small details of the device and follows the directions and can code the device.'
Special educator, Tode Hadzi Tefov Primary School, Kavadarci, North Macedonia

Although in a majority of cases the evidence that indicates an increase of knowledge and skills is qualitative, there is an example of more precise monitoring of the effects of programme activities and results. At the school in Slap (Montenegro) the teacher who coordinated Micro:bit club measured performance based on the frequency and quality of the students' participation in the club, the quality of their assignments, and their coding and presentations skills. According to the monitoring results, while all participating students gained basic knowledge about Micro:bit, about 74 per cent of them reached an intermediate level and showed capability to engage in more complex tasks. Boys and girls showed similar results. Grade 8 students showed the best level of acquired knowledge while only 25 per cent of the grade 6 reached this level.

Graph: Share of students reaching intermediate level of knowledge in Micro:bit club, Milosav Koljenšić Primary School, Slap, Montenegro
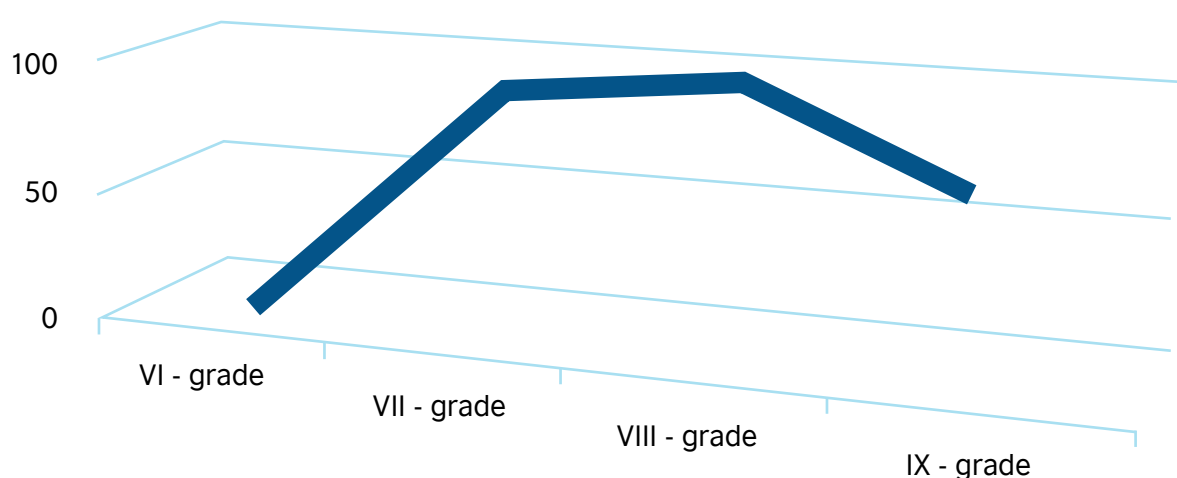
The teacher also measured the portion of students who reached the highest, advanced level of knowledge and ability to combine coding with creativity. Girls performed better in this

regard as about 36 per cent of participating female students reached this level (compared to about 25 per cent of male students). Age wise, students in grade 8 showed the best results.

Graph: Share of students reaching highest level of knowledge in Micro:bit club, Milosav Koljenšić Primary School, Slap, Montenegro

In addition to the core knowledge and skills that were central in the project, evidence points to the **increase of other important skills,** such as **literacy, presentation skills, creativity, public speech, transfer of knowledge to peers,** etc.
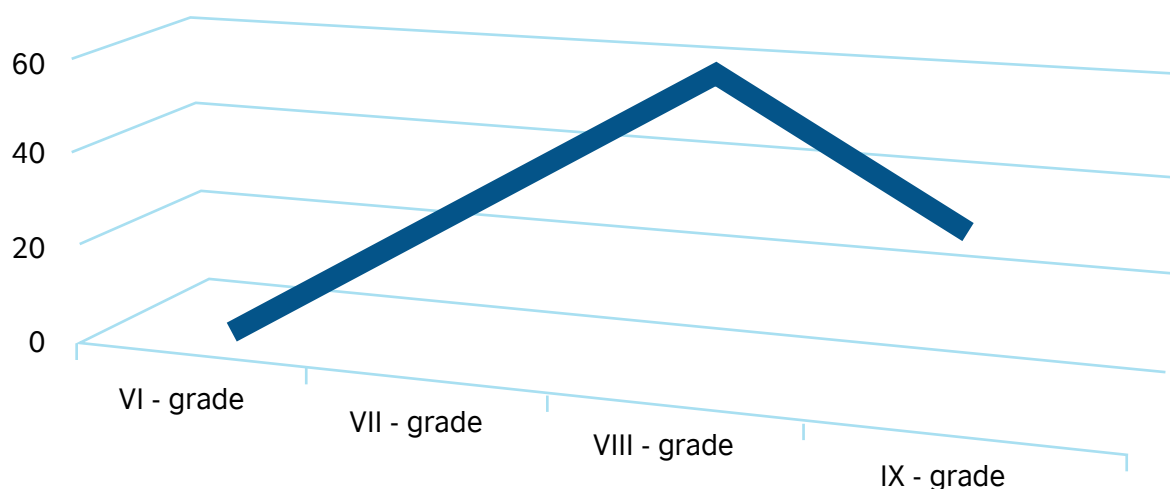
'They learned how they can pass on knowledge to others in the simplest way, and that is another great benefit of this project. They learned this because they presented the programme to other students, both younger and peers.'
Teacher, Dule Karaklajić Primary School, Lazarevac, Serbia

Increased motivation for learning and school attendance. There are many examples of increased motivation to attend school and participate in the education activities that were improved because of the Programme. New teaching methods and coding activities increased the interest and motivation of the children. As indicated by respondents, especially interesting were the techniques such as Six Thinking Hats, Costa Taxonomy, problem tree, three-level questions, Micro:bit and debate. This was in several cases especially emphasized by teachers working with children living in Roma settlements and belonging to some of the most marginalized groups, as well as by teachers working with children with special needs, such in the Ismail Qemali Primary School in Prishtina, for example. Children considered Micro:bit coding as particularly interesting and, when applied in regular teaching, this increased interest among children in the subjects and classes in which the new technology was applied. The new education methods and coding also had a very beneficial impact in the cases of children with learning difficulties. Teachers from schools in Shkoder and Sinanballaj (Albania) indicated that they had to make a great effort to motivate children with learning difficulties to regularly attend the school. However, when the new activities and methods were introduced, these children were more motivated and willing to regularly attend classes. This was also largely confirmed by the interviewed parents from those areas.

Increased collaboration among students, improved peer/social relations. The case study data points to multiple examples of improved interactive collaboration among children due to the shared tasks related to the school projects or specific assignments implemented as part of the Programme. This was particularly noted among children from socio-economically disadvantaged groups. Teachers reported visible social distance between them and other children, however, through joint participation in the assignments and projects related to the Programme, **children felt equal**. The feeling of equality comes from facing the same knowledge challenges, and this improved overall collaboration and socialization between children from disadvantaged groups and those not belonging to such groups.

"The use of debate made children argue facts and eliminated the differences they saw between them".
Teacher, Primary School Ismail Qemaili, Pristina, Kosovo

Using Micro:bit technology in different teaching subjects improved learning of these subjects. Students showed improved learning of other subjects when Micro:bit was used in those classes. They also demonstrated improved ability to create links between different topics. Also, using digital technology is always related to English language (browsing manuals on the internet, using open code, exploring other examples of use, etc.) and therefore, their knowledge of English improved significantly.

'We don't use the techniques always… but when we use Micro:bit, the pupils are more involved in the lessons… they are very fast at integrating their subject lesson with their knowledge of the Micro:bit – for example physics, chemistry… they find it quite interesting… the lessons are more interesting.'
Teacher, Kiril Pejčinovik Primary School, Tearce, North Macedonia

Children developed social sensitivity and empathy for their peers with disabilities. This is one of the very important achievements of the Programme. Including children with learning difficulties in joint projects and working on new assignments related to coding, developed empathy and solidarity among children. Some of the technological inventions developed through the programme were actually designed with the aim to assist students with learning difficulties or hearing impairments. As evidenced by interviewees, the programme greatly influenced student awareness about the problems faced by their friends with autism. This contributed to other activities in which the school took an active role. For example, the students of the Dule Karaklajić Primary School in Lazarevac, Serbia, contributed to the celebration of World Autism Awareness Day by organizing a march in which they wore "I exist" badges, blue T-shirts (because blue is the symbol of children with autism), and at the end of the march they organized an origami workshop where they made different shapes out of blue paper, and they handed out messages to passers-by with the wishes of people suffering from autism, drawing attention to autistic people.

'I think that this kind of action should be supported because we are a society that finds it difficult to accept differences, simply to show that they are just as important and that they are no different from us. Our goal is to bring people closer to autism, that people with autism simply are not less valuable.'
Student participating in the action, Dule Karaklajić Primary School, Lazarevac, Serbia

Increased self-confidence and educational aspirations among children. Achievement of new skills, a sense of progress and success in learning significantly increased the self-confidence of the children. In some instances, the participation in school coding project, success in competition, and opportunities to realize their potential and to manifest their creativity was crucial for children coming from disadvantaged groups in gaining self-confidence but also in increasing their educational aspirations.

'The parents are very happy that I am a member of the Micro:bit club and because I was successful in the competition. And friends congratulated me, so it made me very proud. I am teaching my parents about computers; I know more than they do… I want to study electrical engineering later, so this is great career advice for me.'
Boy coming from socioeconomically disadvantaged family, Kreka Primary School, Tuzla, Bosnia and Herzegovina

Being part of coding club also helped instill self-confidence in Roma children as they often experience low self-esteem, because of the lack of inclusion in regular school activities. The feeling that they are part of a group that accepts them and treats them equally and that they can do the same activities as their peers served to boost their self-confidence.

'In regular classes Roma children are separated, during recess they stay with other Roma, on excursions they share rooms with other Roma, but in the coding club they interacted with other children, shared experiences, showed each other outcomes, so the communication was really good… when they realized that they can do some things faster than others – even faster than some teachers – their self-confidence increased… we included them in the presentation to improve their self-confidence… They realized that they know as much as other children and they gained some self-confidence, so it was easier for them to get involved, to communicate with the other children.'
Teacher, Tode Hadzi Tefov Primary School, Kavadarci, North Macedonia

In some cases the participation in the Programme activities increased the sense of responsibility among children. This was particularly the case with children attending the Mladost Primary School in Kruševac, Serbia, where children who had been trouble with the law also participated. Giving them the responsibility of taking care of technical equipment significantly contributed to their sense of responsibility.

Increased participation in class, more proactive approach to education. New teaching methods and activities contributed to the more active participation particularly in the case of children with learning difficulties and children who were usually silent or passive, due to a feeling of social distance caused by their vulnerable socioeconomic background. The evidence points to their higher readiness to participate, to express their opinions, propose ideas, ask questions. Those students who had practical experience with Micro:bit shared their impressions and this consequently led to the increased motivation of other students to explore Micro:bit capacities. For example, the physics teacher from one of the schools in Montenegro mentioned that after she used Micro:bit in her classes with the grade 9, the eighth graders asked her if they too could work with the Micro:bit. Afterwards, she expended her use of Micro:bit and used it to explain different topics including magnetic field and velocity.

Improved emotional and psychological wellbeing of children with learning difficulties. The parents of children with more severe developmental problems and learning difficulties, as well as teachers, reported beneficial effects of the programme on the emotional and psychological state of these children. Higher motivation to participate in the school activities and higher satisfaction produced a more stable disposition among some of these children, as reported by parents. Their ability to better manage their own emotions and behaviour had also increased.

Improved relations in the family. Several cases pointed to the beneficial effects of the Programme in terms of contributing to better relations in the families of children from vulnerable groups. Children with learning difficulties would require assistance from parents in their homework related to coding, and this provided new content in their relationship with their parents. Unfortunately, as reported by teachers, some parents did not have the appropriate skills to be helpful, which placed limitations on new opportunities for joint activities of children and parents.

Programme was very useful for teachers as it helped them to achieve teaching objectives and made their work more interesting. The evidence points not only to benefits for children and especially those with some form of vulnerability, but also for teachers responsible for their education and for achieving objectives defined by curricula. Many teachers trained in CTPS and coding claim that the CTPS techniques were quite helpful in achieving the teaching objectives. New skills and teaching techniques also increased the motivation of the teachers and their commitment. Teachers also improved their presentation skills and increased self-confidence as students were more attentive in class and more motivated. Many interviewed teachers said that they and their colleagues manage to eliminate the prejudices that coding is very complicated and should be used only in ICT classes. They learned how to use it in other subjects as well and they were ready to engage in coding activities. Teachers started to evaluate their classes more regularly and to listen

to students' opinions on the tools they had been using. The students welcomed this kind of increased opportunity for participation. The participation in the Programme also provided the opportunity for teachers to learn about cross-curricular, interdisciplinary projects and their benefits in skills development and education of children.

In one school a history teacher used Micro:bit to make the class more interesting. She used the Micro:bit shake function to enable students to choose a letter or a question. On one side students really enjoyed more interesting classes and on the other teachers enjoyed learning new things. *'I hadn't used a Micro:bit before and it was nice to learn that. Other teachers have learned a lot'*, one of the teachers noted. *'That was a win-win situation'*, he continued.

The coding was something where all the children had the same start and it was a levelling ground for the Roma pupils in question. This, coupled with teachers' attention, also contributed to the change. *'It was new to all the children… so they didn't feel that they were lagging behind, because in the regular lessons they know that they are not well prepared for the material, so they felt that they had certain deficiencies for getting involved and they felt insecure… This was something new and they felt that they were on the same level with the other children and that prompted them to become actively involved in coding the Micro:bit.'* (teacher)

The Programme addressed noticeable rural/urban disparities, encouraging children from rural areas to more actively engage, develop learning skills and improve self-confidence. Several cases indicated significant differences between children and schools from rural and urban areas. Teachers working in rural schools pointed out many disadvantages, including the lack of equipment, internet, remote position of villages preventing children from participating in social activities in the same way that they are available to children in urban areas. Teachers working in several schools, both urban and rural, had the opportunity to compare students in terms of their proactive approach, self-confidence. According to their testimonies, children in rural areas feel more insecure, reluctant to openly share their opinions, which is particularly important for critical thinking and problem solving.

'Children from the village are very quiet. They don't want to participate because they are constantly afraid that they might say something wrong.' 'Children in the city compete and constantly go to some preparatory classes to further improve their skills. Children from the village are not ambitious.'
Teacher, Milosav Koljenšić Primary School, Slap, Montenegro

The children indicated that because they are greatly involved in the agriculture, their parents often do not have time to be very supportive in their education activities, and even when they do have the time, they lack the skills – especially digital literacy. On the other hand, there are some advantages to the implementation of the programme in rural areas, such as better student/teacher ratio due to the smaller number of children, more time that could be dedicated to programme related activities because there are fewer available entertainment facilities in their surroundings. The evidence points that the programme was very beneficial for children in rural areas as it prompted a more pro-active approach to the learning processes – participation in a project. The critical thinking and problem solving skills increased their openness to exchange and interaction during classes. Coding skills and engagement in the project also improved their self-confidence. This could have a crucial influence on their future education aspirations and labour market skills, and could bring new perspectives for rural employment, combining agricultural and digital activities, decreasing outward migration pressure.

The programme had particularly beneficial effects on girls, eliminating stereotypes that girls are not as interested or capable of working with ICT. The societies of the Western Balkans are still predominantly patriarchal: girls and boys grow up with norms that assign different roles to boys and girls. As different surveys and statistical data demonstrate,

there is clear segregation of boys and girls early on in education, with girls opting more often for fields related to social services, social sciences, humanities, arts, and boys turning more towards technical education, engineering, sciences. The programme created the opportunity for girls to be informed, to participate, to test their own abilities to work with digital technologies and engage in coding. Respondents from some schools indicated that interest in the coding clubs was even higher among girls than boys. For example, according to the computer science teacher and Micro:bit club coordinator at the school in Slap, Montenegro, girls were more interested than boys. His records shows that 79 per cent of all eligible girls joined the club while significantly fewer boys (57%) expressed an interest in joining the club.

The results were striking not only in terms of high interest among girls but also in terms of high achievements. As previously demonstrated by the results of the student performance monitoring at the school in Montenegro, the percentage of high achievers was greater among girls than boys. Consequently, high achievements increase further interest and the motivation of the girls who were engaged, and the reports about their achievements incites interest among girls who are not directly involved in coding clubs or activities related to coding. The high achievements of the girls consequently led to a considerable increase in their self-confidence.

'Now that I've seen that I can do it, then I know I can do everything in life'
Girl, grade 9 student, Milosav Koljensic Primary School, Slap, Montenegro

Additionally, participations in competitions, appointing girls as team leaders in coding clubs or teams preparing projects for competitions, empowered girls in leadership roles, which bears high potential for their future career and participation in different fields of public engagement.

In some cases, such as in the case of the school in Kishnarekë, Kosovo, the teachers recognized the importance of supporting highly motivated and successful girls from families with low socioeconomic status, who wanted to work on coding project on their own time, but did not have computers at home. Therefore, the school lent them computers and enabling the girls to work on coding at home.

Participants in the interviews at the school in Lazarevac, Serbia, agreed that boys and girls reacted differently to the Micro:bit. While the boys were primarily interested in the possibilities of using the micro bit as a game console and when they realized that was not its purpose, they more often gave up. When the task was set to map the problem through conversation with other teachers, the girls coped much better because they connected more easily with a larger number of people and they were not ashamed to ask around the school about potential problems that required solutions. Having in mind these experiences it would be very important to promote ICT education among both girls and boys, in a non-gender segregated manner.

However, data from the field indicates that at some schools, especially in rural areas, there is reluctance to frame the undisputable success of the programme in mobilizing girls as a gender equality achievement. Multiple attempts by the researchers to link this success to the improvement of gender equality among students and to the empowerment of girls was rejected by interviewed teachers. This additionally confirms the great success of the programme as it achieved important results in terms of gender equality despite the reluctance to discuss gender equality and to recognize this beneficial contribution as specifically aimed at changing the gender balance.

The assessment also indicated **multiple benefits for schools**. Schools received equipment, such as the Micro:bits, but the application of this technology provided other benefits, in terms of improved infrastructure. One of the examples was devising thermometers for classrooms at the school in Tuzla (BiH) which provided the evidence of poor heating and placed pressure on the school to change the windows. The successes in competitions, as well as the fact that the schools are implementing new methods and have coding clubs, improves their reputation

and they become more attractive to students. Also, other schools are ready to replicate same activities and practices. In some cases the Programme brought increased concerns for the safety of children with disabilities and increased overall safety as a consequence, and Micro:bit technology was used to achieve this. In other cases the positive experiences of the schools in the Programme was presented to governments and recommendations were provided for improvement of the curriculum.

Finally, some teachers had the opportunity to present the new teaching methods and their achievements to the ministry and to contribute to the **national level policy** making regarding the reform of the school curricula.

4.2. FACTORS INFLUENCING IMPACT OF PROGRAMME ON VULNERABLE CHILDREN

The case studies revealed a number of factors that improve the impact of the Programme on vulnerable children. Some of them are related to the Programme design or the way how the Programme was implemented in the particular context. Some factors are related to the specific school setting, practices, resources, pre-existing conditions. Other factors are related to the characteristics of children and their family or social environment.

ENABLING FACTORS

Programme level factors:

- The focus on practical knowledge was very appealing to children and also refreshing for teachers, which increased interest, motivation and consequently the success of the Programme results, including results related to children from vulnerable groups. A 'tangible' dimension of computing (associated with working with Micro:bit) was seen as a positive factor in learning how to compute/code when it comes to young children, but also how to use critical thinking and problem solving in practice.
- The novelty of Micro:bit, the possibilities it provides for learning processes.
- Clearly defined processes, clear allocation of responsibilities of teachers, timed process, good coordination and cooperation were also mentioned as important factors contributing to greater positive effects.
- The supportive role of mentors[5] was noted as one of the beneficial factors, especially among teachers facing challenges in implementing the Programme in the given context or with specific groups of vulnerable children.
- Independence, freedom given to students to invent through coding and interactive work applying different techniques of CTPS, all contributed to the results among vulnerable children.
- Support from the British Council, in terms of advice, encouragement and support for the competitions, was also listed as positive factor in different cases.

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5 Following face-to-face teacher training in CTPS and coding skills with Micro:bit, each school benefited from mentoring support that is provided to teachers over the twelve weeks of the school implementation cycle. The mentoring scheme supports teachers in addressing practical challenges in the classroom. Such support consists of quality assurance of two lesson plans developed by teachers, focusing on the use of critical thinking and problem-solving pedagogy, and support during the development and implementation of a cross-curricular school project focusing on coding and the use of Micro:bits. During the school implementation cycle, mentors provide continuous support to trained teachers through a minimum of two school visits, as well as through regular communication by phone or email.

Factors related to students:

- The selection of motivated students, good team leaders who brought a good learning atmosphere to the clubs or classes, and motivated others.
- The perception of new learning techniques by students from vulnerable groups as channels for inclusion, as enablers of equal participation and opportunities for high achievements.
- The appreciation of team work that improves overall peer relations, increases not only individual and group learning achievements but also solidarity, improved satisfaction of needs for socialization.

Factors related to schools:

- This set of factors is related to the motivation and commitment of the teachers to introduce new teaching techniques and their previous experience with innovative approaches. Additionally motivated teachers – those who had already been involved in the introduction of interactive and innovative teaching methods, who had worked with children after class, preparing them for competitions – were one of the success factors in the Programme having more beneficial effects on different groups of vulnerable children.
- Similarly, better chances of success were also associated with the school principals who were more open to innovative approaches and prepared to allocate resources and implement the Programme more effectively.
- A good teacher-to-student ratio was also an important factor, as teachers could devote more time to the activities related to the Programme and work more effectively with smaller groups of students.
- In some cases, a positive factor was pre-existing practices of developing teachers' ICT skills, which made it easier to engage in the project activities, particularly for teachers whose subjects are not related to sciences or ICT.
- The results were better or at least easier to achieve if schools were properly equipped with digital technology, computers, Wi-Fi, if the equipment was up-to-date and available in sufficient quantities.
- One of the positive factors was also previously established partnerships between school and the private sector, for raising funds for equipment and activities linked to the implementation of the Programme.
- The availability of personal teaching assistants, special pedagogists or similar education staff, who could particularly support students with learning difficulties in their learning activities, was of particular importance in the case of such children.
- General team spirit and teamwork in the school – where present it contributed to the success of the Programme.

