SAILINTOSTEAM

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White paper on diagnosis of sailing STEAM educational courses needs

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Deliverable summary
This white paper describes the process of diagnosing the needs for STEAM sailing educational courses, providing a comprehensive analysis of the challenges and opportunities in this area. It offers recommendations for developing effective diagnostic strategies that can improve the quality and impact of such courses. It is written in Serbian and English for better dissemination.

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White paper on diagnosis of sailing STEAM educational courses needs

1. Introduction

In a time where science, technology, engineering, the arts, and mathematics (STEAM) are increasingly central to education, sailing emerges as an ideal platform for immersive and hands-on STEAM learning. This white paper aims to thoroughly assess and identify the specific educational needs for successfully integrating and enhancing sailing in STEAM courses. Our goal is to bridge the divide between theoretical knowledge and practical application, creating a stronger educational framework that equips learners to confront both maritime challenges and the demands of a rapidly advancing technological world.

The "Sailing into STEAM" project seeks to design, develop, and test a pilot sailing course adapted to children aged 7 to 12, inspired by an educational model that enables the development of social innovation skills. By intertwining science, technology, engineering, art, and mathematics, with sailing skills, we will create an extraordinary educational experience for young people. In addition, course participants will be able to develop a deeper knowledge of nature as an indispensable component of sailing and learn how they can contribute to its preservation.

As we embark on the Sail into Steam project, we stand on the shoulders of successful educational models like NEMESIS (HORIZON 2020). Taking inspiration from their methodology, we aim to develop a dynamic and innovative learning experience for young sailors. Our approach will encourage the understanding of the principles of STEAM sciences while also fostering problem-solving skills through inquiry-based learning.
To ensure the effectiveness of the syllabus and curriculum of the sailing pilot course based on STEAM sciences, Sail into STEAM consortium relied on the methodology development process outlined in the NEMESIS project. To bring sailing and steam sciences closer to students, we have decided to design an innovative and comprehensive course that is based on a user-centred approach. We consulted with primary school teachers and sailing coaches to ensure that the methodology of the course meets the needs of the students in our area. To ensure that our courses are developed with the active involvement of teachers and coaches, we have designed online questionnaires that cater to their needs. These questionnaires are specifically tailored for teachers and sailing coaches and cover topics such as implementing STEAM principles in the school environment and sailing, effective teaching methods, necessary equipment,

ecology, and sustainability. This approach helps us design the next steps according to the targeted needs of end-users, resulting in more effective courses. Questionnaires were conducted in Slovenia, Croatia and Serbia. We believe that the continuation of communication with trainers and teachers after the earliest stages of course creation is crucial, and it will be continued through the evaluation process to improve the content and effectiveness of the course. With this, we will complete the user-centred approach and create a course tailored to its participants and educators. To examine the extent to which STEAM sciences are currently present in the educational system and sports activities, we analysed the relevant literature.

Guided by the idea that sailing becomes a link between science and sport, by crossing the knowledge of teachers, coaches, and members of the project consortium, the best methodological approach will be developed, which will motivate children to observe challenging moments during sailing through the prism of problem-solving. Troubleshooting will ensure an understanding of basic scientific principles. Such an interdisciplinary approach will create top-class sailors who nurture the spirit of sportsmanship but also the desire to deepen their knowledge.To broaden the inclusivity and reach of this program, it's essential to consider the integration of children who may not initially be inclined towards sailing. These kids can benefit significantly from the program's emphasis on science and problem-solving without the necessity of being on the water. By introducing theoretical and simulation-based activities that mimic real sailing scenarios, these children can engage with the same scientific principles and problem-solving exercises. These activities can cultivate a scientific mindset and introduce the thrill of nautical sports in a controlled, non-intimidating environment. This inclusive approach not only widens the program's appeal but also fosters a diverse community of young learners who are equipped with skills in critical thinking and teamwork, irrespective of their interest in traditional sailing.

The Rationale for Sailing in STEAM Education

At the heart of the SAILintoSTEAM project is the understanding that sailing is intrinsically interdisciplinary, embodying a rich blend of STEAM components. Sailboats, as examples of engineering and mathematical precision, navigate through natural forces, offering an authentic context for experiential learning. The physics of wind and water, engineering in boat design, technology in navigation systems, mathematical proficiency for route planning, and artistic elements in sail design and maritime tradition all come together in this unique educational setting. This blend not only enriches the learning experience but also prepares students for a future where interdisciplinary knowledge is invaluable.

The SAILintoSTEAM project taps into this rich, practical backdrop of sailing. It leverages its historical evolution and technological advancements to fuel curiosity and discovery in students. By transcending conventional teaching methods, it positions sailing not just as a sport, but as a living classroom where STEAM concepts are vividly brought to life. This approach opens up new avenues for learning, making complex principles more tangible and engaging through the practical application of sailing.

Identifying Educational Gaps in Sailing Integration within STEAM

The incorporation of sailing into STEAM education presents a significant but largely unaddressed opportunity. The challenge lies in the effective integration of sailing within existing educational frameworks. Many institutions face difficulties in recognizing and leveraging the multidisciplinary benefits of sailing, often due to a lack of resources, expertise, or a comprehensive understanding of its educational potential. Furthermore, there is a crucial need for the development of sailing programs that are flexible and adaptable across various educational levels, to facilitate meaningful and engaging learning experiences for students of all ages.

In addition to these institutional challenges, sailing clubs, key players in promoting sailing education, also encounter specific obstacles. These include limited educational outreach, where their focus tends to be more on sport than education, resource and expertise constraints in developing STEAM-focused programs, and accessibility issues that may prevent a diverse range of students from participating in sailing activities.

One of the most significant barriers to integrating sailing into educational frameworks is the shortage of educators skilled in both sailing and STEAM subjects. Teachers often lack the necessary background in nautical science and may feel unprepared to teach concepts they are not familiar with. Additionally, educational resources that support sailing-related STEAM education are scarce and not widely distributed. Addressing this gap involves creating comprehensive training programs and resource kits that support educators in delivering high-quality, sailing-integrated STEAM education. Sailing requires specific physical resources, such as access to water and sailing equipment, which can be prohibitively expensive or geographically impractical for many schools. This makes sailing a less feasible option for many institutions, especially those in urban or economically disadvantaged areas. Developing partnerships with local sailing clubs and community organisations can help bridge this gap by providing shared resources and opportunities. Additionally, there are often misconceptions that sailing is only a recreational sport and not a valuable educational tool. Sailing is often viewed as a leisure activity rather than a substantive educational tool, leading to its underutilization in an academic context. This cultural perception can create a significant educational gap, as students and even some educators may not see the value in integrating sailing into STEAM education. Overcoming this barrier requires targeted outreach and educational campaigns that showcase the scientific and technical aspects of sailing. Highlighting successful case studies and providing evidence of the educational benefits of sailing can help change perceptions and encourage more widespread acceptance and integration. Even where sailing programs are available, engaging students who may not initially be interested in sailing can be challenging. The curriculum must be relevant to their interests and designed in a way that emphasises the connection between sailing and everyday technological and scientific applications. Creating interactive and problem-based learning experiences that involve sailing can increase engagement. For example, students could design experiments to test water

quality, study weather patterns, or explore the physics of buoyancy and propulsion through hands-on activities.
Effectively addressing these educational gaps requires a multi-faceted approach that includes curriculum development, educator training, resource allocation, cultural change, and innovative use of technology. By creating an environment where sailing is not only accessible but also integrated with critical STEAM concepts, educational institutions can open up new pathways for learning and discovery that prepare students for a diverse range of challenges in the real world.