Social environmental factors:

- A supportive family and stimulation for learning is very important for the motivation, ambitions, and efforts to which the children are prepared to commit in the learning processes, and this also proved to be important in the learning activities related to the Programme.
- Cooperation between the school and families of vulnerable children was an important factor of success. Where this cooperation was more developed, the results among vulnerable children were higher.
- Perception of the Programme as relevant by different stakeholders in the local community.

INHIBITING FACTORS

On the other hand, certain factors limited the effects of the Programme among vulnerable children. These should be taken into account in the future implementation, replication or upscaling.

- It was difficult to include coding in regular curricula, particularly where there were no ICT classes.
- In the case of children with learning difficulties, there is certain rigidity in individual education plans which prevents or limits their participation in CTPS and coding activities.
- In some schools only a small number of teachers was trained and later on engaged in the implementation of the Programme. For example, in Sinanballaj (Albania), only one teaching assistant was engaged, who worked only with a child with learning difficulty and only occasionally organized group activities in line with CTPS learning. There was some spontaneous transfer of knowledge to other teachers on how to teach children critical thinking and problem solving skills, but this remained far less than what was needed for a more effective impact of the Programme.
- Professional staff for supporting children with disabilities and learning difficulties (special educators, psychologists, pedagogues, personal assistants) were not included in the trainings in many cases, so they were not prepared to provide proper support to the inclusion of these children in the activities related to CTPS and coding.
- Too short training – especially for school principals – providing insufficient time to learn enough about teaching techniques and coding in order to better plan activities and fundraise for initiatives related to the implementation of Programme activities.
- Some of key limitations come from poor school equipment require for coding or other resources needed for more dynamic implementation of the Programme and to support different initiatives based on the Programme. As different testimonials show, due to these reasons, some good ideas have not been supported and implemented, because they required equipment, money or other materials that were not available.
- In some cases, classrooms were overcrowded and it was difficult to properly organize CTPS activities in order to achieve the learning objectives while involving everyone.
- Lack of adequate support to children with learning difficulties, in the form of personal assistants, special educators, especially in schools in rural areas, which prevented more effective participation of children with disabilities in Programme activities.
- One of the obstacles was the teachers' weak skills in coding and implementing CTPS activities.
- The CTPS training did not focus on how to work with children with learning difficulties, so teachers reported that they did not know how to engage them in CTPS or coding activities.
- Lack of a coherent approach to introducing CTPS techniques in cross-curricula activities limited the application of this technique in different subjects. The cross-curricular application depended on the individual initiatives of the teachers in the schools and in many cases they remained primarily limited to specific school projects.
- Parents' disengagement, particularly in cases of children from low socioeconomic status families. Parents are preoccupied with coping strategies and do not provide a supportive family environment for learning and skills development of their children. A lack of digital literacy and skills among parents, which prevented their more active engagement with children around these activities.

A number of inhibiting factors is related to the Covid-19 pandemic:

- As indicated by different respondents, children with learning difficulties are more reluctant to go to school because of the fear of getting infected.
- When classes are held online, children with learning difficulties face significant challenges to keep up with others.
- Teachers have indicated that it is very difficult to apply CTPS techniques in online classes, especially in classes that include children with learning difficulties.
- Extracurricular activities have been cancelled due to the pandemic and many Programme activities are part of such activities.

However, there were some remarks on positive impacts of the Covid-19 pandemic. As students from Knjaževac (Serbia) pointed out, they have had more time to study and practice new skills as they are not allowed to go into town. The example of a teacher from the Kreka Primary School in Tuzla, BH shows how digitalization has contributed to better adjustment to online education during the pandemic. As the teacher reported, engagement in critical thinking and digitalization skills enabled him to record online classes for students in the entire Tuzla canton, which was later used by his colleagues in other schools. Therefore, programme generated results have contributed to a more successful crisis response at the regional level.

5 CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

The Programme greatly benefited children from vulnerable groups, despite the fact that they were not the primary focus during its design and implementation. The benefits are multifaceted, but they differ depending on the type of vulnerability and specific circumstances related to the implementation process and setting.

Children with learning difficulties are a heterogenous group. Although the assessment could not precisely measure the impact on these children in terms of increased CTPS and coding skills, the evidence from the case studies indicates that children with mild learning difficulties improved their skills and managed to engage in some form in coding. For children with severe learning difficulties this kind of benefits was more limited. Nonetheless, the Programme brought a series of other benefits to them as well, such as higher interest in learning, higher motivation to attend school more regularly, improved self-confidence, stronger relations with peers, and in some cases more stable disposition and management of emotions. Their peers also exhibited improved empathy and solidarity and the Programme overall contributed to better social inclusion and groups cohesion.

The same effects are observed in the case of children from disadvantaged groups, in terms of their low socio-economic status or minority group membership. The new CTPS and coding activities reduced – if not completely closed – the gap between them and other children as they faced the same learning challenges. They felt more equal and by achieving success in the learning tasks they gained self-confidence, a more proactive approach to studying and higher education aspirations. The Programme contributed to the improvement of peer relations but also to the improvement of relations between students and teachers.

Particular benefits of the Programme are visible in regard to girls engaging in coding, a field that is usually more open for boys. The evidence points to significant achievements by girls, who were encouraged to engage in coding, and successfully empowered also to take on leadership roles and to participate in competitions. Their examples were very important for other girls and therefore, the Programme had significant transformational impact on gender equality in schools.

RECOMMENDATIONS

All respondents agreed that the Programme has great significance and it is important to integrate its elements in regular school curricula, to replicate it at schools that were not included so far in the Programme and to upscale it to become a part of curricula in all schools in the region. In order to achieve this, it is important to take into consideration sets of recommendations.

Improving curricula and learning methods
- It is necessary to include Micro:bit systematically in the regular curriculum because Micro:bit enables cross-curricular content connections, supports groupwork, connects students and teachers and enables teachers to achieve teaching objectives with all students, it is important to use its full potential and include it in the curricula.
- The specific methods of implementation of the Programme among vulnerable children should be based on their needs assessment, taking into account the specific type of vulnerability and adjusting methods to this type.

Improving actions towards students

- The implementation of new teaching techniques should be planned in the schools in such a way that it provides optimal dissemination to larger groups of children (inclusion of teachers that lecture multiple classes in different grades), but it should also include better transfer of new methods to other teachers through internal knowledge transfer processes.
- The implementation of programme activities or post-programme continuation of the implementation of same methods and new projects should be planned in such a way that it provides more dynamic peer-to-peer transfer of knowledge between students.
- It would be necessary to change the timeline of the Programme, to allow to children to actually learn how to program. As it is now, there is not sufficient time for the students to truly learn how to code.
- It would be beneficial for an assessment of the results to be conducted, i.e. to measure student learning outcomes more precisely.
- The programme can be replicated with younger children.
- Another important area that needs to be further explored and developed is offering more peer-to-peer support when it comes to learning, because children tend to benefit more when working with someone closer to their age and interests so that they may remain interested in the educational process and improve their integration within the school.
- Promotion of the Programme and specific techniques, as well as Micro:bit and the results achieved so far, in order to increase the interest of other schools.
- Support to girls to increase skills interest and participation in STEM education areas but not in a gender segregated way (focusing only on girls and excluding boys). Both boys and girls should be included in the programme, but the programme should be designed in the way that promotes new views on professional orientation of women, meaning their more massive entrance in STEM areas.

Improving actions towards teachers

- In order to improve the implementation of the new CTPS techniques with vulnerable children– especially those with learning difficulties – it is important to include at least one training module on how to apply these techniques when working with these children, how to address challenges in the application of CTPS techniques, how to engage them in coding, and similar.
- Teachers also pointed out that it is important to organize more trainings on coding in order to increase teachers' coding skills, and to train them how to use digital technology and Micro:bit specifically in different subject classes.
- Teachers also expressed the desire to learn more diverse CTPS techniques.
- Teachers appreciated the mentoring support, but they recommended longer mentoring visits as they felt they needed more support for the implementation of new teaching techniques in their specific subjects or in projects.
- It is necessary to train more teachers in order to achieve large scale implementation of the programme, or to design the tools so the trained teachers can relatively easily, systematically and effectively transfer their knowledge of CTPS and Micro:bit coding to other teachers at the school.
- Pedagogical assistants, special educators should be also included in the trainings in order to provide adequate support to the teachers' work with children with learning difficulties or disabilities.

- The pedagogues should be involved in training and programme activities from the beginning of the Programme.

Improving learning environment

- Findings related to the role of the parents indicate a need to create a more supportive learning environment for children in general, through the inclusion of the parents of children with learning difficulties in training for coding so they would be able to support their children's work at home.
- The positive attitudes of teachers and school principals regarding the implementation of the programme is a good basis for replication and upscaling. It is therefore important to spread information and experiences of good practices among teachers in the region.
- It is necessary to improve the ICT infrastructure of the schools (premises, equipment and internet access, some Micro:bit accessories, such as sensors, etc.)
- The Programme activities and achievements should be promoted in the community by posting information about activities on school websites, Facebook pages, or through other media.

6 | CASE STUDIES

6.1. CASE 1: SINANBALLAJ, ALBANIA – POOR TARGETING IN POOR ENVIRONMENT + SEVERE LEARNING DIFFICULTIES = LOW IMPACT

DESCRIPTION OF THE PROGRAM IN SPECIFIC CONTEXT

Sinanballaj is a village around 5 kilometres from Rrogozhine, and around 75 kilometres to the Albania's capital, Tirana. Inhabitants mainly work in agriculture. There is a great migration to urban areas, as claimed by the interviewed teachers who teach long years in the school. The road infrastructure within the village is poor, but the access to a better road that links Rrogozhine to Tirana is quite near.

There is the school in the village, which is a branch of the main school in Rrogozhine. It is accommodating children from the pre-school class to ninth grade. Because of the depopulation of the area, there are only around 50 children who are attending the school, with about 5-8 children per class. The school personnel counts around 12 people. All teachers come from the surrounding area. In 2012, the Rrogozhine municipality started to send one day per week a school psychologist to support the school with needed psychological services.

There was only one teacher from the Sinanballaj school who attended the 21st Century School training program in spring 2019. This was an Assistant Teacher, who started to work in the school two and a half years prior to the Programme, with the task to support the educational activity and integration to school of a child with Down Syndrome and Autism. The child is now in the eight class and started to attend the school more regularly since the assistant teacher was engaged in this role. The child is two years older than the age of other children in the class. He comes from a family with average socioeconomic status. He lives with two parents and his younger sister, who attends kindergarten at present. According to his father, the child has made considerable progress in the last two years.

The school did lack conditions for using the Micro:bit devices properly. There was no ICT cabinet or a computer at least, neither there was proper internet available for making possible to use the Micro:bit in learning process. Therefore, no influence of Micro:bit can be attributed to the learning process in the class or school.

Mainly, the program activities in the school were practiced in one class, which the child with learning difficulty has been attending, and since the assistant teacher trained in Programme is engaged only in work with that class. However, there were indications that the knowledge about the Programme was gradually transferred to other teachers spontaneously.

IMPACT OF THE PROGRAME

Although the school faced the inability of using Micro:bit devices because of the lack of computers and internet, other Critical Thinking and Problem Solving (CTPS) techniques could be used in the teaching and learning process. However, since the Teacher Assistant who was trained through the Programme does not teach any particular subject, nor works regularly with full classes but only supports child with learning difficulties, the opportunities to implement the CTPS learning was underused. The assistant teacher organized occassionally some class activities, including other children in the class, in order to stimulate participation of the child with special needs. In these types of activities, the assistant teacher was able to some extent to apply critical thinking and problem solving techniques, such as **six hats technique, debates in various topics**, where the child with learning difficulties was assigned

some role to play. According to the Teacher Assistant, the child was not able to engage in the same capacity and role as other students. However, the **child engaged in decision-making process** as part of the methodology by providing his vote on the options discussed during the learning tasks. This made the child become more motivated to attend the school.

The interviewed teachers report that the child cannot focus regularly on the learning process and class tasks in various subjects. *"He cannot maintain the level of knowledge absorption as the rest of the class"*, reports an interviewed teacher. The child **engages with the class on general conversations**, such as talking about class rules and other similar aspects, but not indeed on the learning process per se, particularly not at all in in-depth learning. The Teacher Assistant works with the child using Individual Plan, which indeed is tailored in the way that hardly aligns with the curricula of the rest of the class. This is because the child still needs to learn the basic things, but is more motivated to attend classes with children closer to his age. The child engages in writing words, simple numbers, but not sentences or maths operations of any kind. The **child improved also in the social and interpersonal relations** with the teachers and others in the school. *"At the beginning it was difficult to talk to him or have him in the school. Now he is open to teachers, and to class mates. He has changed quite a lot in this direction"*, stressed one of the teachers, who teaches the subject of Albanian Language.

However, the class mates, who were also interviewed, report that sometimes, ***"if children need to collect some money for any class or school related activity*** (like charity-type initiatives), ***the child plays the role of cashier, and collects the money from other children"***. Classmates also note that the child is active in sport activities, as well as in extracurricular activities related to social and environmental events. Classmates emphasize the fact that they work quite a lot to make a more friendly environment for the child, and they remain open to support the child and engage him as much as possible in class activities.

The father of the child, who was interviewed, reports that the child **has become more stable recently, better manages his behaviour and emotions**, since in the past he was quite aggressive at home and in school, and now is **more motivated to attend school, though not regularly**. However, from the beginning of pandemic, the child more hesitates to come to school because he is afraid of the situation with Covid-19. *"The child needs regular support at school, but also home with his hygiene, as well as supporting with homework, though he does not like at all them"*, the father emphasises.

Overall, there were some observations that the CTPS activities that took place, thou very few in number, could contribute to some motivation of the child to engage with the class. However, many of other activities that were reported by the teachers, classmate and the child's father, may not be attributed to the influence of the CTPS.

FACTORS CONTRIBUTING OR INHIBITING PROGRAMME IMPACT

The impact of the 21st Century School to the school in Sinanballaj was very low. The following factors were identified which seemed to relate to this situation.
- It was only one teacher trained, and she was a teacher assistant, focused with her work mainly to one child with special needs. As such, the teacher assistant has not a role to organize activities with the whole class on regular learning process, where the CTPS techniques could be more regularly implemented.
- Another challenge was the lack of ICT cabinet and computers, as well as internet, so teachers and students could work with Micro:bit devices, and involve coding in the teaching and learning process.
- The child was with severe disability, therefore he was not able to properly engage in class learning with other children and in regular class activities.

- The situation with Covid-19 made further impossible for the teacher to continue her activity, particularly using CTPS techniques with distance learning that the school operated for one year.

The program was identified to have also some positive contribution to the school, but particularly to the child with special needs, in the following aspects:

- The child was engaged in the CTPS techniques applied in the class, such as six hats, and debate, in which the child took some role to engage with the group. This increased more motivation for the child to attend classes and work with other classmates.

- Since the Teacher Assistant attends all classes with the child, where other teachers lead with the teaching process, it was more potential of transferring the knowledge and practice of CTPS techniques to other teachers.

POSSIBILITIES TO IMPROVE, SCALE UP OR REPLICATE THE MODEL

The Teacher Assistant, who was directly trained in this program, emphasized that the CTPS program of the 21st Century Schools was quite useful for teachers to achieve the teaching objectives specified in the curricula. Similar thoughts were shared also by other teachers, who also expressed the need to involve more teachers in these type of trainings in the future.

6.2. CASE 2: SHKODER, ALBANIA – 'I CODE MY NAME!'

DESCRIPTION OF THE PROGRAM IN SPECIFIC CONTEXT

The School "3 Dhjetori" is a special school in Shkoder, Albania. Shkodra is known as one of important cities in Albania, both with its history and cultural heritage. Traditionally, people have made a living through trade and artisanal activities. Still at present Shkodra functions based on trade and craftsmanship main business sector. The special school provides educational and development services for children with special needs. It was established around 38 years ago (since 1983), having a considerable experience in special education in the region. At present, the school provides education to children with severe disorders of various forms, from 1st grade to 9th. The school in addition runs all the day and also provides for children food and transportation to the children that attend it.

The 21st Century Schools program was introduced in the second round since the program started (autumn 2019), a few months before the pandemic of Covid-19 started. There were three teachers trained in the program, who also participated in the interviews. One of the teachers was from ICT profile. They organized coding activities with children independently from the objectives of education curricula they were implementing. This was because that ICT learning activities and objectives were not part of this curricula, so teachers had to do it as extracurricular initiative.

IMPACT OF THE PROGRAMME

The teachers who were trained started to implement the new techniques, particularly using Micro:bit for coding. Interviewed teachers reported that children were enthusiastic in the coding exercises with Micro:bit. Since they could not focus longer time and because of the severity of their disorder, they were only involved in simple coding exercises, such as writing their names, and creating figures using led icons, and so on. However, *"children could use coding and complete exercises only on the given models. They were not able to create new coding project themselves"*, said a teacher who led students in such activities. Teachers used coding activities as extra-curricular way of work, because ICT related activities were not foreseen in the curricula of special education.

According to school director, the activities of the program that were implemented, **stimulated more socialization form of learning and more group work interaction**. Particularly, by using the Micro:bit devices, **children could learn from each other, by observing other's work as well as demonstrating their own work to others**. Children liked a lot when they managed to write their names digitally, and that they could put their names in motion in the Micro:bit screens. That was confirmed also by the school psychologist, who was observing some of activities held. The Micro:bit was something new for teachers as well as for students, while other CTPS techniques were more familiar to teachers. According to the school director, other teachers could also benefit from the program, by participating in joint activities with the trained teachers.

The enthusiasm and motivation of the children with special needs in using coding exercises with Micro:bit was also confirmed by a couple of parents that were interviewed, and that had their children attending the school. One parent noted: *"My son liked very much the activity. He was very motivated and he made efforts to work also at home, but we could not help him as we do not understand the program"*. It was noticed that **parents were more happy for new activities that they children participated**, and their children's occupation with them also at home.

FACTORS CONTRIBUTING OR INHIBITING PROGRAMME IMPACT

Main inhibiting factors identified for the proper implementation of the program:
- Teachers claimed that it was not possible to use such activities longer, since it was the lack of space for ICT activities, and it was difficult to organize them in regular classrooms. They had to use own computers bringing from home.
- Besides that, the limited access to internet was also another important factor that children could not continue to organize coding activities with students.
- Teachers mentioned that it was unfortunate that the Ministry of Education in Albanian did not include ICT at all for the curricula of special education schools. Hence, the curricula approved for the school was also not flexible at all to allow other activities not foreseen, such as ICT activities, including coding.
- Because that class activities were mainly organized based on individual plans of children, group work activities were almost impossible to organize. With these children is difficult to orchestrate variety of group learning activities.

- Teachers could not use coding process to link with their curricular teaching activities, because of the incapacity of children to engage in in-depth learning.

While factors contributing to better implementation were fewer, but important to the children:
- The coding activities motivated children enormously, therefore this situation affected children to like more going to school.
- By participating in coding activities, children were more interacting to each other, therefore socialized learning was better promoted.
- It created a more positive attitude also among parents, since their children were more motivated to attend school activities.

POSSIBILITIES TO IMPROVE, SCALE UP OR REPLICATE THE MODEL

There was positive attitude among teachers and school director about the program, and particularly about the follow up potential. They claimed that more teachers in the future would be necessary to train in order to have a more massive implementation of the program. However, according to them, that need to be joined with actions to improve ICT infrastructure in the school (space, equipment and internet) as well as more flexible curricula permission from the educational authorities for special education schools, so the school could follow a more needs based implementation approach.

6.3. CASE 3: TUZLA, BOSNIA AND HERZEGOVINA – A JOURNEY TOWARD MASTERY: CRAFTSMEN AND NOT APPRENTICES!

DESCRIPTION OF THE PROGRAM IN SPECIFIC CONTEXT

Tuzla is a predominantly industrial city, economic, cultural, sports, and educational centre of northeastern Bosnia and Herzegovina (BiH), in the valley of the mountain Majevica. The city is known for its chemical and motor industries. According to the 2013 census, Tuzla has 80,570 inhabitants.

The Primary School Kreka is situated in suburb of Tuzla, economically deprived area. Geographically, the largest numbers of **Roma** in BiH live in Tuzla Canton. According to official estimates, between 25,000 and 50,000 Roma people live in Bosnia and Herzegovina[6]. City of Tuzla and five surrounding municipalities –- Zivinice, Lukavac, Srebrenik, Celic and Kalesija, are home to approximately 15,000 Roma. According to the Local Action Plan for Roma Inclusion, the process of their inclusion in society is not complete yet.

Roma are recognized as the largest, most excluded and most vulnerable minority in Bosnia and Herzegovina overall and in Tuzla specifically. The conditions in which the majority of the Roma families in Bosnia and Herzegovina live can be characterized as a state of deep poverty. Key indicators for Roma children show that these children are three times more likely to live in poverty than their non-Roma peers, five times more likely to be malnourished and twice as likely to be lagging behind in development. The enrolment rate in primary school is lower by one third than among the non-Roma population. A Multiple Indicator Survey (MICS) of the Roma population for 2011 and 2012 in Bosnia and Herzegovina has shown that only one-half of Roma children (47 percent) that are old enough to be enrolled in the primary school attend the first grade of primary school and that over one-half of Roma children

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6 Estimates of the size of the Romani population range from 40,000 (UNDP) to 100,000 (Council of Roma), with a statewide registration of Roma in 2010 yielding a figure of approximately 50,000.

aged between two and 14 years were exposed to some form of psychological or physical punishment by their parents or other adult members of their households.

About 20% of Kreka students identify as Roma. Kreka is a school with children from families with the below the average **socioeconomic status**. Therefore, many students from the Kreka School face multidimensional disadvantage. According to some of the teachers, students from Kreka have limited access to technology and other learning materials and experiences because their parents are mainly unemployed or on a very low wages.