Objective of the White Paper

The primary aim of this white paper is to meticulously diagnose the current needs and identify significant gaps within STEAM sailing educational courses. By conducting a thorough analysis, this document intends to:

- Assess the Effectiveness of Current Educational Practices: Evaluate how well existing courses integrate science, technology, engineering, arts, and mathematics within the context of sailing.
- Identify Key Areas for Improvement: Pinpoint specific shortcomings and areas where enhancements are necessary to better meet the educational goals of STEAM programs.
- Inform Future Course Development and Policy Making: Provide data-driven insights that stakeholders can use to refine course offerings, develop new curricula, and inform policy decisions that will enhance the quality and reach of sailing-based STEAM education.

Through these objectives, this white paper will serve as a foundational tool for educators, administrators, and policymakers aiming to leverage sailing as a dynamic platform for comprehensive STEAM education.

White paper organisation

Following this introduction, the white paper is organised as follows. Section 2 introduces general STEM approaches, their trends and integration of Arts (STEAM) while Section 3 highlights challenges and opportunities of STEM education especially in the Balkan Region. Section 4 provides an overview of STEM sailing courses found in the literature and of the needs identified by the surveyed teachers and coaches. Finally, Section 5 concludes with recommendations and future work.

2. General STEAM Approaches

Introduction to General STEM Approaches

In the evolving landscape of education, STEM (Science, Technology, Engineering, and Mathematics) stands as a cornerstone, adapting to the changing needs of learners and the demands of a technology-driven world. This section delves into the essence of STEM education, its pivotal role in contemporary learning environments, and the innovative trends shaping its future. Moreover, we explore the enriching integration of Arts into STEM, transitioning it into STEAM, and its implications for sailing education.

Definition and Importance of STEM Education

STEM education embodies an interdisciplinary approach, where science, technology, engineering, and mathematics converge to foster a learning environment centred on critical thinking and problem-solving. Unlike traditional education models that treat subjects in isolation, STEM intertwines these disciplines, mirroring the interdependent nature of real-world challenges. This educational framework is not just about imparting knowledge, it's about equipping students with a versatile skill set, including analytical thinking, collaboration, and adaptability, preparing them for a wide array of future career paths. Beyond individual achievement, STEM education is instrumental in driving societal progress, fueling innovation, and propelling economic advancement.

Current Trends in STEM Education

The realm of STEM education is witnessing a paradigm shift towards experiential learning, where theoretical knowledge meets hands-on application. This trend emphasises learning by doing, a methodology that resonates well with the dynamic and interactive nature of sailing. From coding and robotics to the use of digital learning platforms, STEM education is becoming more engaging, accessible, and relevant to students' lives. These advancements not only democratise STEM education but also offer a rich context for integrating sailing, where the principles of physics and engineering directly apply to navigating and understanding the marine environment.

Research highlights the effectiveness of inquiry-based learning and professional development for educators in enhancing STEM education. For instance, the STEM Intervention on Science Knowledge and Skills study demonstrated that a program incorporating intensive teacher training and inquiry-based instruction led to significant improvements in students' science skills and knowledge (Cotabish et al, 2013). Another study, Connecting the STEM dots (Hernandez et al, 2013), clearly investigates the need for increasing the interest of students into the STEM disciplines. The paper analysed a plethora of different publications related to STEM and its application, use and results within the 1-12 grade of school education. It is evident from the analysis that STEM workshops improved the students' knowledge and perception of the STEM disciplines.

Having in mind that this exercise was focused on improving within the class experience, combining the STEM with Sailing should make it even more interesting for students, as Sailing is an inherently interesting and fun activity for students. Furthermore, the potential of blended learning to improve STEM outcomes, especially in underprivileged areas, is evidenced by a study that found a significant positive effect on STEM achievement when integrating digital resources with traditional instruction (Seage & Türegün, 2019). Robotics STEM course (Chen, & Chang, 2018) is an interesting learning experience for the students. In this paper the proposed course used the Sailboat topic for integrative STEM. The students had to design the autonomous/robotic sailing boats by combining software, hardware and knowledge about the physics behind the sailing. Conclusion in the paper comments the benefits of STEM integrated projects and outlines how students who worked through STEM integrated projects outperform groups which were not, including their interest and career orientation towards STEM. These findings support the inclusion of innovative teaching strategies and technology in sailing education to make STEM concepts more engaging and accessible. In particular, blended learning and fully electronic learning became prominent during the COVID-19 pandemic where due to restrictions many schools closed and in-person lessons were replaced by online classes. In the field of STEM, this was especially challenging as hands-on activities, essential for STEM education were reduced or impractical. However, some universities and other stakeholders opened their infrastructure for remote access allowing students from home to perform simple STEM experiments. A good example of this in the field of robotics can be found in (Ferreira et al, 2024). This type of learning and infrastructure can be leveraged as well in the context of the Sail into STEAM project.

Integration of Arts (STEAM)

The evolution from STEM to STEAM, through the inclusion of Arts, marks a significant leap towards a more holistic education model. This integration acknowledges the critical role of creativity and innovation, alongside technical skills, in solving complex problems. Arts, encompassing a broad spectrum from visual arts to new media, add a layer of creativity that enhances problem-solving abilities, encourages innovative thinking, and fosters a more comprehensive understanding of STEM subjects. In sailing education, the synergy of STEAM comes to life. Design and aesthetics in boat construction, the art of navigation, and the cultural aspects of maritime exploration exemplify how the fusion of STEM and Arts can create a richer, more engaging learning experience. STEAM not only broadens the scope of STEM education but also makes it more accessible and appealing to a diverse student body, sparking curiosity and a love for learning that transcends traditional subject boundaries.