'Our school is in a very poor part of Tuzla. That part belongs to the city, but parents and families are generally on the edge of existence. Usually one of them works and the other does not. ...many of parents lost their jobs during the Corona,' one of the teachers said. Various evidences show that students from low-socioeconomic status households and communities develop academic skills slower than children from higher social economic status groups further perpetuating the low-socioeconomic status of the community. Also, children from lower socioeconomic status households are about twice as likely as those from high-socioeconomic status households to display learning-related behaviour problems. In Kreka school 14 students are classified as students with **special learning needs**. According to one of the teachers 'they belong to various groups - mild mental development difficulties, deafness...'. He further highlighted Kreka's supportive approach towards students with disabilities and emphasized great success of one student with hearing impairments: 'In our school last year, one deaf-mute student was a student of the generation.'

Kreka has greatly decreased in the number of students lately although it has been the oldest school in the canton (established back in 1897). Before the war the school had about 1,500 students. After the war it had about 480 students. Nowadays 285 students have been enrolled in Kreka. School's vision is to reach excellence through cooperation, creativity and quality of education. School's mission is to enable students to become responsible and independent citizens and to prepare them to apply the acquired knowledge and contribute to the progress of society.

In line with its vision and mission Kreka implemented the 21st Century Schools Programme with the aim to enhance students' critical thinking, problem solving, and coding skills.

Firstly, four teachers participated in the seminar organised by the British Council. They all were satisfied with the seminar. One of them said on that note *'We all liked that seminar and we all enjoyed it. There was a good balance of theory and practice and it was useful. We had good lecturers and mentors'*. Some of the teachers volunteered to be a part of the project

as they were interested in computers and Micro:bit itself. They all gained specific micro:bit knowledge and according to one of them *'The micro bit is user friendly and it wasn't hard to figure it out'*. Teachers felt that the seminars prepared them well to work with the students. The coordinator of the micro:bit club was also nominated very early on. According to the teacher who coordinated the club, the club coordination brought him a lot of responsibilities because he needed to develop a Plan and Program for something that 'no one did before'. He recalls that experience: *'During that first seminar, the director called me and asked if I would like to be the coordinator of that club. So we were the first to establish a club and get a coordinator, me. I then had to develop a plan and program. It wasn't easy because nothing like it existed so I had to design everything. Afterwards, other teachers asked me for that plan and program during the training. I was a little sorry to give it to them because I knew how much time I had invested in it. But I gave it to them. I know that they were satisfied and that they used it, but I don't know if they modified it later'*.

After the seminar was finished and the plan and program was developed, the teacher established a coding club. He regularly assigned homework to students and used practical exercises as a teaching paradigm. He says in that regard: 'I gave the children homework and I wanted to ensure that all of them gain practical experience working with the Micro:bit. I did not want them to just download the codes from internet. They were given tasks and everyone mastered the skill of coding'. The club was organised once a week and about 10-12 kids were participating in the club. To attract students to join the club, the teacher presented the project and demonstrated a work of a micro:bit to all students in 6-9 grades. All interested students were invited to join and the teacher was 'pleasantly surprised by the response'. Among club members there were three girls, one student with mild difficulties in mental development and one Roma student. Everyone was doing something. For instance, the student with mild mental difficulties did not do coding but she enjoyed observing what others do. In relation to that the club coordinator says: 'She didn't want to deal with the coding, but it was interesting for her to watch what was happening in the club and, for example, to see her name shine on the Micro:bit. That was very interesting to her and I let her learn that way'.

One Roma boy was also a member of the club. He came at the persuasion of a friend, but very quickly became interested and began to make codes for simple tasks.

The club members were working together on the „Slash the Heating Bill" project to apply for the 21st Century School Competition. The idea was to measure the temperature in the classrooms and depending on the temperature obtained to inform whether it is necessary to turn on the heating or cooling or leave it as it is. This was the competition idea but also a real need of the school as Kreka's building suffered from severe carpentry issues. The teacher explains this by telling: *'In our school, the carpentry was very bad, and in the period from the end of summer to the beginning of the heating season and from the end of the heating season to the beginning of summer, the classrooms are very cold and unconditional for work. The janitor literally had to glue parts of the glass with silicone. We asked the Ministry to let us fix the windows, but we never succeeded. Now we came up with the idea to make a thermometer with the help of a micro:bit which would then be theoretically connected to an AC and which would then turn on that radiator to allow us to learn nicely in a pleasant classroom. We did not have air conditioning, of course, but we wanted to count how many days a year we do not have working conditions. We counted about 20 days when the temperature in the school was only about nine degrees. We wanted to include that in the report to the Ministry. And we succeeded. We made a thermometer, we measured it and put it in the report'*.

Moreover, the school secured the funds to repair the windows and in that regard the teacher said: *'Even before the competition, we knew that we had achieved our goal and we were very satisfied. In the end, the ministry gave us money from a fund for smart schools. And the carpenter came and put the windows on and we immediately felt the difference. Now there is no more wind and the temperature is great. Sometimes it's even too hot so we have to open the windows'*.

The teacher also points out that all the students from the coding club worked on this project but due to the competition rules only two students presented the project at the competition: *'Berina and Harris presented and they were great. They knew how to answer all the questions themselves. The competition was online. They won one of the first three places and were supposed to go to Albania for a regional competition, but that was cancelled due to Corona. That disappointed them. The competition was uneven because some schools invested a lot of money and it was obvious that the children did not work alone.'*

Finally, in addition to the work of the Micro:bit club, participants of the seminar later applied and implemented knowledge and strategies on the development of critical thinking in teaching but also the development of digital competencies of students using micro:bit devices. Two programming projects were done and held through classes with the application of critical thinking strategies. Of all the received class preparations at the level of Bosnia and Herzegovina, one from Kreka was included in the online catalogue of preparations. This was a class held in the teaching of B / H / S language and literature in the ninth grade. As the school director said: 'Here we are, a small school, but very successful and recognizable for good teamwork.'

IMPACT OF THE PROGRAM

The Programme has demonstrated beneficial impact at school level but also at **individual level** of some specific vulnerable children. For instance, two boys participated actively in the Micro:bit club. They consequently improved their **ICT skills** but also increased their **capacity to learn and socialise with other students**.

Roma child, passionate about soccer lives in the family below the average social economic status. He comes to school regularly despite the fact that Roma parents, as one of the teachers says, *'often do not send their children to school'*. He is also very sociable and quite popular kid. He ran to be a class president but he lost by one vote. He is also shy in class and according to one of his teachers: *'no way he would raise his hand to give an answer in a class'*.

According to the club coordinator, *'he worked wonderfully at the club'* and his teacher noticed that his **interest in informatics and English subsequently increased** as soon as he became active in the club work.

Also, the teacher noticed that he did very well during online classes, where he continuously kept coming up quickly with solutions using **logical thinking** and newly **acquired digital skills**. In that regard his teacher says: *'He is really very nice, but the Covid situation completely thwarted him with online classes because only his mom has a phone. However, he was organised and hardworking and managed to move on to the next grade'*.

Other teacher says that child appreciated more interactive way of learning *'He liked the new methods I used a lot. He especially liked Vein's diagrams. He is delighted with the Vein diagrams. For example when we analyse a book or a character from a book and then discuss the positive, negative and common traits. Maybe he likes visualization and maybe just that more interactive way of working. He became much more active and that reflected on his success'*.

The language teacher also confirmed that boy has changed quite a bit, and he changed his approach to learning since he started coming to the coding club and working with Micro:bit devices.

Nevertheless, the programme had strong influence on some other students too. According to the English Teacher and the club coordinator all children learned some basic **programming skills** but according to him the students with already developed particular interest in programming progressed the most.

The similar impact is documented in regard to another boy from family of low socioeconomic status. He is 12 years old and has no siblings. His dad works in a coffee shop and mom lost her job because of Corona. He has always been very interested in programming and according to him participation in the club enabled him to increase his knowledge but also **inspired him to develop further some his ideas**. In that regard he says: *'I learned something about the Micro:bit but I still have a lot to learn. When we went to the competition, I also heard presentations from other schools, so it gave me an idea for a hundred others games I could develop'*. He also participated in the final presentation at the competition and it raised his **self-confidence**. He gladly remembers that his parents and friends were very happy that he has been a member of the club and that he was successful at the competition. He said in that regard: *'the parents were very happy because I am a member of the Micro:bit club and because I was successful in the competition. And friends congratulated me, so it made me very proud. I teach my parents about computers, I know more than them'*. Finally, he also emphasized that this project might help him in his further education as he says: *'I want to study electrical engineering later, so this is a super **career guidance** for me'*.

Further on, children improved their **social relations** with other children. They spent more time with their peers and had fun with each other. *'The club also gave me more time to hang out with friends because we spent more time together. I didn't know other members of club before, but this work brought us closer. We all got along really well.'*

Likewise, the club coordinator notes that the students had amusing time while coding: *'The kids had a lot of fun while we were making the thermometer. For example, they took it home and put it in the fridge or blew it with a hair dryer. They had fun'*.

Moreover, the programme gave the students the opportunity to have more interesting classes, to be actively engaged in the class and learn more and in more involved way. As one teacher noticed: *'Students became craftsmen and not apprentice. They managed the class with their questions. They ask questions and know how to make great links between topics. For example, while reading Nušić, they linked the events to the current socio-political situation. Also, the children started reading more. They don't like books, but sometimes I don't intentionally tell them the end. Then they come to school and everyone brags that they read the end on their own. This makes learning more interesting to them. They became more interested, more relaxed and more motivated. There is no better compliment for me than when it rings at the end of class and the children do not want to leave'.*

Child agrees with this by telling: *'Classes with teacher have become more interesting to me because she uses various games'*.

Additionally, one of the teachers also highlights that the project addressed **functional illiteracy** as one of the main gaps in Bosnian schools. According to her, tests showed that the kids have problems with comprehension and that is why the knowledge about how to apply critical thinking in the classroom has been priceless. This has been recognised by all the schoolteachers and some sessions from the Programme seminar now have became a part of the professional development for all the Kreka teachers.

In addition to the listed benefits at the level of individual students, the programme had a significant **influence on the school** in general. For instance, teachers had a chance to improve some of their **skills**. English teacher learned to work with **Micro:bit** and in that regard he said: *'I have been very satisfied because I now know to work with Micro:bit.'* Similarly, teacher of Bosnian language improved her **presentation skills** and built her **self-confidence**. In that regard she said: **'I stopped being afraid of public appearances. I used to be nervous'**. She praised a programme mentor for significant capacity building she experienced through the project. She said in that regard: *'The mentor helped me a lot. She gave me a push and was my moral support. She helped me decide what to apply and what to discard. It is difficult to swim without sinking. She helped me with that. She showed me everything I could do. I was not aware of my capacities earlier'*.

Additionally, School got **equipment** including **20 Micro:bits, new windows and thermometers** for the classrooms. In that regard one teacher said: *'the school got 20 micro:bits and that's of great benefit to us. I gave one micro bit to all the teachers who were in training and now they all use Micro:bit in teaching. I also love that our school has them now. I love when we have the equipment because we use it. '*

Also, as mentioned earlier, Kreka got better windows and one of the students highlights that and says: *'the biggest change is in relation to the school building because we got a thermometer and now we can measure the temperature in all classrooms. We also got windows'*!

Finally, proactive involvement in the project supported Kreka to position as one of the leading schools in the region in applying critical thinking and ICT. In that regard one of the teachers said: *'My engagement in critical thinking and my newly acquired digitalisation skills enabled me to record on line classes for Bosnian for all Tuzla canton. My colleagues from other school used my pre recorded lessons and they were very satisfied with that'*.

FACTORS CONTRIBUTING OR INHIBITING PROGRAM IMPACT

There are different project, school and family factors contributing to the identified changes. In relation to the **programme** implementation those **factors** include: focus on practical knowledge, networking between different schools, mentor's support and early appointment of the club coordinator.

As noted earlier, it was important that the club coordinator insisted on the practical knowledge. He ensured **prevalence of practice over the theory** what according to him and to the students was crucial for high level of the students understanding. Also, **early appointment of the school programme coordinator** was beneficial as it led to the clarity of the process, appropriate allocation of different responsibilities and timeliness of all the interventions.

Dedication and helpfulness of the project mentor was also emphasized as the very important enabling factor. On that note, as mentioned earlier one of the teachers praised the programme mentor for significant capacity and self-confidence building she experienced through the project. Finally, it was useful that some elements of the program enabled **networking between different** schools.

Factors related to the **teachers** implementing the programme include **teachers' motivation** as well as **specific teacher's approach**. For instance, teachers volunteered to be a part of the program and they were deeply motivated because it matched their interests and skills. One of the teachers said: *'I volunteered to be a part of this story about Micro:bit because I was always interested in informatics and my colleague Azra told me that it was a good story and that I would get a lot from that story professionally. I love computers and that is why I attended a seminar on micro:bit.'* **Teacher's motivation** has been very strong.

Moreover, as mentioned within the programme factors, teachers' ensured that students are practically engaged in the classroom and that they all get some practical experience. According to teachers, students learn better if they are involved and if they can see **practical side of what they are learning about**. One teacher says in relation to that: *'I divided all the students into groups so that everyone could hold a micro:bit in their hands and work on it. I wanted to give them a practical experience. So they worked in groups of six. They only got bored when there weren't enough computers for everyone to do something. There was no internet so we had to work off line and the capacity of micro:bit is limited if it works off line. It requires Windows 10, which we only have on two computers. That's why some students used to get bored while waiting their turn. I then found a way to animate them with some tasks.'*

Also, according to teachers it is very important to **approach** each student **individually**. For instance, in relation to a Roma boy, there were constant conversations between his teacher from earlier grades and his current teachers to figure out the best way to motivate him. Finally, high standards in education are an imperative for the teachers of this school in order for students to acquire the highest quality and lasting knowledge. Thus, teachers are permanently additionally educated through various seminars organized by non-governmental organizations, the Ministry of Education of Tuzla Canton, and the Educational and Pedagogical Institute, all with the aim of following modern trends in acquiring new skills and knowledge.

The teachers also emphasize great team spirit and teamwork within the school. On that note, one of the teachers said: *'We are a great team and we were great before the project. The project only established that even more. There are a dozen of us who always want to participate in everything. We breathe with one soul. We support each other.'*

In relation to other, **environmental factors** students' families have been identified as only important factor. Although the majority of parents have been totally disengaged from the school, the teachers mentioned that family's support has been priceless in success of some of the disadvantaged kids. For instance both teachers we spoke with agreed that *'student's parents are very involved and 'shining example'* of Roma parents who do send their kids to school'.

POSSIBILITIES TO IMPROVE SCALE UP OR REPLICATE THE MODEL

According to our respondents, it would be great if the programme would be upscaled and replicated to other schools in Bosnia and Herzegovina. They emphasized different benefits of the programme recognising the importance the programme might have for future employment and professional orientation of the students: *'This is an excellent education and can help with professional profiling. It can also serve as a professional orientation for children, because programming is the craft of the future'*. Thus, the school plans to continue with the club and therefore, some sort of the project sustainability has been already achieved after about only six months of the project. In that regard they say: *'So we will continue with the club. This is a great project that provides a wide field of ideas. It should be available everywhere.'*

Nevertheless, the respondents also identified some areas for improvement. According to them it would be good if the seminar for teachers focus more on the practical work with Micro:bit: *'since teachers mostly have little knowledge of computers, more practical work would be needed during the seminar. Instead of theory'*. Also, both teachers and students agree that it would be good if the project would also support schools to update their IT equipment namely computers, internet and funds for some Micro:bit additions (i.e. sensors).

6.4. CASE 4: ZENICA, BOSNIA AND HERZEGOVINA – DIGITAL SKILLS IN THE SERVICE OF INCREASED SAFETY OF STUDENTS WITH SENSORY IMPAIRMENTS

DESCRIPTION OF THE PROGRAM IN SPECIFIC CONTEXT

Zenica is a city in Bosnia and Herzegovina and an administrative and economic centre of the Federation of Bosnia and Herzegovina's Zenica-Doboj Canton. It is located in the Bosna river valley, about 70 km north of Sarajevo. About 70,553 citizens live in Zenica. It is famous for its steel industry. Unfortunately, it is also known for high air pollution. Ash clouds and black smoke became unflattering symbol of Zenica in the last several decades.

Steel industry is at the same time the main employer but lately unemployment and job insecurity increased (unemployment rate is around 28%). Thus, educational system faced a need to adapt to the requirements and possibilities. Consequently, the economy and reorientation of education and training became a high priority of Zenica educational institutions.

Elementary School "Miroslav Krleza" was established in Zenica in 1901 as the Girl's Elementary built during the Austro-Hungarian rule. Nowadays this is one of the biggest schools in the Canton. About 465 students have been enrolled in the school in the 2020/21 school year. Yet, the number of students is constantly decreasing due to the depopulation of Zenica. For instance, in the school year 1998/99, 734 students were enrolled and they attended one of the 25 school classes. Eleven years later school has 22 classes and about 269 less students. The school employs 57 workers (about 15 less than a decade ago). About 37 employees are teaching staff while about 20 of them are the administration staff. Student-teacher ratio has decreased and therefore, teachers can focus more on students and their individual needs. There are 27 Roma students enrolled in this school. The vulnerable position of Roma children is described in the case of Tuzla school. However, Roma students enrolled in Miroslav Krleza School have been fully integrated with other students.

Roma students mainly live in state facilitated public housing which is predominantly located in neighbourhoods with low median incomes and high rates of poverty. However, while Roma students live in economically and socially disadvantaged families, according to our respondents, they study in *'one of the best and more advanced school in the canton'*. Positive school experience in that way has a good potential to break circle of vulnerability for students from Roma and economically and socially disadvantaged families.

Elementary school "Miroslav Krleža" in the past period has made significant investments in its own infrastructure to make it more inclusive. They also adapted the school building to be more energy efficient. The hall, canteen and toilets were renovated. The school has been included in many internationally funded projects. Some of them were particularly focused on social inclusion of vulnerable students. For instance, they established private-public partnership and secured a valuable donation to equip the cabinet for inclusive practice in the school. They secured smart panels and laptops.

School Miroslav Krleza joined the project 'Schools for 21st Century in mid 2019. Four teachers participated in the seminar organised by British Council. According to the teacher who participated in the training, the first days of the seminar were about critical thinking and in the third day the Micro:bit was introduced to them.

Following the seminar, the teachers organised the Code club. Micro:bit was also used in the book club. The book club was for the students of the 5th class and they got familiar with Micro:bit and liked it. The nineth class students worked in the Micro:bit club. Students had a chance to rent Micro:bit and to work with it at home because one class of Micro:bit club per week was too short for them to fully understand and practice coding. YouTube was also very helpful for them as it offered different tutorials on how to code with Micro:bit. Teachers investigated different ways to use Micro:bit and then they shared that experience among themselves.

On one occasion in the hallway, the teacher on duty noticed that during the transfer of students from one classroom to another, after tying the shoelaces, one boy with sensory difficulties (deaf-mute) lost contact with his friends and could not call them, which made him panic. The teacher then came on the idea to engage a code club to create devices that would enable this student to communicate easier with his teacher.

Students from the Micro:bit club really liked this idea. As a part of the Micro:bit club students and teachers have created a code that would bind two Micro:bit devices. One device was supposed to be fixed on the teacher's wrist, and one on the wrist of a student with sensory difficulties. It was planned that the student wears one of the devices on the wrist that would be connected to the teacher, and at the push of a button, it would audibly signal to the teacher

that the boy is calling her. In the same sequence, when the teacher wants to draw the student's attention, or call him, by pressing a button on his device, it would vibrate signal to the student that the teacher is calling him. Unfortunately, although the students were working hard, Covid pandemics cut their work short and once Covid pandemic started they stopped their work on this project. The devices were never finalized and the student never got to use this device.

IMPACT OF THE PROGRAM

The programme has had a moderate impact on students and teachers of the school and it further supported inclusion of disadvantaged kids enrolled in the school. Many students of the 9th grade participated in the Micro:bit club and deepened and developed social sensitivity and empathy for children with disabilities. They understood better some of the problems of students with sensory disabilities and increased capacity to see world and the school from perspective of students who do not hear and cannot speak.
Also, the project itself raised the safety of deaf-mute students as an issue. Potentially, if finalized, the project could increase security of the students with disabilities and would make everyday teaching and learning easier for them.

Additionally, according to our respondents, students enjoyed participation in the club. 'They were very happy to participate. They had a lot of questions. They are fast. It made them more competitive in the employment field because computers are our future' the teacher emphasises importance of IT knowledge for future employment search. Moreover, both teachers and students got ready for on-line learning. According to the assistant Director, this project enforced familiarization of school staff with computers and it really helped during pandemics when they all needed to switch to the on-line learning.

Finally, the school staff broke some prejudices that language teachers cannot code. Also, older, more conservative teachers overcame their fear from technology and got involved in the project. In that regard one of the respondents said: 'They firstly had a bit of fear that they can break something but they relaxed over the time'.

FACTORS CONTRIBUTING OR INHIBITING PROGRAM IMPACT

Different project, school and family factors have been identified as contributing to the program impact.

In relation to the **programme** implementation the main identified factor has been the **project relevance**. According to our respondents programming and coding are skills of the future and therefore it is very important for students to code and to get familiar with different technology based devices. Therefore, the programme was recognised as important among teachers, students and parents and they all have been very motivated to learn to work with Micro:bit.

In regard to the teacher-related factors they include **teachers' motivation** as well **as teachers' openness for innovations**. According to the respondents it was crucial that teachers from Miroslav Krleza School are in general open to new activities and keen to learn and engage with technology. In that regard, the respondents noted that they did not follow the instructions provided by British Council to send to the seminar teachers of math, technical science and informatics and instead they sent those teachers who, in their opinion, have been the most motivated to engage with the project. Teachers' motivation has been the crucial factor of the successful implementation.

Additionally, according to the respondents it is important that participating teachers have been in school for long time and have been familiar with the students and with the teaching environment. For instance, English teacher who was in charge of the book club has been in the school for 14 years already.

In relation **to the school factors**, the respondents also highlighted importance of the school equipment. For instance, the school has good computer **equipment**, Internet connections, smart boards, on-line platforms etc. The school is proactive and very successful in **funds raising**. Various **public-private partnerships** have been established and cooperation with local business is excellent.

Also, **teachers' IT competencies** are solid because school provided systematic education in that regard. Digital diaries have been introduced a few years ago.
All of the above enabled school staff to always find ways to include vulnerable kids. For instance, 38 economically vulnerable children every day get free school lunch funded by the local community. Also school gave tablets to those students that did not have devices at home to support their easier home based learning. Also, in cooperation with the Canton government the school ensured that all students got solid and stable Internet connection at home. BiH Telecom helped with this initiative.

Assistant Director also emphasised that the transparency has been a crucial element of successful cooperation with donors. In that regard she says *'when donors give some money to the school, they can see what we have done with it, they can see the automatic improvement. That is why they will always give again.'* In relation to other, **environmental factors** fantastic cooperation with the families and broader community have been emphasised as important. Covid was only **inhibiting factor** identified. Because The Government of BiH prohibited any kind of extra curriculum activities after Covid pandemic started, the school had to stop with all project activities and according to the English teacher they 'could not develop the project fully'.

POSSIBILITIES TO IMPROVE, SCALE UP OR REPLICATE THE MODEL

School pedagogic underlined that the project relevance makes it very important and it would be desirable to continue with its implementation in other schools. However, she also says that it is important to identify motivated teachers regardless of their subject expertise because only motivated teachers can implement the project successfully.

6.5. CASE 5: KISHNAREKE, KOSOVO – 'WE BEAT ALL!'

DESCRIPTION OF THE PROGRAM IN SPECIFIC CONTEXT

The village Kishnareka is a medium sized village, around 10 kilometres from town of Drenas, and about 40 kilometres from Prishtina, the capital. It has about 1500-1600 inhabitants, and mainly the population make the living from work in agriculture, and trade to some cases, since it is close the highway from Peja, and Prizren to Prishtina, where at the edge of the road various businesses are flourishing.

The school in Kishnareka is a primary and lower secondary school type, which includes also the preschool level, and which accommodates at present around 375 children in the learning process. It has around 32 school personnel, besides teachers also including the school Director, pedagogue and technical staff. Part of the school was built around 15 years ago, while the other part (half of it) a couple of years ago (2018).

The school was included in the 21st Century Schools training program in spring 2019, and four teachers from this school were trained. The school shortly after the training initiated the creation of the coding club, with participation of 7-8 students of lower secondary school classes. With this project, the school competed in the national coding competition and were ranked in the second place as most interesting project.

The school was chosen also because there are children with special needs (three children) and a child affected by low socioeconomic situation.

IMPACT OF THE PROGRAME

The school director, who is also a certified 21st Century Schools trainer, declared that the CTPS activities were smoothly introduced in the school and the activities run well at the beginning. The teachers who were trained mainly implemented the activities in their subjects, but also worked together in the school project.

The interviewed teachers mentioned that they could implement several of CTPS teaching techniques in their subjects. **Problem tree, effective questioning, as well as the six hats technique** in groups were the techniques that were mentioned the most. Teachers used also the **facts and opinions and debating** exercise to **stimulate students' critical thinking and arguing**. In the last technique children were more stimulating to compete with each other in terms of supporting their opinions with arguing facts in the learning process.

Teachers mentioned that the student coming from family with **low socioeconomic status**, who was in the 7th grade at that time, was considerably engaged in the school project. She was **highly motivated and became interested in coding activities**, as she continued several times working at home. She was challenged on this because of the lack of computer, however she sometimes was allowed to take school's laptop

at home to work on coding. She was one of the main student creating group energy for the project ideas and development. The grou p was able to compile an orientation instrument, a compass, which added voicing element, that could be used for guidance for blind people. The coding club participants, as well as the other children of the school, were highly enthusiastic with this achievement. It definitely brought good motivation and energy in the learning process, as well as higher teacher commitment and motivation to use the CTPS techniques and coding.

FACTORS CONTRIBUTING OR INHIBITING PROGRAMME IMPACT

Besides the school achieved good success with the school project, there were numerous factors that inhibited the implementation of the program, particularly during the past year. First, school faced lack of materials needed for project ideas. That included also the lack of the ICT cabinet, as well as of the functional internet until this year which was ensured as new investment. Without proper equipment and needed materials, the school could not follow up on other project ideas, regardless the enthusiasm they had with the achievements of the first project. Second, teachers had not much developed knowledge and skills in coding, since the space dedicated during the training was not sufficient to get a more in depth know how for the coding, therefore they felt quite uncomfortable to get to work in more complex projects with children. Third, it was difficult to try to engage in CTPS activities children with learning difficulties. The CTPS training did not focus on approaches how to work with such group of students. Finally, the pandemics that hit the society almost stopped everything in terms of coding and implementing other CTPS activities. Teachers could not organize group work with children, and now and then distance teaching & learning had to be applied.

POSSIBILITIES TO IMPROVE, SCALE UP OR REPLICATE THE MODEL

The interviewed teachers, school director and students provided some good insights about how the program could be upscaled in the future. First, and most important, the training program in the future to have modules of clearer methodology about how to work with vulnerable children, in particular with those with learning difficulties. Second, teachers expressed much more need to get trained in coding and using Micro:bit in their teaching subjects. Therefore, they stressed the need to have more examples of CTPS techniques in general, and coding with Micro:bit in particular in different subjects, therefore they could develop a better understanding on adapting their own teaching methodology. Third, the school director expressed the importance that in the future teachers to be required to develop several plans, both in their course topics, as well as for the school projects, and that the trainers conduct longer mentoring visits and advising to them. Fourth, more teachers to be included in the future trainings of this kind, in order to have higher impact in schools. While, finally, students expressed the need for more group learning practices, such as CTPS techniques are bringing up.

6.6. CASE 6: PRISHTINA, KOSOVO – INCLUDED AND MOTIVATED

DESCRIPTION OF THE PROGRAM IN SPECIFIC CONTEXT

The "Ismail Qemaili" School is one of the largest school in Prishtina, with over 1000 students. The school works in two shifts, and classrooms are very crowded with children going from 32-40 children per class. It is a type of Primary and Lower Secondary school, including educational level of pre-school (5 year old children), primary (1-5) and lower secondary (6-9) classes. The school is recognized as a type of "inclusive education

school". It has rooms for children with learning difficulties, equipped with relevant teaching and learning materials. There are more than 10 children identified with some type of learning difficulty, attending the regular education classes in the school. Three teachers with special pedagogy are employed to support the children and teachers in the inclusive education, particularly planning and implementation of individual education plans for the children with learning difficulties.

Prishtina region was the first region to be included in the 21st Century Schools training, which took place in spring 2019. Twelve (12) teachers from the school attended the training, from which five were interviewed for this case study research. Teachers started practicing the attained knowledge and skills from the program in teaching activities with children. This happened in their individual subject classes, as well as joint activities working in the school project. They stressed that the program was a good supplement and support to the implementation of the new educational curricula that started a few years ago. The Kosovo New Curriculum Framework requires competence-based learning, therefore teachers in general find challenging to adapt their teaching methodology towards such requirements. Therefore, the CTPS techniques were perceived as very positive in supporting teachers in such endeavours.

IMPACT OF THE PROGRAME
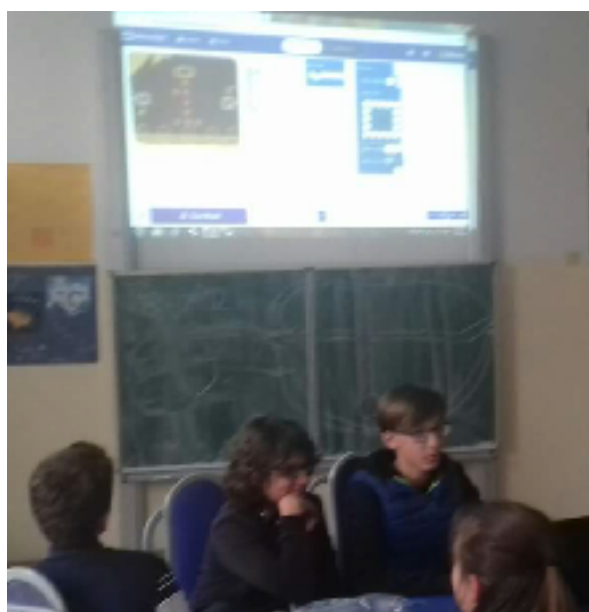
The CTPS techniques of the 21st Century Schools program were considerably implemented by teachers in various subjects. Teachers mentioned techniques such as *six hats, Costa Taxonomy, problem tree, three-level questions, Micro:bit, and debate*, which they adapted to different teaching activities of individual subjects. They stressed that t**hese techniques promote more interactive collaboration among children themselves**, and **between teachers and children**. They emphasized the way this techniques are instrumentalizing learning by taking different roles in the learning process. *"Children felt more free and equal to engage and discuss in such activities"*, mentioned the teacher of physics. Another teacher noted how using **the debate** in the teaching process **made children feel equal**: *"the use of debate made children argue with facts, and eliminated the differences they saw to each other"*. This situation was obvious to **increase the children self-confidence**, because they were given the same space and tasks as the others.

Teachers mentioned that **children with learning difficulties were active to some extend** during these activities. The techniques, particularly the **six hats**, and **Micro:bit**,

stimulated those children to be more active in groups, although their role in the group and in the tasks were less challenging. However, there was no indication whether academic performance of those children improved as a result of implementation of the CTPS activities. In addition, the observations of the Assistant Teacher indicate that **children with special needs were more attracted by and motivated from participation into CTPS activities**.

However, teachers emphasized that it was difficult to engage them in the school projects, since they were more distant to that collaboration, particularly since working in the project was needed to often commit more time, and mainly after regular classes. The school Deputy Director evaluated positively the school project as very welcomed, enthusiastic and interesting for teachers and students. Teachers in addition noted particularly the **difficulties to implement coding activities with Micro:bit**, since the ICT cabinet had to be closed by the school in order to free the room for accommodating a group of children. The school is very overloaded, therefore it is challenging sufficient space.

On the other side, the interviewed parents (three parents of children with learning difficulties that attend the school), seem not to be familiar with the program. They did not confirm whether they ever heard about the programme. This might have been due to the time distance as programme was implemented more than a year and a half prior to the interview and disrupted during the last year because of Covid-19 pandemic. Parents mentioned that they were happy with the school approach to include their children in education, however the situation with pandemics have been a real challenge for them, since those children could not catch up with online classes.

The feedback from the interviewed schoolchildren reveals other issues that they are experiencing in the learning process in the school. They said that children with special needs are mainly engaged in the learning activities, though with difficulties, but that teachers are trying to support their learning. *"It depends a lot on how the teachers approach those children in the class, and then how much those children are engaged and motivated"*, stressed one student from seventh grade. That implies the way teachers adopt their teaching approach to children with special needs means a lot on the level of those children engagement in the learning process. *"Sometimes teachers make critics, and that makes children with learning difficulties more emotionally sensitive and more difficult to focus"*, emphasized another student from the eighth grade.

The school psychologist confirmed that the Programme has supportive effect to the changing methodological practices that teachers are obliged to apply with New Curriculum Framework.

She added that teachers were optimally committed to implement CTPS activities, however the situation with COVID-19 greatly disrupted continuation, because of the shift of the education process in the online mode. However, she did not mention any observable positive change among children with special needs, as a contribution of implementation of such activities. In addition, the school deputy director mentioned the challenges of providing needed materials for the school projects, as the school has limited budget to support different initiatives.

FACTORS CONTRIBUTING OR INHIBITING PROGRAMME IMPACT

Main inhibiting factors were found to be:
- The lack of ICT cabinet, therefore it is perceived as difficult to activate the coding clubs or to initiate new coding groups in order to conduct various school projects.
- The school lacked a coherent approach to introduce CTPS techniques cross-curricula activities, except a school project that they realized at the beginning of the program implementation.
- Since this is an inclusive education school, and children with special educational needs are mainly learning through individualized plans, teachers were not able properly to link CTPS activities with activities of individual plans. This made more difficult for those children to be better integrated in the regular class activities in the cases when CTPS techniques were used.
- School has limited budget support school projects in coding with different needed materials. Therefore, some of the good ideas have not been supported because they costed money to buy needed equipment and materials.
- Classrooms are overloaded with children, therefore it is difficult to properly organize CTPS activities in order to achieve the learning objectives by involving everyone.
- The pandemic interrupted the normal schooling process, therefore teachers declared that it was difficult to implement CTPS via online teaching. Similarly, parents complained that their children could not attend online learning, because it was difficult for them to catch up with the learning process, so parents themselves supported them using the online resources accessed via the portal prepared by the state.

Whereas, there were a number of positive factors identified that contributed to better implementation of the program:
- The level of commitment of the teachers to continue implement CTPS techniques in their regular teaching.
- Teachers adapted their teaching methods to include CTPS techniques. Thus, they recognized the positive influence of these techniques in the learning process as well as child motivation.

POSSIBILITIES TO IMPROVE, SCALE UP OR REPLICATE THE MODEL

The need for the training in the future to focus with one session at least about how to engage and mobilize vulnerable children, particularly children with learning difficulties in CTPS activities, and how to integrate them together with activities of individual plan. The program has good potential to be implemented in the whole school, however all areas of the school needs to be covered with internet, as well as that classes to be supplied with computers, and particularly the re-setting up of the ICT cabinet.

Teachers suggested as a good idea for the coding and the use of Micro:bit to be included in the curricula of all education levels as part of the ICT subject, so children will be more able to develop the coding skills. Also the remark added by the teacher assistant for the need

for more collaboration of ICT teachers with them in order to bring more support to children with special needs in coding particularly. Children stressed the need for more motivational learning approaches by their teachers, as they felt sometimes during CTPS activities.

6.7. CASE 7: PODGORICA, MONTENEGRO – ONE FOR ALL, ALL FOR ONE!

DESCRIPTION OF THE PROGRAM IN SPECIFIC CONTEXT

Podgorica is the capital of Montenegro, covering an area of about 1,500 square kilometres. The latest statistics show that 187,085 inhabitants live today in Podgorica, which represents 30% of the total Montenegro population. The population is 49.39% men and 50.61% women. In Podgorica live: 57.35% - Montenegrins, 23.35% - Serbs, 5.13% - Albanians, 2.22% - Muslims, 1.98% - Bosniaks, 0.36% - Croats, 0.37% - Egyptian. On the territory of Podgorica there are two urban municipalities and 141 rural settlements with 66 local communities.

Primary school Boško Radulović is situated in Komani, one of the rural settlements positioned only eight kilometres from the urban part of Podgorica. Although relatively close to the city centre, it is one of the smallest and poorest rural parts of Podgorica.

Komani's Primary school has exceptionally long history and dates back to 1872. That is when the building of the first primary school in Komani was built. The building had one classroom and one teacher's office. The school firstly operated as a four-grade school but since 1957, it has had eight grades. It got its current name 'Boško Radulović' back in 1960. Nowadays, the school employs 11 teachers and 27 students currently attend it.

Despite school's almost 150 years long history, teachers and students of Boško Radulović School face some significant challenges. Firstly, it is a school with children from families with below the average **socioeconomic status**. For instance, only one student has a computer at home while the majority of students' parents either do not work or have very low wages. Consequently, students from Komani have limited access to digital technology, other learning materials and experiences, including books, stimulating toys, skill-building lessons, or tutors to create a positive literacy environment. Also, prospective secondary school students from Komani are less likely to have access to informational resources about the future education. Thus, students from low-socioeconomic status households and communities develop academic skills slower than children from higher social economic status groups further perpetuating the low-socioeconomic status of the community. Also, increasing evidence supports the link between lower socioeconomic status and learning disabilities or other negative psychological outcomes that affect academic achievement. Evidence shows that children from lower socioeconomic status households are about twice as likely as those from high-socioeconomic status households to display learning-related behaviour problems. In Boško Radulović school 14% of students are classified as students with special learning needs what puts additional demand on the school staff. As research indicates, school conditions, plan and programs as well as classroom environment contribute significantly to the learning outcomes. Therefore, improving school's learning plans and programs may help to reduce some of these risk factors and support disadvantaged students from Komani to develop and fulfil their full potential.

Secondly, in addition to the low socioeconomic status there is significant **gender inequality** in Komani as a consequence of the wider society discrimination against women. On that note, one of the teachers says: *'our society is very traditional, conservative society where women have always been severely marginalized. It was always believed that women are less worthy and that they should be less visible and vocal.'*

According to World Bank, key areas of concern are agency, including violence against women and a lack of female representation in leadership; gender gaps in access to economic opportunities; and low educational attainment for particular population groups[7].

For instance, according to the same report, fifty-two percent of women and sixty-four percent of men aged 15-64 participate in the labour force in Montenegro. Much of the inactivity gap is explained by large gender disparities experienced by rural people. Economic inactivity is especially high among women with primary schooling or less, ethnic minorities, and older women. Mothers of students enrolled in Boško Radulović School mainly have (in)complete primary school as the highest completed grade. Further on, the majority of them are unemployed. Also, overall, women spend more time caring for their families and children, which contributes to reducing their opportunities to participate in the labour market in the absence of alternative childcare options. According to MONSTAT, the gap between Montenegro and the EU-28 average in relation to gender equality is the greatest in the Domain of Money. This means that women in Montenegro are the least equals to their European counterparts when it comes to the outcome of their work in terms of wages[8].

Low socioeconomic status in childhood is related to poor cognitive development, language, memory, socioemotional processing, and consequently poor income and health in adulthood. Considering those challenges of Montenegro society in general and Komani's students in particular, project Schools for 21st Century was greatly welcomed by the project team as it gave opportunity to the disadvantaged students from low socio-economic background, and especially girls, to learn, engage and have a fun. Some girls took leadership roles. Moreover, this project included students of all ages and abilities. Even the students who did not want an active role at the beginning of the project eventually showed interest in technology and coding. Four students with learning disabilities also took part in the project. In total, 27 primary schools students from Komani were involved in the project.

Some teachers and the school principal went through the trainings on how to introduce critical thinking, problem solving and Micro:bit in teaching and learning process. After the training, teachers were instructed to introduce content in school curricula and extracurricular activities. During the implementation of the Project, they had on their disposal a mentoring support. Teachers explored theory and practice of critical thinking and they were introduced to the basics of coding and computing. They were also trained to create projects and lesson plans for teaching concepts for different subject using the micro:bit.

Teachers were then in charge of building capacity of their colleagues by dissemination and demonstration of importance of critical thinking and problem solving skills in the teaching/ learning process. They developed lessons plans using critical thinking and problem solving pedagogy and coordinated development and implementation of a cross-curricular project. Math and English teacher led the cross-curricular project although in the majority of other schools it was lead by the ICT teacher. The school-based projects were focused on using Micro:bit in practical implementation of cross-curricular approach to teaching and they produced a set of school debates and quizzes as outputs. Later on they used Micro:bit to create the traffic model to support students from rural areas to understand traffic rules and basics of behaviours in traffic in the big towns. The math teacher was in charge of the Micro:bit part of the projects. After she learned basics of the programming with Micro:bit she passed it on to the students. She helped them to develop basic codes but at the same time she actively discouraged students of copy-pasting codes from the Internet. She wanted to help them understand plagiarism and importance of independent and unique work. However, later on she learned that what she called plagiarism was actually considered as an open source and that it was legit to take already existed codes as long as students understood what they could do with them. This was a big learning for both the teacher and the students and in relation to that the teacher said:

7 See report 78678 - ME Montenegro gender diagnostic: gaps in endowments, access to economic opportunities and agency https://openknowledge.worldbank.org/handle/10986/21827?locale-attribute=es
8 The Gender Equality Index for Montenegro, 2019, https://eurogender.eige.europa.eu/system/files/events-files/gender_equality_index_2019_report_final.pdf

'I haven't used Micro:bit before, so I also studied with children. All the children had to work alone. The problem was that the student wanted to go online and get the codes from there. I didn't give it to them, but later it turned out that I should give it to them. I thought it wouldn't be ok, it would be plagiarism. And then when we went to the presentation we saw that others were using it. I was strict there and I didn't know'.

The math teacher was very proud to explain the process and the aim of the project:

'When we were making a model of the city, the idea was for the children from the village to get acquainted with the traffic regulations. We included roundabouts, commercials, schools, etc. We even thought about how to involve the sponsors of that teaching aid. If the children answer the question correctly, for example, then they can cross the street. If not, they must return. The children did everything themselves. The goal of the game was to go from home to school but the two teams need to take a different path but with the same number of intersections to make it equally difficult for them. They get questions at every intersection. The micro bit was used by us to do some basic operations. For example, turning on a traffic light. We did not use conditioning. However, we all managed to master at least some basics of Micro bits'.

Figure 1 Multi curricular project - model of a town with accompanying traffic regulations and other elements

However, Micro:bit was not a major focus of the project. Students' participation was a focus instead. English teacher was responsible to ensure that all students can participate in the project and benefit from it. In that regard she said: *'the whole school got involved. The project was for those from grade six to nine. But we enabled students from lower grades to participate as well. The youngest ones were also doing something. They glued and painted parts of our model. They were fascinated by the project. Every day they wanted to do something. We did one great thing to cover all the students. We included those who are studious and those who have special needs and those who are good students and those who are not, we involved both big and small children'.*

English and Math teachers were also in charge of establishing a coding club. The Coding club was a meeting point for students and teachers to exchange ideas and create a cross-curricular project. They were getting together at least once a week in IT classroom where students worked on development of joint projects using Micro:bit devices.

Students firstly developed the quiz about different subjects. There are four children who are categorized as children with learning difficulties in the school. According to their teachers *'They don't have some serious illnesses they are just a little neglected'*. Those students were

also involved in the Code group work. For example, one girl with learning difficulty from 5th grade was in charge of scoring during the quiz. According to our respondents *'she was very pleased with her task and proud of herself'*. Two other students from grades seven and nine were part of the teams and they also enjoyed it.

Teachers provided great support to the students but on the other side, they also got great support. Teachers were provided with mentor support (trainer). This support formally included two on-site visits but in practice it was much more. Teachers were exceptionally satisfied with the support they got from their mentor. According to them their mentor supported them and helped them extend their own capacities and even more importantly helped them understand importance of unconditional support and positive language.

Finally, Coding club had an opportunity to take part at the annual national coding competition. The team got very positive feedback and as one of the best coding clubs they were invited to take part in the regional coding competition. The student who participated in the competition event as an observer mentioned that the event was also very useful for him because he got a chance to see what other students came up with.

IMPACT OF THE PROGRAM

'Students were very engaged in this project and they were eager to participate. They learned that they could enjoy learning. Teachers learned that they could enjoy their job. They both learned that they can develop and that they can be praised. '(Mentor)

The project has influenced the school significantly including at the level of individual students' skills and self-confidence, school-wide increased student participation and improved relationships among students and between students and teachers.