Conclusion of General STEM Approaches

STEM education, with its emphasis on an integrated, hands-on approach to learning, is more than a curriculum—it's a gateway to innovation and a foundation for lifelong learning. The inclusion of Arts to form STEAM further enriches this educational framework, blending logic with creativity and technical skills with artistic expression. In the context of sailing education, these approaches open up a sea of possibilities, making learning an exciting voyage of discovery. As we navigate through the currents of education reform, the integration of STEM and STEAM principles in sailing courses not only enhances the learning experience but also prepares students to sail confidently into the future, equipped with a broad spectrum of skills and a holistic understanding of the world around them. The evidence from recent studies underscores the value of inquiry-based and blended learning approaches, suggesting that such strategies can significantly enhance engagement and achievement in STEAM, particularly when adapted to the unique context of sailing education.

As we transition from a focus on STEM to embracing STEAM, integrating the Arts into Science, Technology, Engineering, and Mathematics, it becomes imperative to consider how environmental sustainability can further enrich this educational framework. The inclusion of Arts not only cultivates creativity and innovation but also provides a powerful avenue for expressing and addressing environmental challenges. By weaving sustainability into the STEAM curriculum, educators can encourage students to use their artistic and technical skills to propose solutions to real-world ecological issues.

Sustainability in STEAM education prompts students to think critically about the environmental impact of human innovations and the ways in which science and technology can be harnessed to protect and preserve our natural world. For example, projects that combine design (Art) and engineering (STEM) can involve students creating sustainable materials or energy-efficient solutions in a hands-on, creative process that underscores the interconnectedness of these disciplines. Such integration not only enhances the learning experience but also instils a lifelong commitment to environmental stewardship.

Therefore, as we develop curricula that blend these five disciplines, it is crucial to incorporate environmental sustainability as a key component. This approach ensures that STEAM education is not only about fostering interdisciplinary knowledge and skills but also about preparing students to meet the ecological challenges of their times, making informed decisions that promote a sustainable future.

3. Challenges and Opportunities in STEM Education

The landscape of STEM (Science, Technology, Engineering, and Mathematics) education within the Balkan region and Europe presents a unique set of challenges and opportunities. This section delves into these aspects, drawing upon research and educational initiatives specific to these regions, to offer a nuanced understanding of the state of STEM education.

Challenges in STEM Education

Resource Constraints and Infrastructure Limitations

A paramount challenge to STEM education across the Balkans is significant resource constraints, particularly the lack of modern educational infrastructure necessary for comprehensive hands-on learning experiences. Dinaric Perspectives on TIMSS 2019 (Elezović & Džumhur, 2021) starkly reflects these limitations, emphasising disparities in educational outcomes directly linked to unequal resource distribution. This lack is further compounded by the broader spectrum of educational infrastructure deficiencies, including outdated curriculum materials, insufficient digital resources, and a lack of access to real-world STEM applications (Kelley & Knowles, 2016). These deficits severely hinder educators' ability to deliver experiential learning experiences crucial for engaging students with the complexities of STEM disciplines.

Furthermore, studies highlight the positive relationship between EU programs and the advancement of human resources in the Western Balkans, suggesting that international cooperation and funding can partially mitigate these constraints (Ajdarpašić & Qorraj, 2020). Nonetheless, public infrastructure development still faces large gaps, underscoring the pressing need for investment to facilitate better STEM education outcomes. This suggests a holistic approach involving government action, international aid, and industry collaboration is crucial for the region.

Lack of Trained Educators

The Balkans, mirroring broader European trends, grapples with a notable shortage of adequately trained educators in STEM disciplines, a situation exacerbated by the rapid pace of technological advancements (Henry et al., 2019). This challenge is further highlighted in the study STEM on Demand (Jahić & Pilav-Velić, 2020), which points out the impact of poor R&D infrastructure and limited resources on universities' capacity to foster innovation in STEM and industry collaborations. Dinaric Perspectives on TIMSS 2019 (Elezović & Džumhur, 2021) underscores the critical need for targeted professional development opportunities for educators. The authors advocate for the creation of educator training programs that incorporate modern pedagogical strategies and new technologies, thereby enabling teachers to more effectively engage students in STEM subjects. They also call for regional cooperation in professional

development, suggesting that pooling resources and initiating cross-border training programs could significantly improve the standard of STEM education throughout the Balkans.

Student Engagement

Engaging students in STEM subjects remains a widespread challenge across educational settings in Europe. (Billiar et al.,2014) emphasise the curriculum's frequent failure to connect theoretical concepts to real-life applications, a gap that significantly affects student interest in STEM fields. Highlighting the interdisciplinary nature of STEM and its relevance to everyday life and future careers is crucial for maintaining student engagement and interest. In the Dinaric Perspectives on TIMSS 2019 Elezović and Džumhur argue for the development of a curriculum that is not only academically rigorous but also directly connected to students' lives and potential career paths. They suggest that making the curriculum relevant to real-world applications and the economic needs of the region could significantly enhance students' perception of STEM as viable and attractive career paths. Furthermore, they advocate for policy frameworks that encourage cross-border partnerships and joint investments in educational technology to improve the delivery of engaging and relevant STEM education (Elezović & Džumhur, 2021).

Opportunities in STEM Education

STEM education is a critical pathway to equipping students with the skills necessary to thrive in the 21st century. Emphasising opportunities within this educational approach, particularly in promoting equitable access and engaging underrepresented groups, significantly broadens participation and interest in STEM fields. Such initiatives are crucial for fostering a diverse talent pool that is well-prepared to tackle global challenges through innovative thinking and problem-solving skills.

Among these initiatives, "STEM4MATH" plays a pivotal role in enhancing maths education through integrated STEM approaches, showcasing significant strides in learning outcomes. Originating from a Europe-wide collaboration under the KA2-Erasmus project, STEM4MATH focuses on making challenging maths concepts more accessible through action-based learning relevant to children. The project developed a didactic model emphasising "integration" and "process," and produced 20 STEM-focused practices aimed at maths learning, shared on stem4math.eu for educator use. By involving teachers from five countries in its implementation, the project aims to shift student attitudes towards maths. Research indicates that while older students (9-12 years) recognized the utility of maths more after activities, especially boys, they enjoyed it less. Conversely, younger students (6-8 years) felt more positively about maths and their classroom experiences after the activities, though they struggled to see its real-life relevance.
Another noteworthy project is Robogirls (Robogirls, 2024), led by FER in Croatia, a leading institution in the Balkan region. This international initiative focuses on reducing the gender gap in STEAM by empowering

girls through coding and robotics. Similar to other projects, Robogirls employs blended learning combined with innovative pedagogical methods such as gamification, demonstrating the effectiveness of interdisciplinary methods and hands-on experiences in making abstract concepts more tangible and engaging for students.

Moreover, the integration of coding within STEM education, as evidenced by various European projects, underscores the role of innovative strategies in enhancing learning outcomes. These projects highlight the importance of practical application, collaborative learning, and adaptable teaching strategies, offering a blueprint for enhancing STEM education across the Balkan region and Europe.

The importance of integrating coding into STEM education is increasingly recognized across educational systems. By incorporating coding, educators can provide students with essential skills that blend scientific inquiry with technological fluency. Coding projects not only enhance computational thinking but also promote problem-solving skills, creativity, and digital literacy. Examples such as the 'Coding in STEM Education' project reflect a collective European effort to make STEM subjects more engaging and relevant for students by embedding coding into the curriculum. This project not only supports the development of coding skills but also encourages students to apply these skills in scientific contexts, thus making learning more interactive and applicable to real-world scenarios (Coding in STEM Education). The integration of play-based learning into STEM education in early childhood is foundational. It allows children to explore and experiment within a structured environment, enhancing their understanding of STEM concepts in a way that is both natural and intuitive. This approach is pivotal as it engages children's innate curiosity and capacity for learning through play, an essential component of their development. Researchers like Johnston (Johnston, 2015) have highlighted the benefits of structured play, where specific resources are arranged to enable children to explore objects and phenomena. Such learning environments lead to more meaningful and impactful educational experiences, aligned with how children naturally learn and interact with the world. Additionally, advocates in researches like (Torres-Crespo et al., 2014) and (Stylianidou et al., 2018) support integrating play-based approaches into educational policies, showing that play-based learning not only makes education more enjoyable but also fosters essential skills such as inquiry, problem-solving, and critical thinking. This method has proven effective in developing a deeper understanding and retention of STEM concepts, laying a strong foundation for future educational pursuits.

Teaching STEM through sports, as demonstrated by the STEM Sports curricula, illustrates the diversity of contexts in which STEM concepts can be taught, covering popular sports such as Basketball, Football, Tennis, Volleyball, but not yet Sailing. Since its inception in 2016, STEM Sports has expanded rapidly, with its curriculum now used in schools and camps across the U.S. This growth reflects the increasing demand for engaging STEM activities that expose students to potential careers early on.

4. STEM courses in Sailing

In this section, a multifaceted diagnosis is performed with first a needs analysis based on direct surveys to the target groups and then a desk research capturing the state of the art in STEM courses in sailing. The first subsection explains the survey methodology, and the analysis framework before providing the feedback and needs identified through the surveys. The second one highlights examples of existing STEM courses, their pros and cons as a motivation for the STEAM course being developed in the Sail into STEAM project.

Evaluating Needs Through Surveys and Feedback Analysis

Survey Methodology Overview with Data Collection Strategy

This white paper details a survey methodology designed to evaluate the integration of a sailing-themed STEAM curriculum in various educational environments. Targeting educators, including school teachers and sailing coaches, the survey uses both qualitative and quantitative methods to gather essential insights for the curriculum's implementation.
The data collection strategy included:

- Multiple Choice and Likert Scale Questions: These provide quantitative data while allowing educators to add contextual comments for deeper insight.
- Open-Ended Questions: Designed to elicit detailed feedback, these questions let educators express their views and concerns, providing a comprehensive understanding of their perspectives.

Google Forms is used for data collection due to its user-friendly interface, broad accessibility, and efficient data compilation capabilities. This tool also facilitates follow-up communication through email, enhancing the richness of the data collected.
This robust methodology aims to thoroughly explore both the enthusiasm for and the practical challenges of incorporating sailing into STEAM education, ensuring the feedback collected is relevant and insightful for developing an effective curriculum.

For a full summary analysis of the survey answers given by the teachers, the interested reader can check Annex I while the summary analysis of the coaches' answers can be found in Annex II.

Feedback Analysis and Identified Needs

This section builds upon the insights garnered from comprehensive surveys conducted with sailing coaches and elementary school teachers in Croatia, Serbia, and Slovenia, directly informing our strategy for integrating STEAM disciplines into educational settings through sailing. It encapsulates the collective experiences, challenges, and perspectives of these key stakeholders, highlighting the unique potential of sailing to serve as a conduit for STEAM education. By examining the feedback through the dual perspectives of educators and coaches, we identify critical areas for curriculum development, potential barriers to integration, and opportunities for enriching STEAM learning. The synthesis of these findings lays the groundwork for developing actionable strategies that leverage sailing as an innovative tool to enhance interdisciplinary education and promote environmental stewardship.

Executive Summary: Survey Overview of School Teachers' Feedback on STEAM Integration through Sailing

This section synthesises findings from the "Sailing as a STEAM Educational Platform - Survey for Teachers" conducted among teachers in Croatia, Serbia, and Slovenia. This survey explores teachers' perspectives on integrating Science, Technology, Engineering, Arts, and Mathematics (STEAM) through sailing into the educational curriculum. The responses highlight the diverse educational backgrounds of the participants and their extensive teaching experience. Teachers discussed the practical relevance of sailing to STEAM subjects, its potential for curriculum integration, involvement in extracurricular activities, and the role of sailing in fostering environmental awareness. The collective feedback underlines a strong enthusiasm for incorporating STEAM-oriented sailing courses within extracurricular programs. This white paper outlines actionable strategies for educational institutions and policymakers to harness the interdisciplinary nature of sailing, thereby enriching STEAM education and promoting environmental stewardship among students.

Survey Insights and Implications for STEAM Integration through Sailing in Education

Demographics and Background of Respondents:
The survey recorded inputs from a cross-section of educators primarily from Serbia, spanning ages 23 to 59 years, with an average teaching experience of 17 years. Their extensive background covers a broad spectrum of subjects across different educational levels, presenting a well-rounded understanding of the current educational landscape.

Involvement in Extracurricular Activities:
The active participation of educators in various extracurricular initiatives, such as international eco-projects and specialised workshops, demonstrates their readiness to extend learning beyond conventional classroom settings. This is crucial for the innovative integration of sailing into STEAM education.

Perceived Relevance of Sailing to STEAM:
Educators highlighted sailing as a practical medium for imparting STEAM education, offering tangible applications across geometry, mechanics, environmental science, and more. They advocated for its inclusion in the curriculum to boost student engagement and deepen their understanding of STEAM subjects.

Potential for Integration into STEAM Education:
The unique value of sailing as an educational tool was recognized for bridging theoretical concepts with practical experiences. Educators suggested various integration approaches, from dedicated weekly sessions to thematic block courses, designed to fit seamlessly within existing educational frameworks despite some logistical challenges.