While some students improved their already existing **coding skills**, others started from the scratch. Many got interested in the coding although before they did not consider programming as important. According to one of the teachers children **learn through play** and that is why Micro:bit as a teaching aid has been so important and engaging.

Students emphasized that the project was fun and that they really enjoyed making the games because of the companionship. *'We were close to each other before this project but the club brought us even closer. The best part of the project was the **socializing**. We joked and played songs and danced. The atmosphere was great'* one of students illustrated **improved social relations between students**.

Moreover, the project **addressed above mentioned widely spread gender inequality problems**. Being aware of a status of women in Montenegro society, teachers involved in the project purposely encouraged girls from the school to participate in the project. One teacher said in that regard: *'Montenegro always puts woman down. That's why we focused on the girls. In a school of 27 students, we have only two girls in grades 6-9, and both of them were selected to be a team leaders'*. One of the girls who took a team leader role Dragana is a child from the village, a child of two parents who only finished primary school. She was initially unmotivated and did not even want to participate in the project. Later on, she was hesitating to participate in the project public presentation. Teachers put special effort to encourage her to participate, gave her space to make decisions and lead her team.

Consequently, she increased her self-confidence and started to be one of the most active project's participants. *'When she figured her own abilities and when we let her be the leader, she became very interested and saw that she could do whatever she wants. This also affected her relationship with her friends because we told them that they had to listen to her because she was a leader. We're sure we've instilled enough confidence in her that she'll never think again 'I'm just a girl from the countryside. And I can't or I don't deserve it''*, one of the teachers

said in relation to the project's impact on the girl. Moreover, the teachers emphasized an importance of gender role modelling and mentioned that other younger girls from the school could see her success and understand that there is no limit for girls if they put dedication and hard work into something. *'There was also another girl who could watch how she managed everything and that will be able to continue where she left off'* one teacher noted. The girl herself mentioned that the project also positively influenced her two younger sisters because they could see *'that the girls can code'* and that *'our potentials are limitless'*. She is now in high school but according to her she is still very proud of everything she achieved in this project. It gave her a sense of self-achievement and confidence.

Further on, the students also appreciated **independence** given to them and in that regard one of them says: *'the teachers let us do everything ourselves. It empowered us and gave us strength to succeed'*. The other student stressed that the project also **brought students and teachers closer together**. Along those lines, he says *'I was even closer with ICT Teacher because of teamwork. It will be difficult for me when I leave this school because I will miss the computer science teacher because she is great. I will also miss all my friends'*.

Relationship between teachers and students also improved because teachers learned how to approach students in a positive way and support them to get the best possible results. According to the participating teachers they learned from their mentor how important support is and they mirrored the approach mentor used for them and applied it back to the students.

Teachers not only learned how to communicate with students in more positive way but have also been encouraged to do **further self-development**. Teachers also expressed desire to cooperate together in future project as they now developed trust among each other and discovered synergy they get out of joint work. They also mentioned that the project built knowledge and skills of employees as the project helped conservative teachers to engage with some innovations and apply them in the classroom.

FACTORS CONTRIBUTING OR INHIBITING PROGRAMME IMPACT

'Access and support are crucial. Disadvantaged students need to be involved and positively encouraged. That is a key of the project's positive impact on disadvantaged kids.' (Teacher)

Various specific factors reinforced the project's positive impact on disadvantaged students. In relation to the **programme** factors, it is important to note that the school's teachers got outstanding and very well targeted support by their mentor. Capacity, commitment and motivation of teachers have been identified as the crucial **school related** contributing factor to the project's success. Deep knowledge of their school environment enabled teachers to use particular strategies to include all students in the project.

The essential factors for the project's success in relation to disadvantaged children is the school's principle commitment, readiness and capacity. Motivation of principle to participate in the project is identified as very essential. Teachers mentioned important support they got from the school management.

In relation to the specific **inclusion strategies** used in this school and applied in the Schools for 21st Century project, it could be important to notice that Boško Radulović employees pay special attention to the inclusive education. Also, when choosing who will present at the competition teachers decided to couple up two students one of which needs to build her self-confidence but is hardworking and one who is already very relaxed and confident but needs more practice. That proved to be good strategy because they both learned a lot and got what they needed – she got a confidence boost, he learned that more he practices better he is.

Figure 2 Stefan and Dragana (left to right) - Presentation at the national competition

Only **negative school** related **factor** was degraded IT infrastructure. In relation to that, one of the participating students said: 'the Internet at school is not good. The computers are very old. Only one computer is actually usable, but it is also constantly shutting down'. Similarly, one of the teachers said: 'If it rains or the wind blows, we lose both electricity and Internet'.

According to one of the participating students, **negative side of the program** was insufficient focus on coding and Micro:bit itself. 'We ran out of time to seriously code. And we did not have capacity to do that. That is the flaw of the project. I learned a little bit but not much' he says. According to him, the project timeline needs to be revised to allow for more time for coding. Also, he believes that all students need to learn to code and not only those who are already good with programming.

The main **negative environmental factors** include disengagement of the families and their economic hardship. According to the teachers *'Parents did not help us. These are mostly people who take care of cows or gardens and their maximum is to come to the parents teachers meetings but they do not interfere with their kids education and do not ask further'.* Students confirm this and say: *'My mum and dad knew what I was doing but they were not really interested in it.'* Children could not continue practicing Micro:bit at home as they did not have sufficient equipment to do it.

POSSIBILITIES TO IMPROVE SCALE UP OR REPLICATE THE MODEL

There is a consensus among our respondents that this project is useful and should be replicated in other schools. According to them digital literacy as well as critical engagement are essential for learning but also for the future employment. Respondents have identified some areas of improvement. Three main identified gaps are parents' disengagement, lack of access to technology at home and condition of IT structure at schools. Therefore, according to the respondents, if replicated, the project should include activities to address all of the above.

Also, according to some of the teachers it would be better if the trainings were tailored based on teachers' IT knowledge assessment. It would support trainers to deliver better-targeted training and would consequently increase IT knowledge of teachers in charge of the project. Moreover, it would be good if schools that have strong IT knowledge assist those schools that lack relevant knowledge. In general, networking between schools was insufficient and before the replication that segment of the project can be enhanced.

Also, the students who most actively participated in the project expressed wish for the project to continue to give them a chance to enhance their coding skills further, to improve their individual projects, to travel and present their work regionally.

6.8. CASE 8: SLAP, MONTENEGRO – YES, WE CAN!

DESCRIPTION OF THE PROGRAM IN SPECIFIC CONTEXT

'Now that I've seen that I can do it, I know I can do everything in life' (Milosav Koljenšić student, grade 9).

Primary school Milosav Koljenšić is located in the village Slap, rural part of Danilovgrad municipality. Slap is a small village. There are only 34 adults living in Slap, and the average age of the population is 43 years. There are 19 households in the settlement and there is a significant decrease in the number of inhabitants in the last two decades. All school-age children from Slap and surroundings go to Milosav Koljensic School. There are 53 students and 19 teachers. No teacher lives in Slap.

Students from Slap are disadvantaged in comparison to the majority of their peers. Their disadvantages are primarily arising from their village location. Some of the students also come from the families with low socio-economic status. Although rural areas of Montenegro can be beautiful and relaxing, their inhabitants confront significant challenges. These challenges include a lack of public transportation, social services, and particularly health care facilities. The key problems that have been identified in Slap are poverty, illiteracy, and unemployment. Slap also struggles with the poor infrastructure such as electricity, roads, communication, energy supply, Internet, public lighting. Remoteness and isolation were the main problems mentioned by the interviewees.

Students from Slap rarely travel even within Montenegro and only a few of them had a chance to go abroad (and even than only to Serbia or Bosnia). Like the majority of their peers, the students from Slap love playing video games and enjoy in digital technology. Unfortunately, unlike their peers from other parts of Montenegro, they rarely have computers, tablets and phones. The majority of students from Slap do not have an Internet at home.

Hence, school Milosav Koljenšić and its entire staff got a tough responsibility to compensate for the disadvantages attributable to factors listed above. The project 'Schools for 21st Century' reinforced their efforts in that regard.

The project started with the initial seminar organised to build capacity of the school teachers in relation to Micro:bit and critical thinking. This seminar was emphasized as an important first step of the program. Although, according to our respondents, teachers are mainly overloaded with extra curriculum activities, this particular training was very helpful for teachers participating in the project to understand the project's aim and to get familiar with available tools. *'The director called me and told me that I should go to the seminar. At first I was not happy about it because I knew that it would take me three full days. But afterwards I was glad because I learned a lot. We listened to tutorials on how to use the Micro:bit and we covered both the Micro:bit essentials and critical thinking stuff. The seminar was interesting and the mentors were excellent'*, one of the teachers said in that regard.

Shortly after the seminar, teachers were encouraged to apply the Micro:bit and critical thinking in their teaching. They came up with ideas and many of their ideas really paid off. For instance, a physics teacher used a Micro:bit with the nine graders when they were learning about electrical circuit. She divided the students into two groups and let one group work traditionally while the other group used the micro:bit. According to her,

the students were thrilled. 'I asked them how they liked working with the Micro:bit and they said that it was the best class, the best teacher, a fantastic class, a phenomenal class' she said.

Also shortly after the seminar, teachers of informatics and physics introduced Micro:bit to the students by doing show and tell school-based presentations. Those presentations were very effective and attracted a lot of students to the Micro:bit club.

There were 34 students from Slap enrolled in Milosav Koljenšić' grades six to nine in 2019/20 and therefore, they got a chance to participate in the project 'Schools for 21st Century'. Among them, 19 (11 girls and 8 boys) actively and continually participated in the Micro:bit club work. Although skeptical at the beginning students became interested because of the teachers' engaging presentations and joined the club to further investigate Micro:bit capacities.

According to the informatics teacher and the Micro:bit club coordinator, **the girls were more interested than boys**. The club coordinator conducted a detailed analysis of the students learning achievements and motivation during the project. The analysis shows that 79% of all eligible girls joined the club while significantly less (57%) of all boys expressed an interest to join the club. In terms of age, the most interested were the students of the seventh grade while the least interested were the students attending the grade nine.
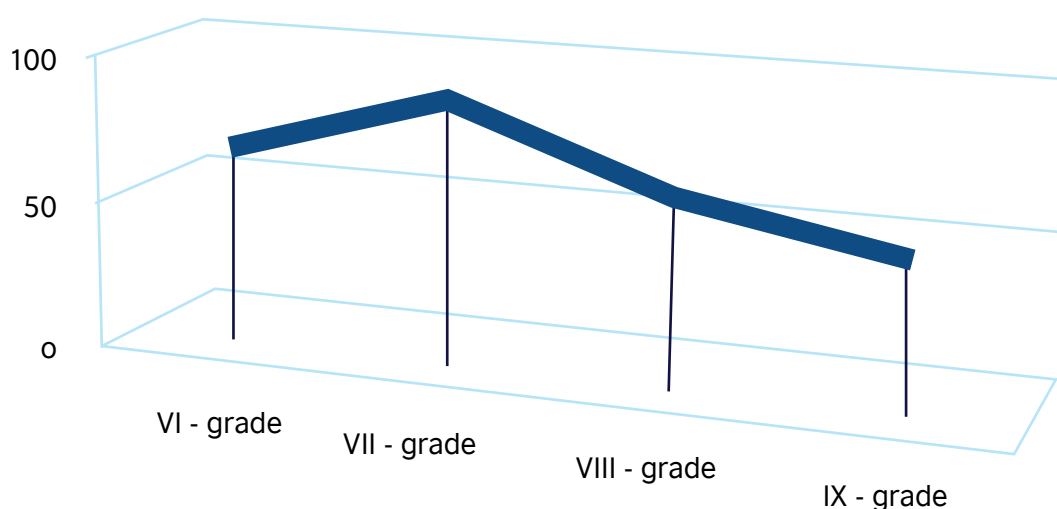
They had one to two Micro:bit club sessions per week and came up with the mathematic game to promote student engagement with science, technology, engineering and mathematics. Moreover, the project idea was inspired by the specific needs of one school student who has been categorised as a student with learning difficulties.

'We have a little student who is not well and does not do well in mathematics, so we wanted to help him with basic mathematic functions. He really liked the game. he said 'I really needed this', one of the students from the Micro:bit club said.

The members of the club developed the game over a few months. It included different functionalities namely addition, multiplication and division. Four members team (two girls and two boys) were the most active in its development. Two girls then led the team that represented the school at the national competition in March 2020. They took the second place and qualified for the regional competition.

Some of the students have been very motivated by an opportunity to create their own project and present it to the wider audience. They wanted to show their knowledge and creativity as well as originality. *'We wanted something that no one else was doing. We didn't*

want to take it from the Internet. At the competition we saw that some were taking codes from the Internet. We didn't want to' one of the students stated. They were motivated by an idea of participating and by compassion for their friend with learning difficulties. The prospect of winning was not that important to them. However, once they figured that they stand a good chance to win, the victory itself became very important too.

'Our school presented the last one. There were eight of schools before us. We hoped to win but we were not sure if we will. When a woman from British Council came to us during lunch and said that we were great, we knew we maybe got a good score. When they announced the winners we held hands and then we jumped from joy when they announced (drum sound) MATH GAME, THE SECOND PLACE! It is OUR math game we knew! We were very happy'.

The team plans to continue their work on the game, to improve it and add some more functions. Also, the students highlighted that the mathematic game has potential to be used with younger kids too. With small modifications, the game could be applied in work with the younger children, even in a preschool.

IMPACT OF THE PROGRAMME

They are somehow freer now. I used to have to prompt every their word in a classroom but now they are much more involved in a class',
Teacher

During interviews with the School Principle, Teachers of Informatics and Physics, Micro:bit Club Coordinator and some of the school students, it was confirmed that the participation in the School for 21st Century project in general, and in Micro:bit club more specifically have supported vulnerable children from Slap in several ways. Firstly, the positive impact has been noticed in relation to **new skills and knowledge students immersed**. Acquired analytical and critical thinking, coding and public speaking will likely increase their employability and be important for a successful career in highly digitalised labour market. Secondly, **both students and teachers increased their self-confidence and readiness for participation and promotion of their work**. Finally, the **project positively influenced relationship between students among themselves as well as between students, teachers and parents**.

The informatics teacher conducted assessment to measure **students learning achievements**. He evaluated students based on the frequency and quality of their participation in the club, quality of their assignments, and their coding and presentations skills. While all participating students gained basic knowledge about Micro:bit, about 74% of them reached intermediate level and showed capability to engage with more complex tasks. Boys and girls showed similar results. Students of the grade eight showed the best level of acquired knowledge while only 25% of the grade six reached this level.
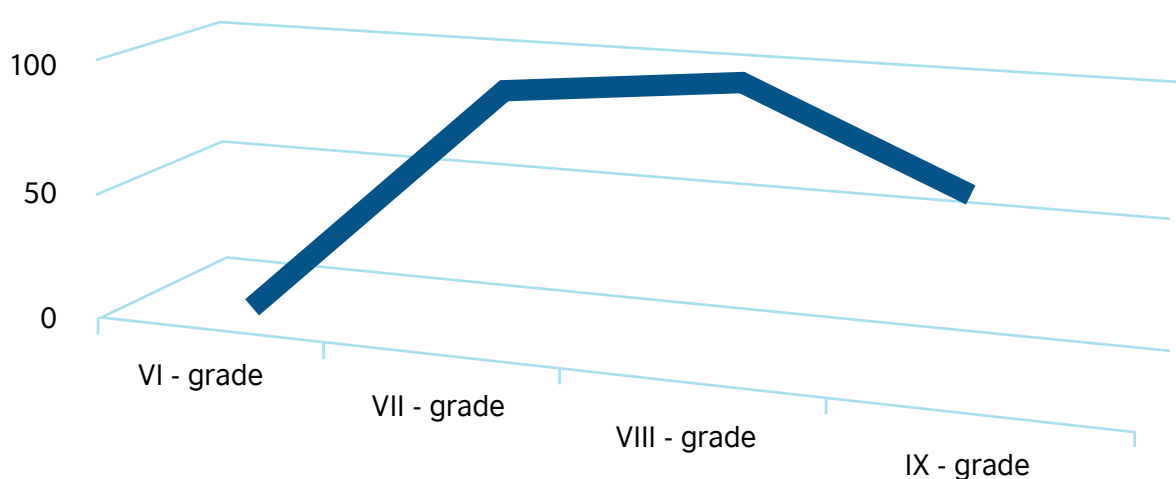
The teacher also measured percent of students who reached the highest, advanced level of knowledge and ability to combine coding with creativity. Girls performed better in this regard as about 36% of participating female students reached this level (comparing to about 25% of male students). Age wise, students of grade eight showed the best results.
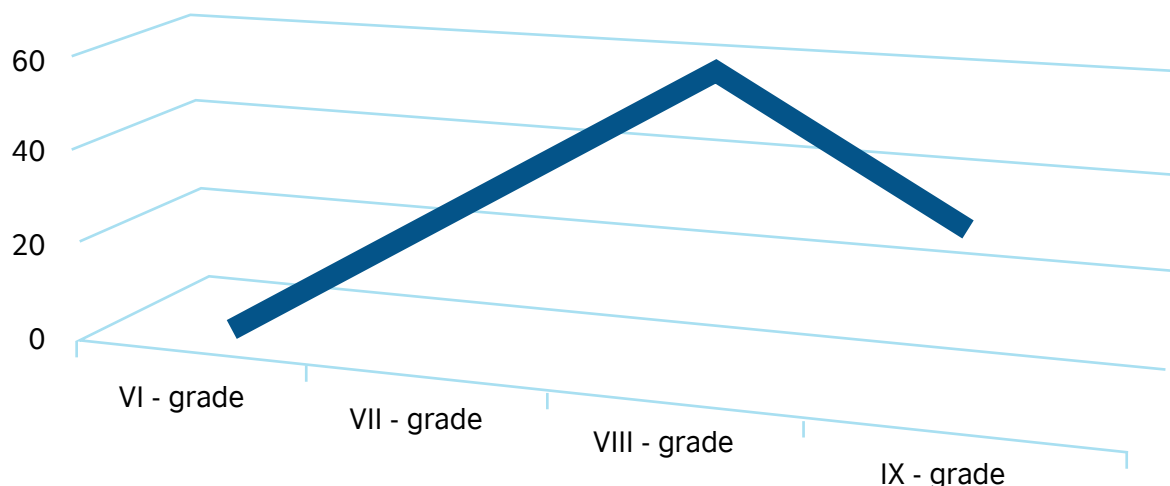
The students engaged in the competition belong to this group of advanced students and they doubtlessly not just strengthened their **coding skills but also their critical thinking, presentation skills and creativity**. According to one of the students they have expanded and diversified their knowledge a lot and they consider their knowledge increase as the main project's impact.

Further, both teachers and children emphasised that this project significantly improved public speech and presentation skills of the students participating in the competition. This is essential because as one of the involved teachers stated *'Children from the city express themselves better'. 'It is difficult for the children from the village to make presentations, but they were great'* she said. (Teacher)

This consequently led to considerable **increase in the girls' self-confidence**. *'Now that I've seen that I can do it, then I know I can do everything in life'* one of the students said. The teachers noticed this newly gained self-confidence too. *'They are proud and we are proud of them too'* one of the teachers noticed. *'They are somehow freer now. I used to have to prompt every their word in a classroom but now they are much more involved in a class'*, the same teacher continued.

In addition to above-mentioned project's impact on students' knowledge and self-confidence, the project also visibly **improved social relationships** between students and teachers, between parents and students, between students among themselves and between teachers.

According to teachers and students, parents of students from Milosav Koljenšić School have not been actively engaged with their children education. More often than not, they have been overwhelmed with house and farms works and they had no time nor interest to participate in the school tasks and activities. However, success that the school achieved in the national competition did not go unnoticed among parents. Students participating in the competition mentioned that their parents were very proud of them and their success. One student said that her parents were very happy: *'that happiness cannot be described. They said 'well done son, I knew you could do it!' The other one mentioned that her 'parents were very surprised because they did not expect it. At first, they didn't believe it. When I showed them the diploma I got, they were very happy'*.

Similarly, one of the students said that teachers were very supportive of them and also very proud of their achievements. According to her, *'It was a school day just two days after the competition and there were many teachers who congratulated us. They said that we were persistent and the best. they said WOW'.*

'We had wonderful support from school - they believed in us more than we believed in ourselves' the other students emphasized along the same lines.

Further on, students' increased interest in Micro:bit also supported teachers to **apply new technics in the classrooms**. Those students who had practical experience with Micro:bit shared their impressions and consequently, this led to the increased motivation of other students to explore Micro:bit capacities. For instance, Physics Teacher mentioned that after she used Micro:bit in her classes with the grade nine, the eight graders asked her if they could work with the Micro:bit as well. Afterwards, she expended her use of Micro:bit and used it to explain different topics including magnetic field and speed.

Similarly, a history teacher used Micro:bit to make the class more interesting. She used Micro:bit shake function to enable students to choose a letter or a question. On one side students really enjoyed more interesting classes and on the other teachers enjoyed learning new things. *'I haven't used a Micro:bit before and it was nice to learn that. Other teachers have learned a lot'* one of the teachers noted. *'That was a win-win situation'* he continued (teacher, Milosav Koljenšić school, Slap, Montenegro).

Moreover, teachers started to evaluate their classes more regularly and to take care of students' opinion on the tools they have been using. The students have welcomed this kind of **increased opportunity for participation**.
Finally, the participation in the project brought **wider exposure** of the school and to the individual teachers. For instance, one of the teachers had a chance to present her teaching methods to The Department of Education and to provide recommendations for further curriculum development. Also, students and teachers also felt that the project success strengthened school reputation. *'Through this project the school got for the first time a chance to present our work abroad'* one of the students highlighted.

FACTORS CONTRIBUTING OR INHIBITING PROGRAMME IMPACT

'We had wonderful support from school - they believed in us more than we believed in ourselves' Student, grade 9.

Different project, school and environmental factors enabled disadvantaged children from Slap to benefit from the project.

In relation to **the project factors**, according to the school staff, first and foremost the project has been **well structured and specific activities and their order have been valuable**. As noticed earlier, many specific activities have been evaluated as positive and their contribution to the program overall effectiveness was emphasised as high. Those activities include initial capacity building seminar, school based presentation and formation of the Micro:bit club at the school level, application of the Micro:bit in the classroom and the participation in the national competition.