Country-Specific Insights and Extracurricular Opportunities:
- Croatia: Educators expressed openness to integrating sailing for a few school hours, particularly in subjects like Informatics, indicating a curriculum flexible enough to accommodate new content.
- Serbia: Responses highlighted logistical and financial challenges but recognized the significant educational value for schools near bodies of water, suggesting extracurricular or elective formats as viable integration methods.
- Slovenia: There was unanimous support for extracurricular sailing courses, emphasising quality and cautioning against sessions led by non-teachers to maintain educational standards.

Collaboration and Support for Sailing in STEAM Education:
There is broad support for partnering with sailing clubs to offer extracurricular courses, noted for providing access to specialised knowledge, practical learning opportunities, and heightened student engagement. Such collaboration is deemed essential for successfully integrating sailing into STEAM education, offering a comprehensive approach that combines physical activity with intellectual development.

Analysis of Educator Profile Preferences for the SAIL into STEAM Course:
Feedback indicates a preference for instructors who combine practical sailing experience with specialised STEAM knowledge. Recommendations call for professional development for educators, the adoption of

innovative teaching strategies, and a thoughtful integration of STEAM principles to ensure an enriching educational experience.

Analysis of Didactic Methods and Required Equipment for SAIL into STEAM Course:
Educators favour hands-on, experiential learning methods, supported by the appropriate technological tools and specialised equipment. This approach aligns with the objectives of the SAIL into STEAM course, advocating for interactive, project-based learning experiences that effectively convey STEAM concepts within the context of sailing.

Analysis of Environmental Awareness and Practices in Schools:
Responses indicate a strong commitment to environmental sustainability practices, ranging from recycling initiatives to sustainability-themed educational programs. This focus on environmental consciousness is integral to the SAIL into STEAM curriculum, providing a basis for fostering responsible ecological stewardship among students.

Conclusion: Charting a Course for STEAM Education through Sailing
Feedback from educators underscores significant interest in using sailing as a dynamic platform to enhance STEAM education. The survey highlights sailing's potential to serve as an interdisciplinary tool that not only enriches learning but also promotes environmental awareness and sustainability. By leveraging these insights, educational institutions and policymakers can develop effective strategies to integrate sailing into educational curricula, thereby offering students a more engaging, practical, and comprehensive educational experience.

Executive Summary: Survey Overview of Sailing Coaches' Feedback on STEAM Integration through Sailing

This part of the white paper synthesises findings from the "Sailing as a STEAM Educational Platform - Survey for Sailing Coaches," gathering insights from coaches across Croatia, Serbia, and Slovenia. It explores the potential of sailing as a dynamic educational tool within the framework of Science, Technology, Engineering, Arts, and Mathematics (STEAM). The survey provides a unique perspective on the educational viability and challenges of integrating STEAM principles into sailing, emphasising coaches' pivotal roles in translating theoretical knowledge into practical, experiential learning.

Demographics and Background of Respondents:
The survey engaged 14 male coaches from Croatia, Serbia, and Slovenia, ranging in age from 25 to 75 years, with coaching experience from 1 to 32 years. These coaches have experience with trainees from early

childhood through youth and up to seniors, with some having trained athletes who have competed in European or world championships. This demographic diversity offers a broad spectrum of insights from coaching at various levels across a diverse range of sailing clubs. This section acknowledges the limitation of gender diversity in the respondents and suggests broader representation in future research.

Current Instructional Practices and Opportunities for STEAM

Coaches utilise a mix of traditional and modern teaching methods, including video analysis, situational sea training, and the use of digital tools such as YouTube and whiteboard drawings. Notably, the use of real-time simulation technologies, as well as radio controlled sailboats (used most in Croatia), illustrates a substantial foundation for enhancing teaching methodologies through technology and science-based approaches.

Challenges in Sailing Education

The survey identified several significant challenges in sailing education that offer opportunities for STEAM to make a substantial impact:

- Sensing Wind and Waves: Coaches often find it challenging to teach sailors to intuitively understand wind patterns and wave behaviour, especially in dynamic sailing conditions. This difficulty underscores the importance of practical experience and suggests the potential for simulation technologies in STEAM to bridge knowledge gaps with prior explanations of physical concepts which lie underneath.
- Apparent Wind Perception and Motor Skills: Explaining the concept of apparent wind involves the complex interplay of natural forces, and teaching motor skills to younger sailors presents specific difficulties, suggesting an opportunity for STEAM approaches to use visual aids and interactive models to clarify these complex dynamics.
- Visualisation and Execution of Manoeuvres: Sailors struggle to translate theoretical manoeuvres into practical execution, highlighting a gap that can be addressed through video analysis and real-time feedback systems integrated into STEAM curricula.

Responses to STEAM Relevance and Application

Coaches highlighted the critical importance of understanding scientific principles, with many emphasising that such knowledge is "Fundamental for children's skill development" and also "Only relevant for advanced sailors." Examples of STEAM in action include the application of aero- and hydrodynamics, technology in sail manipulation, and the artistic aspects of sailing, demonstrating the practical use of STEAM concepts.

STEAM Integration Preferences and Strategies

Coaches showed a preference for implementing STEAM through extracurricular activities, suggesting a pathway for innovative partnerships between sailing clubs and educational institutions. This approach aligns with the flexibility required to effectively introduce complex STEAM concepts in a practical, engaging manner. Additionally, there is interest in integrating these courses into existing curricula or offering them as standalone courses.

Actionable Strategies for Effective STEAM Integration

- Foster Collaborative Programs: Enhance partnerships between sailing coaches and STEAM educators to develop engaging, comprehensive programs.
- Tailor Programs to Specific Challenges: Utilise detailed insights from the challenges identified to create targeted STEAM curriculum components.
- Equip with Necessary Resources: Secure technological and educational tools needed to facilitate effective STEAM teaching in sailing.
- Promote Sustainability Practices: Integrate ecological and sustainability lessons into the STEAM curriculum to instil environmental stewardship.

Feedback on Training Duration and Scheduling

Feedback indicated that the duration and scheduling of STEAM sailing sessions should be flexible, varying from short 15-30 minute sessions to more extended periods depending on the age and maturity of the trainees, also it is important to consider other factors such as weather conditions and equipment availability when planning the training schedule to ensure efficient and safe implementation of activities.

Conclusion: Navigating the Future of STEAM in Sailing Education

The insights from the survey not only illustrate the current state of sailing education but also highlight the significant potential and enthusiasm for integrating STEAM. The proposed strategies emphasise collaborative, targeted, and resource-supported approaches to enhance the effectiveness and appeal of sailing training. This initiative aims to prepare young sailors not only for the technical demands of the sport but also for broader intellectual engagement through STEAM. Nearly all coaches expressed interest in participating in or supporting these initiatives, indicating a strong, positive reception toward STEAM integration in sailing education.

The analysis of feedback from teachers and coaches on the implementation of Sailing into STEAM courses reveals a strong consensus on the educational value and diverse benefits of integrating STEAM (Science, Technology, Engineering, Arts, Mathematics) principles with sailing instruction.

Identified Needs:

- Educational Enhancement: Surveys reveal a pressing need for innovative resources that demystify complex sailing concepts, making them more accessible and engaging for young learners. This includes integrating physical education to bolster motor skills and coordination, and crafting practical sailing scenarios that illustrate STEM principles effectively.
- Engagement Strategies: A notable challenge is deeply engaging students with sailing's physical and tactical aspects. The feedback suggests a demand for methods that effectively rival the allure of digital entertainment, enhancing physical engagement.
- STEM Integration: Teachers and coaches highlighted difficulties in conveying abstract STEM concepts through sailing. This presents an opportunity to develop sailing scenarios that clearly demonstrate these principles, thereby enriching the learning experience.

Benefits for Schools and Sailing Clubs:

- Interdisciplinary Learning: Both settings stand to benefit from the rich, interdisciplinary nature of sailing as a STEAM tool, which fosters a comprehensive learning experience extending beyond conventional classrooms.
- Enhanced Engagement: By applying STEAM concepts in practical sailing contexts, student engagement and interest in STEAM fields are significantly boosted, fostering a dynamic and interactive learning environment.
- Skill Development: STEAM courses in sailing not only improve sailing performance through an enhanced understanding of scientific underpinnings but also promote critical thinking, problem-solving, and teamwork.
- Collaborative Opportunities: Integrating sailing with STEAM education opens avenues for cooperation between educational institutions and sailing clubs. This collaboration enhances resource sharing, professional development, and community engagement.

Recommendations:

- Tailored Educational Strategies: Based on detailed feedback, there's a need for customised educational strategies that cater to specific challenges. These should include developing curricula that blend theoretical and practical elements effectively.
- Engagement Techniques: Innovative engagement strategies should be implemented to captivate and maintain student interest, potentially incorporating gamified learning environments.
- Interdisciplinary Approaches: Schools and clubs are encouraged to foster environments that integrate various STEAM disciplines through sailing, promoting a holistic educational experience.

In conclusion, the synthesis of feedback underscores a robust foundation for integrating sailing into STEAM courses, revealing its potential to enhance student engagement and promote interdisciplinary learning. The identified need for tailored educational strategies, innovative engagement techniques, and an interdisciplinary approach highlights the importance of catering to diverse educational needs and preferences. Moreover, the survey insights emphasise the practical relevance of sailing to STEAM subjects, its potential for curriculum integration, and the benefits of fostering environmental awareness. This indicates a promising opportunity for educational institutions and policymakers to harness the interdisciplinary nature of sailing, enriching STEAM education and fostering environmental stewardship among students.

Desk Research Overview of Sailing Education Programs

The initiative to weave STEM (Science, Technology, Engineering, and Mathematics) education into the fabric of sailing is an innovative pedagogical strategy that presents both significant challenges and promising opportunities. This approach seeks to engage students in an immersive learning experience that goes beyond traditional classroom settings. Here, we delve deeper into specific courses and programs that embody this educational fusion, highlighting their contributions, potential improvements, and the broader implications for STEM education through sailing.

The field of sailing education is not new to the inclusion of STEAM aspects or the use of sailing as a way to teach STEAM. The most comprehensive, well structured and disseminated course is the REACH program by the US Sailing Association (US Sailing, REACH program). Program has started in 2012. In the 2023 edition the program had over 2500 students according to the 2023 Reach Impact Report (2023 REACH IMPACT REPORT). This program has a set of modules that can be acquired as a manual as well as a Student log book. However, there is also space for improvements which we will detail in the following.
There are 10 modules which are aimed for primary school students and 7 additional modules that are aimed for high school students. Module 1 is focused on wind and its correlation with Math and Earth science. There is a set of really great experiments and exercises, such as making your own wind vane, that can serve as inspiration for our own curriculum. Module 2 is covering the topic of how the boat floats. Again there is a set of different explanations and experiments from where the students can learn about why the objects float, how, why they sink etc. There is a good set of references that should be investigated by the students additionally. However, one thing that is barely covered and requires further expansion if one were to implement such a module is a challenge where students should design their own boat. Potential further avenues that can be explored is the design and 3D print of the boat, use of artificial intelligence etc. Module 3 is focused on the sail area and perimeter where it connects geometry/maths and physical science. Aspects of sails are covered with a great level of details. Practices like measuring the sails, or comparison in size and the performance of the boats are also covered. Potential improvement in this module could be covering the topic of different sailing materials and what it takes to engineer the new material/cloth for sailboats. In the fourth module, topics being analysed are the simple machines that exist on the sailing boat. Those are pulleys, blocks, sheet cars, different ropes etc. Here students can easily connect the knowledge gained in physics and maths with real life examples. This is one of the best modules of the REACH curriculum. Potential improvement for this section could be on how to fix machines if they are broken or how to design your own device/machine while thinking about the tradeoffs such as significantly lower price as off the shelf components while losing somewhat on the performance of the components. Next module is focused on water quality and testing of it. This model has a great set of exercises, however we believe those should be connected better with sailing. For example, one thing that

students should investigate is if there is a difference in performance if the sailing boat performance is in a river, sea or a lake. Analysis of the water and its quality can help sailors decide which tactics to use, or how to trim their sailboat. Module 6 covers marine debris topics. This is one of the essential topics for the long term especially from the ecology point of view. However, this is another topic which is not tightly coupled with sailing where further expansion can help in that direction. Few examples. Striking the marine debris during sailing can cause serious damage to the boat. Another example could be, collecting the plastics from the river/sea and by using recycling methods, implement some of the previous modules in practice and engineer new devices for sailing boats. Upwind sailing is described in module 7. Here the geometry of sails, sailing and physics are analysed. Module 8 covers the topic of maths and weather/pressure and atmosphere. This module has good general coverage of the topic, however some of the sections are very focused on the USA. Hence, to implement a similar curriculum in Europe would require to extend and focus on some of the places in Europe where interesting phenomenons exist (such as Lago di garda in Italy or Adriatic sea) that have an impact on the way you sail your boat. Wind power and its use in sailboats is covered in module 9. Certain parts that are covered in this module could be combined with the module on up-wind sailing. Proposal for improvement here would be to reorganise the modules in such a way that wind power is introduced first. Two additional sub modules, for example “wind and sailing” and “wind and its use for powering the sailboat” should also be added. Practical exercises could be designing and implementing the simple wind generator by using a 3D printer or some materials taken from marine debris modules (plastic bottles can be easily wind mills). Module 10 covers underwater exploration. It covers the basics of the underwater and it is not connected with the sailing very well. However, connection with sailing can be made through boat hull inspection for example. This is something where one of the project partners - FER has experience, specifically how robots could be used to perform such an inspection and thus this will be considered in our curriculum. Modules 11-17 are focused on high school students which are currently out of scope for this project, but sections 13 (Microscopic mysteries) could be combined in water quality module five. Geology is covered in module 14 in concrete basins and watersheds, however this can be further expanded on the Adriatic sea for example in a similar approach. Modules 12 and 16 cover the topic of the extreme weather which is very important even for junior students, so adding it to earlier modules could be beneficial.