Additionally, our respondents also identified support from the British Council as a very important project element. *'British Council is great. They are wonderful and professional. They always meet us when we need it and positively solve our problem'* one of them said.

In relation to **the school factors**, school's Management support to the project has been very important for the project's success. **Principle's understanding and commitment** to the project proofed to be essential for the project success especially in relation to the vulnerable students. According to the Principle, he had coordinating role but also needed to continually maintain teachers' motivation and to encourage them to participate. Teachers needed a self-confidence boost as many of them were convinced that 'small village school cannot compete with the big schools as for instance from Niksic'. Further on, **proactive and motivated teachers** were crucial in further engagement of students. Moreover, according to teachers, it was also very important that **employees have worked as a big family**, that they have

always been open to support each other and to cover each other gaps. *'The team at that school in Slap is simply wonderful. They have always been there for everything I needed. They are the best group of colleagues I have ever had. … We have some family atmosphere'* one of the teachers point up.

Finally, some **environmental factors** were also identified as important for the project's success in relation to the vulnerable children. According to one of the teachers, rural schools are smaller and therefore teachers have **more physical space and time to dedicate to each student**. Although all school students face some challenges being the kids from rural remote areas, those who were from families with **better educated parents with higher income** showed higher participation in the project. Also, according to the all respondents, **female students** were much more likely to actively participate and finalise the project.

Some **barriers** to active participation of the vulnerable school children have been identified too. One of the teachers mentioned that students from rural areas are less likely to actively participate in the classroom: *'Children from the village are very quiet. They don't want to participate because they are **constantly afraid that they might say something wrong**.' 'Children in the city compete and constantly go to some preparatory classes to improve their skills further. **Children from the village are not ambitious** and have no preparations although they have more respect for teachers'* the other teacher agreed.

Further, there are other challenges that students, teachers and management of the Milosav Koljenšić school face on daily base. For instance, **school Internet is very slow** and sometime does not even work. Moreover, **computers are old and very out-dated**. Additionally, all students come to the school by van because they live a few kilometres away and some of the roads are hard to drive and walk on. For a while, the school used a very old van for the students' transportation and it was a serious safety issue. *'The old **school bus** was so bad. Often the door would just get open during the drive. The Internet is also bad, at home it is better.'* one of the students said. The school fortunately managed to purchase newer van and now students are safe and sound in that regard. However, a fact that all the kids used a school bus during the project and were supposed to leave the school at the same time, created a logistic problem for Micro:bit club as all non-participating students needed to wait for those from the club so that they can all go home together. *'The problem was because all the children go home by bus together so if anyone stays in the Micro:bit club everyone else has to wait for them'* the Micro:bit class coordinator said.

Although at the beginning, many students became interested to join the Micro:bit club, many of them **lost interest over the time**. According to the informatics teacher 'some lacked motivation and other lacked capacity'. Similarly, students said that some their peers were bored or they didn't have time to participate because of high learning demands. Some students left the club because they were **scared from public presentations**.

Some parents were not supportive of their kids' participation in the club. For instance, according to one of the teachers, one parent, a father, was not satisfied because his son had bad grades in a school. According to one of the teachers, he could not see a difference between computer games and computer science, so he did not let his son continue his engagement with the Micro bit section.

The project impact was significantly jeopardized by COVID19 pandemics. *'There was not much project's influence after the competition because the competition was on March 9 and we went to online classes on March 19. Then we stopped the Micro:bit club'* the club coordinator said. Unfortunately, students could not travel to Albania for the regional competition because of the pandemics and that really was deflating for the girls. They were so looking forward to that trip'* he continued.

Also, because of the COVID19 and a switch to on-line learning, teachers became too busy to think about innovative ways of Micro:bit use: *'online teaching is very difficult, especially the*

week when we have consultations. Then we work all day. And in general, most teachers work on weekends because not everything can be achieved' one teacher stated. She also noted that COVID's influence was big because the students forgot everything when they started on line classes last year. *'The 22 of them are following on line now but it is not going properly. That is why I don't feel that we have any impact of the program this year because the students have forgotten everything they learned last year. The COVID was a big barrier'*.

POSSIBILITIES TO IMPROVE, SCALE UP OR REPLICATE THE MODEL

There is a consensus that the project overall has been very useful for the school and for the disadvantaged students and that therefore, it should be included in curricula and implemented in other school in Montenegro. Some possible **improvements** were identified. For instance, according to our respondents, it is crucial that schools **voluntarily commit to the project**, as it is demanding project and school staff need to ensure that they have capacities to actively participate. Further, it is equally important **to change a timeline to allow to school kids to really learn to program**. As it is now, there is no sufficient time for the students to really learn to code. In that regard, one of the teachers said *'I plan to include a micro:bit work into computer science and programming. I suggested that at a round table. This is one of the better projects but it should be understood that it takes time to learn programming. Children need to know how to code first so that they can be creative. Learning time first and then creativity'*.

It would be good to do **screening assessment** and ensure that participating schools have resources to implement the project in terms of solid Internet network and computers equipment.

To have more beneficial impact on vulnerable children the program should include detailed **resource/need assessment**, which would then be addressed either by British Council or by complementary government funds or other donations. Also, it would be better if there were specific activities that would aim on parents' engagement.

Also, in terms of specific improvements there was a suggestion to **strengthen trainer team** by teachers of physics, maths and informatics and to couple up teachers/matter experts during the mentoring sessions. *'For instance, math teachers need to mentor math teachers and physics teachers to work with physics teachers. It would be then easier to understand and apply the knowledge'* one of the teachers suggested. That would enable teachers to better understand the project and possibilities of Micro:bit use in the specific classes. Consequently, this would lead to the more effective knowledge transfer.

To conclude, according to all our respondents, it would be good to replicate the improved project to other rural schools in order to support vulnerable children engagement with STEM but also in a classroom more general.

6.9. CASE 9: TEARCE, NORTH MACEDONIA – HOPE FOR A CHILD WITH HEARING IMPAIRMENT

DESCRIPTION OF THE PROGRAM IN SPECIFIC CONTEXT

This case outlines the work with a pupil with disability. The case is focused on the positive changes that happened for a child that is with severe hearing loss and has limited speech. Most of the work was done during regular classes, but the child was also involved in the coding club of the school together with other pupils.

The case study is located in a larger village in a Western part of the country. The village is located between a larger town and a national border crossing. The village is the largest

in the municipality and is the centre of the municipality. The region is an agricultural one, but many inhabitants also work in the town. The school itself is among the larger village schools for the region and the country. It has 320 pupils in the central building and 18 pupils in a satellite building in a nearby village. The central building has three languages of instruction: Macedonian, Albanian and Turkish. The school is involved in a project for multi-ethnic integration and has received a grant for improvement of the infrastructure, but is not involved in any other project about social inclusion.

The school started working on the 21st century school programme in 2019/2020 and implemented a number of activities in the spring semester of 2020. The coding club was formed from the pupils that were most interested or best in performance with the Micro:bit during the regular lessons. As such, the coding club included children from all languages of instruction. The coding club realized few small scale activities during the spring semester before the closure of school as a result of the pandemic, the most notable one being programming the Micro:bit to know the school schedule. The club is preparing new activities this year as well, but due to the pandemic they meet quite infrequently and have more work to do before they showcase their work. Some activities of the club are shown on the Facebook page of the school[9].

The child which is in the focus of the case study comes from the Turkish community and is attending classes on Turkish language. He is following an individualized schooling programme, but does not receive special language therapist sessions within the school as there is lack of such personnel at the school. He took part in the coding club as the teachers noticed that he is very motivated for the activity and even tried to offer new ways of programming the device during regular lectures. The work with the child was also pointed as a success story by the informatics teacher (Students with hearing impairments excel in programming | British Council)

IMPACT OF THE PROGRAM

The case points to a successful breakthrough in the contact between the teachers and the pupil and uncovering a talent for a child that teachers find hard to communicate with. The **child's interest and motivation to further advance his knowledge of programming are the main outcome of the programme**. However, most of the people involved also point that the child needs additional help if the success of the programme is to be more longer lasting. Student is described by the interviewees   as a very bright child and a child with fine school achievement despite the problems that he has with his hearing and speech: *He is a pupil with fine achievement although he has disability, special needs pupil… he is quite gifted for Informatics, technology, computers…* (teacher). He is quiet socially active as well and the pupils accept him as part of the group: *he is very laborious child, he wants to play with us… and we take him with us… he likes to be with us… he always calls us to play or learn together… he knows as much as we do, but he has one issue only he does not hear… he is kind, fair towards friends, he is a lovely friend* (Child) . The parents of the other children describe him as very intelligent child and as part of a social group of peers: *he is included in the school life… they study together… he is very active and nice… and he is quite intelligent child.*

Despite being bright and well-adjusted and despite teachers' realizing that the child has potential, they found it hard to work with him as they were not quite sure on how best to support his interests: *he understands a lot about technology… but we had to find ways to help him…* (Main teacher). The same is corroborated by the mother of the child: *he searches on his own using internet and if he is interested in something he knows everything about it… but it is hard to communicate with him… he is not really verbal… he has no speech, not yet, only few words.*

9 https://hr-hr.facebook.com/pages/category/Elementary-School/PSKiril-Pejcinoviq-Tearce-393063581128/

The teachers are also searching for ways to help the child advance more, but feel that they are not prepared well: *We have one pupil who is deaf and mute, but he is very talented for technology… and we always look for ways to help him … but we can't do much* (teacher).

The main impact of the programme was in the realization of the teachers that the Micro:bit can be very motivating for the hearing and speech impaired child that is very bright and that the child can excel in coding: *'especially we have a child who is quite vulnerable, he does not speak or hear. .. the program has some impact on him… he was very active, he wanted to sit and work and follow instructions that he got from the teachers… it was amazing… we didn't expect that… it doesn't mean that the others are not interested, but with him it was interesting how he accepted the program and he got directly involved to work with the devices that we got… it was really positive impact'* (School Principal).

This was a very positive revelation for the teachers as it became easier to connect with him given that has very limited speech and hearing. The teachers were relieved that they can offer something to the very bright child and that the progamme aligned with his personal interests. The initial results came as a surprise to the teachers as they were very sceptic about the acceptance of the new activities and the Micro:bit as a device: *'and this was very interesting for him and he got involved right away… and at the beginning we were sceptic whether he would be able to do something… but he managed quite well… we included him in the programme with the other pupils and he was one of the most active ones'*. Therefore the Micro:bit as a device and the coding as an approach directly impacted the learning and cognitive development of the child.

After the introduction of the Micro:bit the teachers were surprised at the level of motivation and engagement of the child with the Micro:bit: *With the programme he started to show us more from what he has learnt… he showed more initiative… he would say let me show you this now… let me show you that… he got involved on his own… he started reading quite a lot about Micro:bit… he did his own little projects* (teacher).

The project also provided new techniques to the teachers that can be used in lessons to get better results with all pupils: *We were also shown some new methods of teaching… and that is nice for working with the class* (teacher). The programme brought the attention back to the planning of their work and how better to prepare activities that pupils can benefit from: *With the programme we started… we realised a number of activities… we started talking about the goals of our work…what to do with the children* (teacher). The programme was a welcomed addition to the skills set and improvement in the teaching and learning process: *I want to improve… I want to work better with the children… so these activities are welcomed* (Main teacher).

Finally, finding something that they could jointly use without using many words helped in the overall well-being of the child. The teachers felt that his success in using the Micro:bit helped the child feel more self-confident and his general satisfaction with the school grew: *'He is more satisfied now and his self-respect grew… self-believe that he contribute… that he can do something in the same manner as other pupils… it is quite hard to work with him… but with this he started to flourish quite fast'* (teacher). The positive change meant that he was initiating contact with pupils outside of the class and getting more involved in other school activities like arts: *'He is now more involved… he started communicating with older pupils, younger pupils… he started getting involved in other projects that we have in the school… he even started to draw more…he used to be more introverted… now he gets involved in more school activities'* (teacher).

The Micro:bit was really something which as a novelty brought a renewed interest of the teachers and pupils to engage in teaching and learning. The teachers discovered that Micro:bit can be useful in regular lessons as well: *The device is really suitable for mathematics… for certain lessons… the children get really interested in the device and then they show more interest for learning* (teacher). The teachers realized that using the

Micro:bit can make their usual lessons more interesting and that the device is versatile enough to be used in many different subjects. What came as a surprise to them is how well the pupils can integrated their subject knowledge and their coding knowledge and how using activities that pupils find interesting can aid their learning in many subjects: *We don't use the techniques always… but when we use Micro:bit the pupils are more involved in the lessons… they are very fast in integrating their subject lesson with their knowledge of the Micro:bit for example physics, chemistry… they find it quite interesting… the lessons are more interesting* (teacher).

The children found the device quite interesting and matched to their interests: *We work with Micro:bit and scratch… it was quite interesting… We used Micro:bit in lessons… I really liked the coding part…* (pupil). This has instigated the motivation of all children and made them realize that the activities are something they can benefit from. Even the parents realized that such knowledge can help their children in the future: *My son told me that they work with some devices, micro:bit or whatever they are called… but I don't know much about them… only that they are very interesting… and he got really interested and we bought a new computer as a result of his interest and he now attends Informatics course now as he was impressed with the Micro:bit* (parent of another child).

FACTORS CONTRIBUTING OR INHIBITING PROGRAM IMPACT

The main factor contributing to the impact in is the **match of the project activities to the child's personal interests**: *he is quite interested in technology… He is very bright, intelligent interested in many things… he searches on his own using internet and if he is interested in something he knows everything about it…* (mother). This match was especially visible to the teachers who work with him: *He is impressed by electronics. The program suited him because it enabled him to get closer to technology and innovations… he uses the computer for everything now.*

The program opened a new way of communication between the staff, pupils and student. For the first time he had something that he can do without much words and show how good he can be. The coding club also offered social interaction with other pupils that revolved around something the pupil was good at. The possibility of working in a group and being involved on equal terms as other children in the school activities really helped the pupil advance: *The combination of Micro:bit coding with scratch and being in a club with other pupils made him feel happier… he wants to feel involved… he doesn't want to be alone… he wants to feel that he belongs* (main teacher).

An important factor that contributed to the positive impact on the student with hearing impairment is the support he had from his family: *'At home they support him very much… it is a very good family… he has a sister and they study a lot with him and the parents work with him as much as they can'* (Main teacher). The mother also mentions that the family is investing in private support for the needs of the child and try to offer him the best possible treatment for the child: *We fulfil all his wishes for technology… We take him to a speech therapist privately* (mother).

Although the programme itself helped the teachers with new techniques and opened up new possibilities for working with a child with disability, this new understanding has not brought much change in terms of school policy on social inclusion. The school does not have proper help for the child as there is no speech therapist and the child does not have regular contact with the special educator. Therefore, the family realizes that maybe too little has been done in terms of helping him and they are thinking of moving to a different country to get better support: *The biggest problem in the school is the lack of speech therapist and there is nobody that can work with him on the issue. We have asked for it through the municipality and nothing…so we have decided to maybe move to Germany… as we can see that there is no successful approach for him here… his father is there now* (mother). This was also corroborated by one of the teachers: *the father wants to take him to Germany… and maybe for an operation… they want to help him more.*

The realization that the school needs to be better equipped in terms of human resources to help such vulnerable children is also visible in the interview with the Principal: *The Pedagogues should have been involved from the beginning of the program. This is like my critiques to the program. We left the Pedagogues aside and included only teachers... but because this is about the whole school approach to teaching and the school curricula their involvement should be accentuated in the future ... The cooperation between the professional support staff and teachers is inevitable... their involvement would help to get even more teachers interested in realization of the program and to help the teachers in the programme... Special Educators as well*. Therefore, more accent should be put on instigating planning for a whole school change rather than change in individual teachers for the programme to be even more successful. Schools might need help in that area.

Another factor that negatively impacts the programme is the closure of the schools and inability to use a number of activities connected to the programme more regularly, as well as having more control over the schoolwork of the pupils by the teachers themselves: *Now with the COVID the teachers do not really have control over the children... and they try harder now... they are online all the time and they try to make it work (parent)*.

POSSIBILITIES TO IMPROVE, SCALE UP OR REPLICATE THE MODEL

Besides the realization that the professional support staff need to be engaged more into the project activities to offer more tailored support to the children that need additional help, the teachers were really positive about replicating the programme even with younger children as it would be something that children could easily grasp: We could start with the programme with younger children... they will find it even more interesting... it's intuitive. The main teacher also thinks that it might be good to include more pupils in more activities that will be connected to certain topics as part of the extra-curricular activities with shorter duration, but more often to motivate more pupils to get involved: We might organize shorter courses for different topics... more children involved... they want programming.
All stakeholders agree that using the Micro:bit and coding should be integrated in the main curricula as it is something that prepares the children for the future, but is also quite easy to use and very versatile, so it could be used to support even pupils that do not have adequate support system at home: *It should be involved in the regular curricula... it is the time of technology... and this would help a lot... not all pupils have space and support to learn such skills at home... so it would be good if schools can support that more* (teacher). This is supported by the realization that the children want more practical approach in teaching and learning: *This makes all classes practical... they don't like theory... so this is good approach* (main teacher). The Principal even realizes that this idea might be easy to get through now with the new changes in the approach to primary education in the country: *The program should be included in regular curricula... they are preparing a new program now... there will be changed from January (2021) onwards... and ICT will get more hours and I think this is a good place to start and this program can be integrated within the changes*.

6.10. CASE 10: KAVADARCI, NORTH MACEDONIA – INTEGRATION OF ROMA PUPILS

DESCRIPTION OF THE PROGRAM IN SPECIFIC CONTEXT

This case study is a description of a successful work of a coding club that also helped aid the inclusion and learning of Roma pupils. The school in question has a coding club where the number of participants varied between 10 and 12 and it also included 3 Roma pupils (one of which also has problems with memory span and learning difficulties and is receiving regular help from the special educator employed at the school).

The school is located in a small town in the central part of the country and consists of one central building and one satellite school building in a nearby village. The case study is set up in the central building in the town. The school is one of the oldest schools in the town and used to be a very big school, but over the years pupil numbers have dwindled and the school now has around 660 pupils in 38 classes (this is mainly due to the decrease in the population in the town). The majority of the pupils (around 96%) are Macedonians with the remainder being Roma and a very small number of Turks. The school is involved in a project for multi-ethnic integration and paired with another school, but there are no other project related to social inclusion.

The school became part of the project in December 2019. The coding club has pupils from 8th and 9th grade only. The coding club was formed in the school year 2019/2020 when the school started implementing the programme in the regular classes as well. Four of the teachers trained in the programme were in charge of running the coding club and they selected pupils to participate in the club. The main idea of the club was to include pupils with varying degree of school achievement as well as various characteristics. The Roma pupils involved in the coding club were two girls: one aged 15, the other aged 13 (also with a learning disability) and a boy aged 13. The coding club was set to prepare a project for smart waste bins in the spring of 2020, but their efforts were cut short when the COVID-19 pandemic resulted in physical closure of schools mid-March. The fall term of the school year 2020/2021 was used to resume the activities of the coding club and the pupils had face-to-face meetings to work on an activity for COVID-19 using Micro:bit (to help in reminding the pupils to keep physical distance and to stop them from touching their faces). The activity had a successful ending and the final outcome was presented to the grades 1 to 3 that have face to face classes. The activity was also promoted on a local news station and information about it was posted on the Facebook page of the school.

The data from the case study points to a positive effect of the work of the coding club and the use of micro-bit in the schooling experience of the Roma pupils involved in the activities. The impact is generally focused on their interest and motivation for becoming more involved in the educational process. The arguments below will outline the main aspects of the change noticed in pupils as well as factors that have contributed to the change. The case study will also outline the ideas that the stakeholders have regarding improvements in the programme, replication and upscaling.

IMPACT OF THE PROGRAME

Roma children that are primary focus of the case study have been known as pupils that have low attendance and problems with motivation for learning. This has contributed to them lagging behind their peers more and more in regular classes. This has been pointed by the school staff as articulated by the Pedagogue: *'These children that we are now talking about that are included in the project, I personally know them as pupils that have many absences, with low achievement, and are constantly discussed in the Teacher Council meetings… and I have to personally call them and talk to them and their parents about their achievement or absences… It is not the case that they cannot study, I am talking about regular classes, but they simply do not have interest to study, they are not motivated and they have with various excuses for their absence'.*

The finding that the children were not motivated to attend school and the lack of family support for learning has been corroborated by the teachers and the School Principal as well. Even the Mother of the two children admits that she is not very interested in the educational process of the children as she is burdened with work and family obligations: *'I am not at home that much, I have to work, and I don't talk to the children much and I don't know much about their school activities'.* Therefore, the main motivation to include the Roma children in the coding club was to help them get more motivated for school activities as they do not show much interest in schooling and education. Their involvement was part of a group of children with different characteristics, but the Roma children were the only ones with low achievement as explained

by the class teacher: *'they perceive the school as something compulsory, something ascribed by the law and so they perceive the education as a burden. So I had to call the parents regarding absences of the children… I am aware that we need to work more with these children, to put more effort and so that has motivated me to include two of the pupils that I have in the coding club… so two of them are from my class and one of them has special needs. We had pupils with different characteristics, from the other classes we had a pupil with physical disability… but all of the other children were with good achievement apart from the Roma.'*

The inclusion of Roma children in the activities of the coding club brought noticeable changes in the children mainly related to their interest and motivation for attending school and getting actively involved in the teaching and learning process which is something that positively surprised the school staff as a teacher involved in the project explains it: *'I was pleasantly surprised by their interest and involvement in the project. They collaborated with the teachers and other pupils as much as possible. They showed interest… they asked questions… it was nice to see them show interest as this activity was new to all of us.'*

The level of interest shown by the children was also accompanied by getting more engaged in cooperation with the staff and their peers and motivation to achieve something which is in contrast to the regular classes: *'During regular classes those children even when they come to school we can't see interest in them to be good in something, to stand out with achievement and now we can see that they have great interest for this. And activity as well, not just interest, they cooperate now'*. (Pedagogue)

Even the parents of the children notice improvement in the children's motivation to attend school and become more involved during classes: *'She is more involved in lessons now… she used to be more absent…now she shows more interest in English classes.'*

This was particularly valuable for the child with special needs who was especially disconnected with the school experience besides working with a special educator from time to time and was very isolated from the rest of the peers as she was very shy: *'I am working with a pupil with special needs who is coming from Roma family and she is absent…. they are all absent quite a lot as a group…with her inclusion in the project, she felt important first and foremost… her desire for attending school has increased…. Even in the pandemic they were called to be physically present and she wanted to come and she asks whether she could come again to code… The children with special needs are usually quite shy, but this helped overcome shyness… she started to ask questions, to ask for more work…'* (special educator).