Similarly, and also in the US, the National Sailing Hall of Fame, a non-profit foundation, has a STEM Sailing Initiative that includes classes on Maths and Physics related to the science of sailing (NSHOF, STEM Sailing). Eight classes of 90 minutes each teach the basics of maths and physics and allow students to design a sailboat. In addition, they also teach American History through Sailing. Although it’s not STEM or STEAM related, this is an innovative approach worthy of being mentioned. Unfortunately, also in this case, not much information is available online.

The STEM Crew programme developed by the 1851 Trust foundation, exemplifies a pioneering effort to merge STEM education with the dynamic world of sailing (1851 Trust, STEM Crew). Drawing inspiration from the British team's participation in the 36th America's Cup, this programme uses the allure and challenges of sailing to foster an engaging learning environment for secondary school students. This prestigious international sailing competition, renowned for its history and the technological prowess it demands, serves as a fertile ground for educational exploration, making STEM concepts both accessible and engaging to secondary school students.

The programme's curriculum is a rich tapestry of lessons spanning physics, mathematics, engineering, and technology, all meticulously designed around real-life sailing scenarios. This not only brings STEM subjects to life but also instils in students a practical understanding of how these disciplines underpin the sport of sailing. For instance, modules on the physics of sailing delve into hydrodynamics and aerodynamics, elucidating the forces that propel sailboats forward. The mathematics of navigation, another crucial area of focus, introduces students to the complexities of plotting courses and calculating speeds, using the real challenges faced by America's Cup teams as illustrative examples.

A pivotal aspect of the STEM Crew programme is its commitment to environmental education, a commitment that has been significantly bolstered by the "Race for the Future'' initiative. This collaborative effort, involving STEM Crew, the Great Britain SailGP Team, and the Ocean Conservation Trust, is a testament to SailGP's vision of a world powered by nature. Central to this initiative are the Biology resources developed to educate students about ocean conservation issues such as ocean acidification and the role of seagrass in carbon sequestration. These resources not only enrich the STEM curriculum but also highlight the critical role of environmental stewardship in sailing and beyond.

Building upon the STEM Crew programme's foundation, there are cost-effective yet impactful ways to enrich its curriculum. This program, which integrates sailing's complexities with STEM education and environmental awareness, offers many opportunities for expansion within budget constraints.

Introducing simple, low-cost projects that use everyday materials to build model boats or illustrate mechanical principles of sailing can make the scientific aspects of sailing both engaging and accessible. This approach ensures active learning and innovation without significant financial investment, leveraging resources like recycled materials and low-cost supplies to bring the principles of sailing to life for all students.

Expanding the program's scope to include diverse global perspectives doesn't require an extensive overhaul. By integrating case studies and examples from various cultures and regions, accessible through online resources or by forging connections with local sailing communities, the program can offer students a broader understanding of sailing. This method allows for a cost-effective way to enrich students' learning experiences by exposing them to different sailing cultures and environments.

Moreover, the program can harness existing, freely available digital tools and open-source software to simulate sailing experiences, bypassing the need for expensive technology. This use of accessible

technology facilitates an interactive learning experience that dives deep into the intricacies of sailing strategies and scenarios, enhancing students' digital literacy in the process.
Finally, forging partnerships with local sailing clubs, educational institutions, and environmental organisations opens up a wealth of learning opportunities at minimal to no cost. These collaborations can provide students with unique insights into the practical applications of their studies, enriched by real-world expertise through guest lectures, virtual field trips, and collaborative projects.

There are other more commercial educational materials available online. For instance, for children from the 4th to the 10th grade, the STEM Integration Guide for Flinn Science of Sailing Kit (Flinn, STEM Integration Guide for Flinn Science of Sailing Kit) allows students to design and build a sailboat in around 3h. This is a one off class that can teach engineering design but does not have a comprehensive approach of all STEM principles involved in sailing. Similarly, Science of Sailing—Newton's Third Law Laboratory Kits allows younger students (6 to 12 years old) to understand Newton's third law and play with sails (Flinn, Science of Sailing—Newton's Third Law Laboratory Kits). However, it is a very limited kit that focuses only on a couple of physics laws. On a similar approach, but requiring much more work on the construction and technology side, STEM Sailboat Challenge Math and Engineering - Do it Yourself (DIY) kit can be used to teach sailing principles to students (Vivify Team, STEM Sailboat Challenge Math and Engineering Activity). While this kit does not provide either a comprehensive view of all STEM aspects in sailing, it does include much more hands-on activities on the construction and electronics than simpler kits. A more complex DIY Sailing Demonstrator project provided on the Instructables website can be used to teach sailing principles through play to students (Kiff, Hands on Sailing Demonstrator). This project, while more labour-intensive than simpler models, provides a comprehensive platform for experimenting with and understanding the fundamental principles of sailing. By manipulating elements such as wind direction and sail position in a controlled setting, students can visually and tactically observe the effects of their adjustments in real-time. The demonstrator uses a potentiometer as a tiller to control a model sailboat's angle, while another stepper motor adjusts the position of a fan to simulate changing wind directions. With an Arduino Uno controlling everything, this setup affords students the opportunity to learn about sail positioning and adjusting to shifting winds in an interactive way, without the pressures and variables of being on the water.

In Embodied Phenomenology in Mathematical Modelling of Sailing for Integrated STEM Learning (Ekici, & Alagoz, 2020.), connection has been made between mathematical modelling and Sailing. The manoeuvre of sailing towards wind and sailing between the point A and B could be done in many different ways. Hence this problem is fruitful for integration with mathematical modelling and STEM in general. As the paper nicely describes it: ***"In sailing practice, the sailors often struggle to describe how and why they execute a series of bodily actions during sailing."***. Through mathematical and physics modelling combined with the iterative approach, both regular and sailing students could gain scientific and sailing knowledge. Having in

mind this novel approach that combines research of mathematical modelling of complex problem situations, that is using events from Saling sport, is yet another testament that integration between STEM and Sailing could provide benefits for all interested parties.