Being part of coding club also helped with instilling self-confidence in the Roma children as they often experience low self-confidence to the lack of inclusion in the regular school activities. Feeling that they are part of a group that accepts them and treats them equally and that they can do the same activities as the rest of their peers served as a way to boost their self-confidence as their class teacher explains: *In regular classes Roma children are separated, during breaks they stay with other Roma, in excursion they share a room with other Roma, but in the coding club they interacted with other children, shared experiences, showed each other outcomes, so the communication was really good… so when they realized that they can do some things faster than others, even faster than some teachers their self-confidence increased… we included them in the presentation to raise their self-confidence…* Being part of the coding club also raised their self-confidence through another mechanism which is related to their abilities as for the first time in their school experience those children realised that they can be as good as the other pupils in a certain activity: *They realized that they know as much as other children and they got some self-confidence, so it was easier for them to get involved, to communicate with the other children* (teacher).

A very important change valuable for further inclusion of the Roma children and their future interest in the schooling process is the change in the group dynamics. Namely the group activities and working jointly on common project changed the relationship between the Roma children and the other children: *'They all worked together, joint group of all pupils…*

they cooperated quite well and they were not shunned by the other pupils… they all got equally engaged and cooperated with each other' (teacher). This is corroborated by a girl that was part of the coding club: *'After the project we are closer… we talk more, for example with the girl X… I talk to her more now even in regular lessons.'* The mother of one of the children also accentuates a similar finding stating that the interaction during the project helped all children realize that they have common topics they could talk about: *'They managed to find mutual interests with those children… they wanted to help each other… they became closer as they had more mutual things.'*

The project even changed the dynamics and the relations between the teachers and pupils. This was especially visible during the activities in the coding club. The extracurricular engagement provided for a more relaxed atmosphere where both teachers and pupils felt at ease: *'There is a slight change in the relations between the teachers and pupils… the pupils became more confident in solving certain problems… they got a lot of ideas where to use Micro:bit… and it created a more relaxed atmosphere between us and the children… and they got a bit more freedom in the relation with us'* (teacher). A similar pattern of more relaxed atmosphere and more comfortable communication between the teachers and pupils even during regular classes when the Micro:bit is used is also pointed as a positive development by one of the teachers trained as part of the project: *'When I use the Micro:bit the lessons are more fun, more relaxed and the pupils can express themselves freely, to ask, whereas in the more classic approach the things are kind of preset what we need to say, what we need to do… so these classes are more productive'*.

All of the changes mentioned above were coupled with a surprising realization that the pupils can quickly understand the logic of coding the Micro:bit and use it very proficiently, especially when the pupils were classified as being pupils with low achievement: *'I was really surprised that even pupils with lower achievement in mathematics… during coding which I thought was very connected to mathematics… they understand the sequence of orders and giving orders… and I was surprised as how quickly they understood that, although they maybe have low achievement in mathematics, in coding they showed not just interest but knowledge as well… and having in mind that they haven't coded before I was positively surprised'* (teacher involved in the project). This realization was even true for the Roma child with learning disability: *'She is quite good in following instructions, and she notices the small intricacies of the device and follows the directions and can code the device'* (special educator).

The change in interest, the change in the group dynamics and the use of the Micro:bit jointly acted as enhancement of the learning process and although all staff agree that they cannot see visible improvement in cognitive abilities yet, some of them come to a realization that the children's learning is enhanced as they find it easier to learn the material when they use the Micro:bit: *'Even those with low achievement with the use of Micro:bit somehow managed to learn the material… teachers give me that feedback… somehow the pupils manage to learn the material, as they are interested in the Micro:bit'* (School Principal).

Small changes in achievement of the Roma pupils is visible in certain subjects where teachers are trained to use the methods of the project: *'They got slightly better at least in mathematics… for example we had to do some calculations… we started with smaller numbers and gradually went to bigger numbers… we had mathematical operations with random numbers… we started with smaller numbers and that motivated them to realize that they can do it and they became more involved… and their resistance slowly dissipated and they became slightly more involved in regular lessons'*. (teacher)

FACTORS CONTRIBUTING OR INHIBITING PROGRAMME IMPACT

A number of factors connected to the project contributed to the small but valuable changes in the integration of Roma pupils into the school activities. Those factors are connected to the novelty of the Micro:bit, changes in the approaches that teachers use, the atmosphere in the coding club, as well as realization that the Roma children can do as much as other

children when they are given a chance, the changes in the motivation of the teachers in the school. The factors will be listed next.

One of the main factor that stakeholders pointed as important for the change created by the programme is the novelty of the Micro:bit was accentuated as one of the most important factors that contributed to the change: *'the use of the Micro:bit was the key, it was new...new approach, many projects before this were the same and this is something different'* (School Principal).

The trainings received and the uniqueness of the Micro:bit aroused the creativity of the teachers and motivated them to think ahead, to use better planning when it comes to utilizing various activities for development of CTPS in the pupils: *'but now with the critical thinking and problem solving skills we plan ahead.. we think more in the planning phase about which problem to focus on... which example, which activities to use to help them develop critical thinking or to make them change perspective'* (teacher) and *The trainings that we had motivated us to find a way to get them interested, and the Micro:bit, the coding for the Micro:bit that was new'*. (teacher) That has sparked the creativity of the teachers to come up with ideas for activities that would be interesting to realize in the coding club as well.

This new and unusual device was something that motivated the pupils to get more involved and sparked their interest for learning as well.

The coding was something that all children had the same start at and it was a levelling ground for the Roma pupils in question. This coupled with teachers' attention contributed to the change as well: *'it was new to all children...so they didn't feel that they are lagging behind, as in the regular lessons they know that they are not well prepared for the material so they felt that they have certain deficiencies to get involved and they felt insecure... and this was something new and they felt that they are on the same level with the other children and that instigated them to become actively involved in coding the Micro:bit'* (teacher).

The project also provided a convenient way for the personal mission of some of the teachers to help the Roma children in their educational endeavors and to motivate their learning and *academic motivation: I want to help these children to get good education... it is part of my professional mission... to realize that education is not just part that needs to pass... it is a period that needs to be used... to make them realize that the knowledge will be useful in life* (class teacher involved in the project).

Despite being successful the impact of the programme was somehow limited to the group of teachers being directly involved in trainings by the British Council and as the Pedagouge stated this might pose a threat to the spread of the changes within the school: *It is better if we include all teachers in the project*. The successful work of the coding club started to get the interest of the rest of the teachers which could be a potential positive change on whole school level if more activities start being realized and more teachers become involved in the project.

It also has to be noted that nobody pointed that the school changed its approach towards integration or that there are specific steps undertaken by the school management to allow for better dissemination of the activities. This is stopping for better involvement of the other children in the school thus making the impact of the project rather limited: *The negative aspect is small number... we need more clubs... more children involved.'*

The current pandemic with COVID-19 was accentuated as a big hurdle for the activities and a potential threat to the continuation of activities as well as sustainability of the results: *The online teaching during the pandemic is stopping further interaction between the pupils... if they were physically present more changes might have happened... the interaction has changed in the club between all children, but I am not sure about how much it will last with online teaching* (Special Educator). Therefore new ways of implementing the CTPS component of the project needs to be reinforced and alternatives to the use of Micro:bit need to be explored.

POSSIBILITIES TO IMPROVE, SCALE UP OR REPLICATE THE MODEL

Several possibilities for improvement of the activities, accentuating various issues as well as replicating and upscaling the project were listed by the interviewees. Some of them are specific for the Roma pupils and most are more general approaches to continuation of the project.

When it comes to the Roma pupils the teaching staff accentuated that more work needs to be done with regards to instigating interest among the pupils for schooling as well as raising their self-confidence when it comes to their ability to learn and to get more involved in educational activities.

Another important area that needs to be further explored and developed is offering more peer-to-peer support when it comes to learning as there is a realization that the children might benefit most from working with someone closer to their age and interest so that they can remain interested in the educational process and improve their integration within the school.

When it comes to replication of the project the teacher emphasized that this project might be beneficial for the younger pupils and it might be beneficial as extended activity of the coding clubs and even joint events and activities with other schools: *'So maybe we could instigate cooperation on municipality level… just like inter-ethnic integration. joint activities between schools, camps…'* (teacher). Sharing of information in form of a web-site or another electronic media is something that the staff deems crucial for successful continuation of the project and enabling sustainability as the teachers might share positive practice and get new ideas for activities with the children: *'Croatia is a good example as they have a web-site… we found many activities there… they post the interesting activities with Micro:bit there'* (class teacher).

The interviewed school staff view the project as something very valuable to the learning experience of the pupils and they are in agreement that this type of working should become part of the regular curricula as it is focused on developing skills which will be very applicable in the future, it offers discovery learning and builds motivation. The teachers also state that changes in the regular curricula need to happen towards better integration of CTPC and coding skills as the approach will equip the children for the future.

6.11. CASE 11: KNJAZEVAC, SERBIA – HAVING FUN

DESCRIPTION OF THE PROGRAM IN SPECIFIC CONTEXT

Elementary School 'Mladost' is different from most schools in Serbia since almost all pupils come from vulnerable groups. Starting as the State Home for the Enrolment and Protection of Child Orphans, founded in 1945, after three years it grew into the Institute for the Education of Children and Youth, which in 1958 established a special primary school within the Institute. As a special organization, separated from the Institute, the elementary school "Mladost" was formed in 1995 based on the decision of the Ministry of Education. Since the 1997/98 school year, the school implements the curriculum and examination program for students with behavioural disorders[10].

This curriculum was adapted to a given category of students who, in addition to behavioural disorders, often had mild mental difficulties, motor restlessness, poor visual-motor coordination, slow response, poor vocabulary, reading and writing difficulties, verbal communication difficulties, problems with learning, reduced attention and the absence of abstract thinking. In addition, there are social and emotional immaturity and undeveloped work and hygiene habits of students.

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10 Official Gazette of the RS Educational Gazette No. 11 of July 31, 1997).

The given curriculum aimed at re-socializing students in the regular course of life. With the recommendation of the commission for the evaluation of the pilot program, in 2009 the school switched to a regular program for primary education, which introduced new subjects such as a second foreign language, computer science and a chosen sport.

Students from all over Serbia have been enrolled in this school based on referrals from the Centres for Social Welfare.

The students are mostly from a group of children with problems in behaviour, often with combined developmental and learning difficulties. About 60% of students live without parental care mainly due to abuse and neglect in the family. Some of them are Roma children. Many of the kids come from the foster families. One girl changed six different foster families before she got enrolled in the school "Mladost'. The majority of students lives in the Institute for Youth and has not been in touch with their parents or carers. Many of students also have juvenile delinquency files. For instance, one of the students was recently referred to the Juvenile Justice Institution in Krusevac as he had over 500 criminal charges. The majority of students experienced violence and in their lives violence has been normalized. Almost all students have diagnosed some mental health problem. According to their teachers, their learning capacities are limited.

All students have Individual plans for development of social skills. Those plans are developed in cooperation with the main teacher, psychologist and carers. There are 29 students enrolled in the school, and 8 of them are girls. Classes are small with 1 to 6 students per a grade. The school employs 22 teachers. They are mainly employed on the part time bases.

The programme Schools for 21st Century was implemented in the school in 2019 and students from grade 8 were actively involved in the project as well as a group of four teachers. Teachers were trained to apply critical thinking approach in the classroom. They also learned about the concept of cross-curricular teaching. Accordingly, they encouraged students to solve non-routine problems and questions, consider different perspectives on issues and evaluate evidence for and against different positions. Some of the teachers were also trained to apply coding using Micro:bit.

According to our respondents, students' capacities did not allow for extensive use of critical thinking or programming in the classroom. The majority of teachers enjoyed the seminar but were hesitant if any of the proposed can be used with the students of the School Mladost. In that regard one of the teachers said: *'I got responsibilities to implement the project but I*

was hesitant because our kids are different and special. I was afraid that our kids could steal devices. They are very complex kids with very problematic behaviour. They have no parents. They have no anyone. They were abandoned by everyone'.

Likewise, the other teacher said that while usually about 80% of the students can acquire basic knowledge, in case of students from their school, this percent is much lower. Sometime, some kids have potential to learn and develop but it is obvious that the environment let them down and they did not have opportunity to fulfil their full potential. However, the school managed to adopt the project and tailor the project expectations in line with the specific capacities of the school students. Therefore, the students' participation was limited to their involvement in the project Energy efficiency, where they measured the difference between outside temperature and the temperature in the classroom with the use of Micro:bit. About five students from the grade eight actively participated in the project and they were all enthusiastic and positively reacted to the activity. Eight grade students were chosen because they have had the biggest authority and could protect Miro:bit devices from being stolen or lost.

Responsibility around the project was divided between three teachers and students. Teacher of informatics programmed Micro:bit to act as a thermometer and he did all the coding by himself. All teachers agreed that students do not have capacity to programme. In that regard one of the teachers said *'we all agreed that it would be mission impossible for students to learn coding or to programme device by themselves. That's why IT teacher took that part of the project on'.* Teacher of mathematics and the students created the tables for data entry and then students recorded the data. A data analysis was beyond their understanding so the teacher herself did it. According to the math teacher, *'Students like tables, they are interesting to them'. Also math teacher was in charge of students'* selection because she is only full time employee and knows capacity of the students the most. Music teacher organized placing Micro:bits around the school and regular temperature readings in cooperation with the students. According to him students were interested in the readings, He said: *'It was interesting to them. As long as they do not need to put too much work, they have been happy to participate.'*

After they finished with measuring they wanted to use data to get funds for the new windows but because of Corona pandemics funds sourcing was put on hold.

IMPACT OF THE PROGRAME

While the programme did not have significant impact at the school level, some benefits have been noticed in relation to the knowledge and attitudes of the group of students involved in the project. Students **learned basic temperature** measures and it was nicely incorporated in the regular curriculum. They also increased their knowledge about temperature and the idea of solar energy was introduced to them too. In that regard the math teacher said *'sometime during the classes, it was sunny outside and our classrooms were very hot. Too hot. I then explained to the kids that sun energy can worms us up even if it is cold outside. I introduced an idea of solar energy.'*

Students also were proud that they were given responsibility to protect Micro:bit devices from other students. This helped them to develop **sense of responsibility** because they got a task to care about something. They were very **persistent and consistent**. They exceeded their teachers' expectations in that regard. One of them said: *'I thought that they will get bored very soon but they actually did measurement all the way through without complaining.'*

They were also proud that they could put Micro:bit devices very high and that they did not need ladders to climb up. This helped them develop **healthy and positive body image** what is very important in general but especially during puberty when their bodies are going through lots of changes.

Overall, as one teacher noticed *'they really had **fun** while participating in this project'.* According to the math teacher, they simply enjoyed going around and being active.

Music and IT teachers agree with this and emphasise that any type of **physical activity** for them has been attractive and that therefore they really enjoyed the project.

Other changes including social relations between students, relations between teachers and students, changes in school procedures, organizations, roles, knowledge and skills of employees etc. have not been identified.

FACTORS CONTRIBUTING OR INHIBITING PROGRAMME IMPACT

There are some positive factors and some inhibiting factors contributing to the project's impact.

School related positive factors include very experienced Director, openness to different projects, good teacher student ratio and good school equipment.
School has very experienced Director with 25 years of experience in the education sector. According to one of the teachers: *'Our director has a vision. We do not do ad hoc activities, all our projects are tied together'*. Also, on positive side, the school is involved in many other programs that are all well connected and complementary with each other. For instance, most recently, the school has been involved in Erasmus plus project, Adult education programme and project 'selfi' aiming at improvement of students' digital skills. Complementarity of the entire school's project involvement increases positive effects of each of the projects.

Further on, school has great ratio of teachers and students. It is almost 1:1 what makes individual approach to each student much easier.

The school is also very well equipped with Internet, Wi-Fi and computers. They even have laptop per class.

Finally, teachers also identified some factors related to work with the specific group of children enrolled in this school. According to the teachers *'Attention span of our students is very short. 10 to 15 minutes maximum and then they have to have some fun. After break we can continue. To get them engaged in the project we had to follow their needs and their attention spam'*. Micro:bit work allowed for that so it worked well according to them.

School related negative factors include a lack of full-time staff. According to the teachers, uncertainty of employment prevents teachers from long term planning. Also, the period of measurement was not so good because it was not winter and temperature was not as low as it can be.

Some negative factors related to the Programme have also been identified. For instance, the training for directors took only one day what was insufficient for all covered topics according to one of our respondents. Also, according to the other teacher, objectives of the training for teachers have not been well communicated. One of the teachers says in that regard *'I expected to learn more about Micro:bit but instead it was all about critical thinking what I did not find useful.'*
Also, the period for programming part of the project was too short according to him and other teachers.

There are too many subjects that students have to do. It exceeds their capacities and any additional work puts only additional burden on both students and teachers. That is why he was not sure that participation in the program was a good idea.

Some teachers also felt that they could not really apply Micro:bit in their work. According to one of them curriculum is anyway so dense that 'there is no way one can include something else in it'. Among the teachers Micro:bit was not perceived as a tool that can help but mainly as an additional demand. Also, students enrolled in the school often run away from the Institute and consequently they did not consistently participated in the school or the club. Finally, in relation to Corona, all respondents agreed that the pandemics positively influenced the project because students were not allowed to go to the city. They had to stay in their accommodation and therefore there were fewer incidents and 'the kids considered going to the school almost like going out'. Also, according to the school psychologist *'because students did not misbehave, instead on putting energy on punishments, teachers could focus on incentives and work much more productively with the students'*.

POSSIBILITIES TO IMPROVE SCALE UP OR REPLICATE THE MODEL

Overall, our respondents agreed that the project could be beneficial but only if the project's objectives are fully adjusted to capacities of the group of students and if they are elective and not mandatory. In that regard one teacher said: 'The project is alight if the expectations are not too high. It is very important to understand that not all kids can learn to programme. I was firstly very worried that we will not manage to do what we were asked to do. Then, we did what we could. We consider any kind of additional learning a big success'. Likewise, according to the other teachers 'it would be good if the work with Micro:bit is an elective subject so that only kids very interested in programming can work with it'.

6.12. CASE 12: LAZAREVAC, SERBIA – 'I LOVE SOMEONE WHO HAS AUTISM'

DESCRIPTION OF THE PROGRAMME IN SPECIFIC CONTEXT

The municipality of Lazarevac is the centre of one of the 17 Belgrade municipalities with population of 56,595 inhabitants. Lazarevac is 55 kilometres away from Belgrade, the capital of Serbia. Total employment, gross domestic product and income are mainly dependent on the coal industry "Kolubara". On the other hand, the development of this industry greatly affects the poor air quality.

According to the 2019 data, 4,711 students attended primary school in Lazarevac. There are 10 primary schools in the municipality of Lazarevac. "Dule Karaklajić" primary school in which the project of one of the three city schools was implemented, which is also the largest school in Lazarevac with 1,220 students, distributed in 53 classes, 7 of which are special classes in which there are mostly children with different spectrum of autism. In the first cycle of education from the first to the fourth grade, children with special needs attend regular classes, but after that cycle children usually move to special classes, and there is a trend in school to include as many children with special needs in regular classes as possible, so now in the seventh grade there are five children with disabilities in regular classes, and four children in special classes.

The school is known for the fact that in addition to compulsory school activities, it has developed extracurricular activities in various fields: literature, mathematics, oratory, astronomy, robotics, which are attended by a large number of students. According to the school principal and teacher, a large number of students from this school participate and achieve great success in various national and regional competitions in various fields: mathematics, physics, chemistry, Serbian language.

The mathematics teacher, who later mentored the students who represented the school in the competition, saw the call for the project in the daily newspapers. She immediately informed the principal, and after that they made the decision to apply. Their school was not chosen in the first round and the teacher contacted the British Council to check why they did not enter the programme, because she thought that the programme is very important, also that the capabilities of micro bit devices are excellent, that it will be important for students and she thought that colleagues are ready to work with modern technology. However, in the second round of the project, the school was selected. The first task was to animate teachers from other subjects, since that meant additional learning for other teaching staff as well. The training included 10 teachers of different subjects: biology, physics, mathematics, technical education, computer science.

The introduction of students to the Micro:bit took place through workshops organized by the mathematics and computer science professor. When they presented the programme to the students of the school, the teachers usually showed how the Micro:bit works as a pedometer or they showed how the love meter works, because it was interesting for the students, so it was easier for them to interest them. They presented the Micro:bit in math and computer science classes. During the programming week, they visited a dozen classes and students of lower grades, who were shown the Micro:bit and its use, adapting the explanation to their age. The first-graders most often used it to type a number, because it was appropriate to their age. The computer science teacher describes the encounter of younger students with the micro bit in the following way: *"The lower grades were most interested because it was interesting for them to have something that looked like a robot. They're interested in special effects, they still don't think about how it works, but it's good to develop an interest in devices and programming and how things work to develop critical thinking."*

After getting the project, they were told that they should apply for the competition within the project, and the math teacher decided to send two girls, sixth and seventh grade students to the competition, who had participated in math and robotics competitions before. They were given the task by their mentor to find a problem and find a solution. The two of them first went to the school principal and asked him what problems their school was facing, and received the answer that these were high bills for water and heating. In addition to these problems, talking to the math teacher who has a child with learning difficulties, as well as having special classes in their school, they came up with another idea, and that is to try to find a way to help children with developmental problems. Students managed to design two programmes with the help of the micro bit, which reduced the water consumption in the school building, thus reducing costs.

The second part of the programme was designed to help assistants who work with autistic children. One of the problems of autistic children is their uncontrolled leaving of the room, so they developed a programme that sends a signal to another device whether the door is left open. Their mentor describes the process from the idea to solution in the following way: *"First you need to find the problem, go and ask the principal what our problems are. We agreed on everything over the phone, because I was in the hospital with the child at the time. They wrote the code themselves, they first tried to solve the problem with a large code, I directed them that they should find a simpler solution. In the end, they realized that with three lines of code, they could solve it."*

Two students' understanding of the task is reflected in the following: "When we were given this task, we wanted to meet three criteria that show our environmental, social and financial awareness… We wanted to focus on those who need help the most." The epilogue of their participation in the "School for the 21st Century" competition was winning the first place. The great success they achieved resonated with the school and helped the children become even more interested in the micro bit.
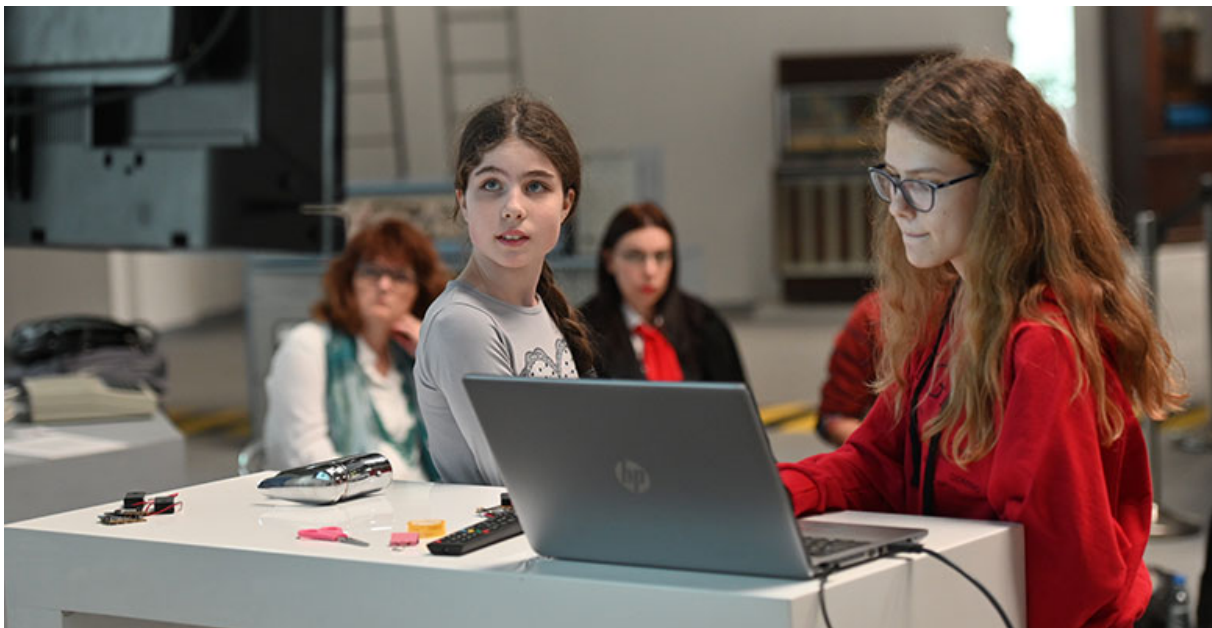
Figure 2: Students at the School for the 21st century competition

Before presenting the programme at the competition, two girls participated in the presentation of the Micro:bit, first in their class, and then in other classes in the school. The presentation as well as what they specifically did with it, had a dual function: on the one hand, the goal of introducing as many children as possible to the micro bit was achieved, and on the other hand it helped them develop presentation skills. In the end, their mentor evaluated their work as following: "I saw entrepreneurial skills, critical thinking, working in pairs, after this they can do anything now".

Although the school is large, after the success of Nina and Tijana, all students were informed about the existence of the micro bit in the school. About 200 students of the school participated in the workshops of the "School for the 21st Century" programme. At the workshops, all interested students were given the opportunity to take the micro bit home, because the teacher's idea was to interest parents in this way, as well as for students to try to do something on their own. This eventually had an effect, about 20 students managed to do something on this device.

The computer science teacher states: *"There is no class in which we did not use the Micro:bit, the students are interested in the fact that someone from our school got an idea that was so highly rated. It is a signal to them that they need to do something like that. Now, whether everyone would come up with an idea that is thankfully worthwhile is a question. But in any case, any child who knew what it was about was proud and would not mind participating in a future project."*

IMPACT OF THE PROGRAMME

The project had an impact on the whole school, but its greatest impact, including the level of individual skills and self-confidence of students, increased student participation and improved relations between students and between students and teachers, was realized within the group of students who participated in the programme.

When we look at the changes that have taken place at the school level, they are mostly reflected in the changes in the approach to teaching, i.e. showing that the traditional model of education is not the only option and that the application of knowledge in practice has a better incentive for children and that in this way students can master the material better. The principal emphasizes the following: *"The main achievements of the project are the awareness of teachers that students can work in a different way. For the children, this way of working was a more interesting, long-lasting process and connected them with teachers from different subjects. The programme gave the idea for the introduction of block classes, which were later accepted by two schools in the municipality of Lazarevac."*

From the point of view of the students who participated in the programme, especially the two students who were the most active, there was primarily a connection between knowledge from different subjects and the application of that knowledge. Working in a group, which the programme implies, also contributed to the development of social skills. Girls developed presentation skills, because they had to present their work. Since they were supposed to present the work in English also, they connected with the English teacher who was actively helping them and broke the fear of conversations in English. They also talked to teachers who teach in special classes and connected with friends from those classes with whom they had not had the opportunity to spend time before.

For about 20 students who actively participated in the programme, the teachers indicated that they had also developed knowledge transfer. In that regard, the computer science teacher says: *"They learned how they can pass on knowledge to others in the simplest way, and that is another great benefit of this project. They learned this because they presented the programme to other students, both younger and peers"*.

All participants in the interviews agreed that boys and girls reacted differently to the micro bit. While the boys were primarily interested in the possibilities of using the micro bit as a console and when they saw that that was not its purpose, they more often gave up work. When the task was set to map the problem through conversation with other teachers, the girls coped much better because they connected more easily with a larger number of people and they were not ashamed to ask around the school about potential problems that could be solved.

The promotion of the Micro:bit did not end only in the school classrooms, but took a step further: a workshop was organized in the Modern Gallery in Lazerevac in which five students of Dule Karaklajić school presented the micro bit device to all interested visitors.

Teachers and programme participants who we spoke to also noticed an increase in self-confidence in children who were active participants in the project. For children, programming was something that was exclusively related to the "smartest", and now everyone who wanted could participate, not just the gifted, given that the micro bit allows programming with simple codes.

By including children of low socio-economic status in group work, it contributed to increasing their self-confidence and better integration with other children. This is how the math teacher describes changes in a Roma child: *"In each project, the group leader allocated responsibilities to all members of the group. Thus, one of our students of Roma nationality and especially low socio-economic status, who did very poorly with the use of a mobile phone, was given the task to research the prices of materials on the Internet for the needs of his team. He successfully completed his task and was proud because he learned to search the internet. Since the students were in contact with each other over the phone and visited each other for the needs of the project, he started hanging out more with other students. After the project, he also participated in a school event. And last year he enrolled in technical school"*.

The programme greatly influenced the awareness of students about the problems faced by their friends who live with autism. The students of this school contributed to the celebration of the World Autism Awareness Day by organizing a walk in which they wore "I exist" badges, blue T-shirts because blue is the symbol of children with autism, and at the end of the walk they organized an origami workshop at which they made different shapes out of blue paper, and they passed messages to passers-by with the wishes of people suffering from autism, and in that way they drew attention to autistic people. This is how one of the students who participated in the organization of the walk explains their action: *"I think that this kind of action should be supported because we are a society that finds it difficult to accept differences, simply to show that they are just as important and that they are no different from us. Our goal is to bring people closer to autism, that people with autism simply are not less valuable"*.

Figure 2: Preparations for marking the World Autism Awareness Day at the Dule Karaklajić School

In mathematics and computer science, the micro bit is now used during classes. It is also connected with other subjects. The math teacher says: "I stimulated them with the help of the micro bit to measure pollution and in agreement with the biology teacher they found out which plants grow fastest and which absorb pollution best, after that we organized a plant planting action."

There has also been a change in employee relations. They started cooperating much more than before. First, the teachers of mathematics and computer science started to cooperate with the

lower grades teachers because they wanted to show the programme to younger students, which also accelerated their cooperation. Then they became even more connected with teachers from other subjects. Thus, for example with the biology teacher, the idea was developed to make a box for medicines for people who have a problem with dementia, which would measure how many times the box was opened, and she agreed with the art teachers about decorating the box. Unfortunately, due to the corona, they failed to realize the common idea.

Although the success of two girls' that participated in the competition had the greatest impact on the school since they won, it is not the only major application that the students of this school have made with the help of the Micro:bit. The computer science professor states: *"We participated in a competition in which we had the task to use the Micro:bit in traffic and so we came up with the idea to make a billboard that uses the micro bit to write on the screen that children are being picked up from school and traffic participants are asked to slow down. Also, if someone is injured at school, it is written at the intersection that ambulance will come soon. And in another competition, our students made a digitized sundial. And yes, two girls used the Micro:bit during corona for the girl's day, they measured calorie consumption based on steps and vitamin C and vitamin D intake."*

FACTORS CONTRIBUTING OR INHIBITING PROGRAMME IMPACT

The positive factors that contributed to the impact of the project are undoubtedly the principal and teachers who are focused on a modern approach to working with children. The principal strives to monitor new ways of working that are applied in education within the country and participates in regional forums. He believes that the most important task of teachers is to motivate students to reach their maximum. This is how the principal explains it: *"The key phrase of our education is how to get a grade, not the knowledge behind that grade, grading is a big pressure for children, but it does not teach them how important the learning process is and how important it is to enjoy the process. Patterns in evaluation should be avoided, i.e. children should not be asked for factual memory, but should be taught through schooling how to apply the acquired knowledge, and that is exactly what the 21st century schools programme has brought to the school".*

When it comes to teachers, primarily the project leader, before the project she was focused on developing different sections in the school that relate to applied mathematics and stimulated students to participate in them. She is an advocate of programme and project-oriented teaching, and in this regard, the "The 21st century schools" programme that the school should have implemented, is in line with how she sees what the teaching process and the learning process should look like. She is the co-author of one of the textbooks in mathematics for 7th and 8th grade, which is designed so that mathematical tasks are used in the application of specific problems, e.g. problems of the school, so it is not surprising that she was the initiator of the school to apply for "The 21st century schools" programme. Given the high motivation, perseverance and knowledge, she managed to interest some of the teachers to actively participate in the project. Computer science teacher: *"Jelena presented the programme to us with great enthusiasm, we immediately started designing together how we will present the programme to the students, how we can connect other subjects with the micro bit"*. This is how one of the students who participated in the competition sees the contribution of the teacher: *"My participation in this competition, like other competitions, has to do with my teacher, because she finds competitions and registers us and supports us all the way. She is also open for all our suggestions, if we find a competition on our own, she helps us with the application. In general, she supports our ideas, it means a lot to me."* One of the students who participated in the project, and in the meantime finished primary school, describes his relationship with the teachers at the school as follows: *"In Dule school we had a friendly relationship with the teachers, whenever I needed one of the teachers they would respond to me immediately, they had motivation, desire, willingness to work with us, that is unfortunately not my experience in grammar school".*

According to the professors, parents and the students themselves, the students who represented the school at the competition are of the opinion that although they had developed critical thinking and the ability to connect knowledge before the programme, after the project these qualities became even more pronounced. And as the biggest benefit, they see that they have started thinking about how their work can make life easier for people who have learning difficulties or some kind of disability. Nina's mother: *"If she did not have a critical thinking, she would not have been able to do what she did, even before the project she also had a high awareness of social problems, and her project is to have the tools to do what she already has in her."* Girl participating in the coding competition: *"Our school has a department for children with special needs, we have had contact with children who have these problems and we are familiar with what they are facing. We had contacts with them before, but we got to know each other better through the project, which motivated us to continue to focus our further work on making their daily lives easier."* Their work on solving the problems of children with learning difficulties and disabilities continued. This year, Nina learned sign language because she planned to make a device that would communicate instead of deaf-mute people, by translating sign language, so that people who do not understand sign language could understand them.

The girls who participated in the competition together with the teacher founded a club where school students can work with micro bit devices. They explain to them how the device works, together they come up with ideas of what they could do with them. This is how Tijana describes her experience "we have increased the self-confidence of the children who participated in the club because we are not teachers but children, and if we can work with the micro bit, why couldn't they also."

FACTORS INHIBITING THE PROGRAMME'S IMPACT

When it comes to factors that prevent the impact of the project, none of the participants said that there is a long-term factor that can be an obstacle to the implementation of the project. The school has the technical conditions to work with the micro bit, the teaching staff who have been involved in working with the micro bit so far have expanded their curriculum to other teachers, so the school has registered 10 more teachers in the next round for a workshop to obtain a license to work with the micro bit. However, there is one obstacle that they have faced since the second half of the previous school year and throughout this school year, and that is the changed working conditions during the COVID-19 pandemic. The pandemic has made it virtually impossible to work with older children for two reasons: they are now significantly more burdened than before the pandemic *"there are many more tasks that they are obliged to do than before and they have less time for other activities"*. Secondly, they stay in school for a short time and cannot work in groups, and working with the micro bit requires group work. And not only does it require work with groups of students, but it also implies the work of teachers from several subjects, which is not possible to conduct online in a quality way. That is why most of the activities that are planned to be done with the micro bit are left aside until the students return to school. Given these circumstances, the programme has now been intensified with lower grade children, as they are still coming to school and thus have managed not to put the project completely aside.

POSSIBILITIES TO IMPROVE, SCALE UP OR REPLICATE THE MODEL

All participants in the conversation agree that coding using the Micro:bit should be included in the curriculum, because it enables the connection of material, supports group work, and connects students and teachers. And it is especially important for teachers that it gives them the opportunity to modernize their work and approach children in a different way, to get closer to them.

The school currently has all the technical possibilities to implement the programme in the educational cycle, because they have enough devices, and those devices can be coded without the need to invest additional funds. When it comes to professional qualifications, some teachers are already involved in this work, but even greater involvement of teachers who will soon be trained will allow the programme to be implemented even easier and better.

The teacher suggested that this programme be implemented in technical schools, especially in the areas of process management: *"Micro bit is a process computer and they need to learn on it so that they can later apply it more easily in production, in a large system, for example, a programmer in Kolubara could show them how it works in a large system"* In addition, in the future, the programme could include more children with special needs, although they usually cannot master coding in the micro bit, they could be included in the way that they could test devices made by their friends.

ANNEX 1: ANALYTICAL FRAMEWORK

The assessment will be based on the analytical framework that includes following dimensions and sub-dimensions:

1. The type of positive change, result. What is the change that was assessed as outstanding? This line of research has the aim to describe the change – what was child/class/school educational performance before the programme and how that performance has been improved due to the interventions, in which aspects has improved, what has been different? This should be described in detail in the following aspects:

   1) Benefits for individual as unit
   a. Individual child motoric and cognitive development, learning skills, capacities to learn, increased knowledge, improved skills (numerical, ICT, technical, reading, critical thinking)
   b. Subjective feelings of achievement, motivation, satisfaction, self-confidence
   c. Social relations with other children, interaction in the class, school, other social networks
   d. Gender equality
   e. Changes in relations between student and teachers
   f. Participation in other learning activities, extracurricular activities
   g. Functionality within the family (participation in personal and family activities in the household), relation with family members,

   2) Benefits for class/or group as unit
   a. Changes at the level of individual students (along previous aspects)
   b. Overall achievement of the class in learning success in other subjects, broader learning process
   c. Changes at the level of classes: some that increased performance more than other classes, or overall increased performance of all classes in terms of better marks, higher participation, higher motivation
   d. Class social dynamics, relations, inclusion, solidarity, cohesion, gender equality
   e. Participation in competitions, collective motivation, 'class morale'
   f. Changes in relations between teachers and students
   g. The positioning of the class or group in the school environment

   3) Benefits for school as unit
   a. Changes at the level of individual students: skills, learning abilities, knowledge, motivation, etc.
   b. Changes at the level of classes: some that increased performance more than others, or overall increased performance of all classes in terms of better marks, higher participation, higher motivation
   c. Social relations between students, and particularly with students with learning difficulties, gender equality, social inclusion
   d. Changes in relations between teachers and students
   e. Changes in school procedures, organizations, roles, knowledge and skills of employees

f. Initiatives schools took in competitions, broader community, etc.

g. Changes in school 'popularity' for enrolment after the programme implementation.

2. Factors contributing to the effective achievement of results among vulnerable students. This analytical dimension should provide answer to the question: What contributed to the achievement, to the results? The potential factors can be grouped in the following categories:

a. Factors related to the Programme – specific components, methodology of the Programme

b. Factors related to the teacher/s applying the method, the immediate person who was/were engaged in teaching applying these methods and teachers' approach in implementation oof defined methodology

c. Group/classroom factors – the previous peer relations, inclusion mechanisms, group dynamics, etc.

d. School level procedures, attention paid to the inclusive education, innovative education, etc.- differences in pre-Programme period and in program period

e. Environmental factors: family, social networks

f. Circumstantial factors: threats posed by COVID-19 for vulnerable children disengagement

3. Possibilities to further improve, upscale and replicate model. This dimension should enable answers to questions:

a. What can be improved?

b. How it can be used for better results, broader impact?

c. Where should be replicated?

d. How it can be upscaled?

ANNEX 2: LIST OF CASES

Case 1: Sinanballaj, Albania

Country	Albania
Location of the school (city/village)	Sinanballaj, Rrogozhinë
Name of the school	Sinanballaj
Type of vulnerability	B/Difficulties One child with Syndrome Down and Autism
Who benefited in this case?	One person
Status	Field work completed
Total number of interviewed persons for the case	8
List of persons by name and role/position	Parent of the child 3 Students School Coordinator and lecturer 2 teachers Main teacher / teacher assistant

Case 2: Shkoder, Albania

Country	Albania
Location of the school (city/village)	Shkoder
Name of the school	Special school "3 Dhjetori"
Type of vulnerability	B/Disadvantages Children with special needs of various fields
Who benefited in this case?	The whole school
Status	Field work completed
Total number of interviewed persons for the case	8
List of persons by name and role/position	School psychologist School director 3 teachers 3 parents

Case 3: Tuzla, BiH

Country	Bosnia and Herzegovina
Location of the school (city/village)	Tuzla, Canton Tuzla
Name of the school	"Kreka" Elementary school
Type of vulnerability	Children from disadvantaged groups – Roma population
Total number of interviewed persons	3
List of persons by name and role/position	Davor Trade, IT teacher Azra Ušanović, teacher of Bosnian language Haris Tanjić, student/peer

Case 4: Zenica, BiH	
Country	Bosnia and Herzegovina
Location of the school (city/village)	Zenica, Zenica-doboj Canton
Name of the school	"Miroslav Krleža" Elementary school
Type of vulnerability	Student with disability (deaf-mute)
Total number of interviewed persons for the case	2
List of persons by name and role/position	Aida Habibović:, English Teacher and Assistant Director Elzina Muratović-Tutmić, Pedagogue

Case 5: Kishnareke, Kosovo	
Country	Kosovo
Location of the school (city/village)	Kishnareke, Drenas
Name of the school	School "7 Marsi",
Type of vulnerability	Children with special needs, and coming from family with low socioeconomic status
Who benefited in this case?	School
Total number of interviewed persons for the case	7
List of persons by name and role/position	School Director 3 teachers 3 students

Case 6: Prishtina, Kosovo	
Country	Kosovo
Location of the school (city/village)	Prishtina
Name of the school	School "Ismail Qemaili", Prishtina
Type of vulnerability	Children with special needs and disabilities
Who benefited in this case?	The whole school
Total number of interviewed persons for the case	16
List of persons by name and role/position	School Deputy Director School Psychologist 4 teachers Teacher assistant 3 parents 6 students

Case 7: Podgorica, Montenegro	
Country	Montenegro
Location of the school (city/village)	Podgorica, Komani (rural part of Podgorica municipality)
Name of the school	Primary school Boško Radulović
Type of vulnerability	Children from disadvantaged groups (children coming from families with low socio-economic status (SES), children with learning disabilities. This case is also an example of girls making significant progress in the area of coding.
Total number of interviewed persons for the case	6
List of persons by name and role/position	2 teachers 3 students Mentor, Psychologist

Case 8: Slap, Montenegro	
Country	Montenegro
Location of the school (city/village)	Danilovgrad, Slap (rural part of Danilovgrad municipality)
Name of the school	Primary school Milosav Koljenšić
Type of vulnerability	Girls from rural areas
Total number of interviewed persons for the case	5
List of persons by name and role/position	Director 2 teachers 2 students

Case 9: Gevgelija, North Macedonia	
Country / Држава	Macedonia
Location of the school (city/village) / Локација на учичиштето (град/село)	Miravci, Gevgelija
Name of the school / Име на училиштето	Elementary school "Kliment Ohridski"
Type of vulnerability / Вид на ранливост	Student with disabilities
Total number of interviewed persons for the case	9
List of persons by name and role/position	Principal 3 teachers 3 parents 2 children

Case 10: Kavadarci, North Macedonia	
Country / Држава	The Republic of Macedonia
Location of the school (city/village) / Локација на училиштето (град/село)	City Kavadarci
Name of the school / Име на училиштето	OOU „Tode Hadzi Tefov"
Type of vulnerability / Вид на ранливост	Children from marginalized groups (children from families with low socio-economic status, Roma and other minority groups)
Total number of interviewed persons for the case	12
List of persons by name and role/position	Principal class teacher 2 teachers Special Educator Pedagogue 4 parents 2 students

Case 11: Knjazevac, Serbia	
Country	Serbia
Location of the school (city/village)	Knjazevac
Name of the school	Elementary School "Mladost"
Type of vulnerability	Children with difficulties in learning and development and Children from disadvantaged groups (such as children coming from families with low socio-economic status (SES), Roma children, other ethnic minority children).
Total number of interviewed persons for the case	5
List of persons by name and role/position	Director 3 teachers Psychologist

Case 12: Lazarevac, Serbia	
Country	Serbia
City/town/municipality	Belgrade, Lazarevac
School	Dule Karaklajić
Unit of analysis (individual child, group or class, school)	Group children
Total number of interviewed persons for the case	8
List of persons by name and role/position	Principal Mentor/ mathematics professor Mathematics and computer science professor 2 students who participated in the project Parent of the child who participated in the project Two other students