A great example of teaching STEM principles in sailing comes from the MicroTransact Challenge (M. Neal, Y. Briere, The Microtransat Challenge). This challenge goal is to design a robotic sailing boat to cross the North Atlantic. This requires considerable knowledge in STEM and even though the webpage includes a wiki and several free resources on how to build a boat and what components to buy, it is more suitable for university level students. The somehow related World Robotic Sailing Championships (WRSC, 2008) is simpler as the races occur in a smaller area like a harbour, i.e. there is no need to cross the Atlantic, it is similarly fit to University level. Instead, the SailBot - International Robotic Sailing Regatta (SailBot, 2008) requires at least 50% of students from secondary or undergraduate level for each participating team. It is still a challenging competition but a great way to teach STEM to students. To help new teams, some design principles and CAD models and instructions to build a robotic sailboat are available on the website.

Challenges and Opportunities in STEM Education Through Sailing

Sailing, as a multidisciplinary activity, offers a unique and effective platform for STEM (Science, Technology, Engineering, and Mathematics) education. It encompasses a range of skills and knowledge areas, integrating natural phenomena and engineering principles with physical activity and environmental stewardship. However, embedding sailing into the STEM curriculum presents both significant challenges and remarkable opportunities. This section discusses these aspects, drawing from current research, pilot programs, and educational trends.

Challenges in STEAM education through sailing

Age-Appropriate Curriculum Development:
Designing a curriculum that is both engaging and suitable for children aged 7-12 involves distilling complex sailing and STEAM concepts into manageable lessons that are age-appropriate yet challenging. This requires creating interactive, visual, and practical learning activities that capture young minds without overwhelming them. Curriculum developers must consider cognitive development stages, ensuring that concepts like the physics of buoyancy or basic aerodynamics are taught through hands-on experiments and simple explanations.

Resource Accessibility:
Sailing requires specific physical resources not readily available in all educational settings, particularly in schools without direct access to aquatic environments or those limited by urban settings. The challenge extends to acquiring miniature boats for classroom activities, creating scaled water testing setups, or even accessing safe, navigable waters. Addressing these needs creatively through partnerships or virtual technologies is essential but requires innovative thinking and strategic planning.

Safety and Accessibility:
Introducing young students to sailing involves comprehensive safety protocols to manage risks associated with water sports. Tailoring these experiences to be inclusive, especially for students with physical disabilities or those from diverse backgrounds, adds another layer of complexity. Schools must develop clear safety guidelines, conduct regular risk assessments, and ensure all activities are accessible, which often involves additional resources and specialised training for staff.

Integration into School Schedules:
Fitting sailing STEAM activities into the already crowded academic schedules of primary schools is a significant challenge. Coordinating these activities requires flexible scheduling and often additional time outside of standard classroom hours, which can conflict with other school programs and the availability of students and parents.

Opportunities offered by integrating STEAM education through sailing

Digital Tools and Interactive Technologies:
The advancement of affordable educational technology provides an excellent opportunity to integrate sailing into STEAM education. Interactive apps and games can simulate sailing experiences and teach navigational skills, which are particularly engaging for children. These tools can be used in classroom settings to demonstrate sailing mechanics or environmental factors affecting sailing conditions, making the learning experience both fun and informative.

Enhanced Community Engagement:
Collaborating with local sailing clubs, marinas, and environmental organisations can turn theoretical knowledge into practical experience. Such partnerships might provide students with opportunities to visit local water bodies, interact with professional sailors, or participate in community-led environmental conservation projects. This not only enhances learning but also strengthens community ties and supports local ecosystems.

Professional Development and Resource Sharing:
Developing a community of practice among educators interested in sailing and STEAM can lead to significant advancements in curriculum design and delivery. Online platforms and professional networks allow teachers to share resources, lesson plans, and best practices without the need for extensive travel or conference attendance. This collaborative approach can lead to more enriched learning experiences and a better support structure for educators.

Project-Based Learning and STEAM Integration:
Sailing is inherently multidisciplinary, making it an ideal subject for project-based learning approaches that encompass multiple STEAM disciplines. Projects could involve designing model sailboats, studying marine biology, or exploring environmental impacts on local waterways. Such projects encourage critical thinking, problem-solving, and collaborative skills among students, while also making learning relevant and exciting.

Environmental Stewardship and Sustainability Education:
Sailing naturally lends itself to teaching about the environment and sustainability. Incorporating these topics into sailing-based STEAM activities can empower students to understand and appreciate the delicate balance of marine ecosystems. For example, students can engage in projects that monitor water quality or study the impact of pollution on aquatic life. These activities not only educate but also instil a sense of responsibility towards environmental conservation, aligning with global educational trends towards green practices and sustainability.

Adaptive Learning Environments:
Creating adaptive learning settings that cater to various learning styles and abilities is crucial in sailing education. Interactive and multisensory teaching methods, such as using tactile materials, visual simulations, and auditory cues, can make sailing concepts more accessible to all students, including those with learning disabilities or those who are visually or hearing impaired. This inclusive approach ensures that every student has the opportunity to participate and benefit from sailing-based STEAM education.

Potential Impacts of STEAM education through sailing

Enhanced Critical Thinking and Problem Solving:
By engaging with real-world challenges through sailing, students develop enhanced problem-solving skills and critical thinking abilities. Navigating a boat, predicting weather patterns, and understanding marine ecology require applying knowledge in dynamic and often unpredictable situations, which sharpens decision-making skills and fosters a hands-on approach to learning.

Increased STEAM Engagement:
Sailing can make STEAM subjects more tangible and exciting, which increases student engagement and interest in these fields. The practical application of mathematical calculations, scientific observations, and engineering principles in sailing helps demystify abstract concepts and showcases the real-world utility of STEAM education.

Social and Emotional Learning:
Collaborative sailing projects and activities can also support social and emotional learning by promoting teamwork, communication, leadership, and resilience. Working together to navigate a boat or solve a sailing-related problem can help students develop interpersonal skills that are vital in all areas of life.

Support Structures Required for incorporating STEAM education through sailing

Institutional Support:
For sailing-based STEAM programs to succeed, strong institutional support is essential. Schools need to provide resources, facilitate professional development, and create policies that encourage innovative teaching practices and interdisciplinary learning.

Community and Parental Involvement:
Engaging the wider community and parents in sailing activities can enhance learning outcomes and provide additional resources and support. Community events, parent-teacher sailing days, and local sponsorship can help sustain these programs financially and logistically.

Continuous Evaluation and Feedback:
Implementing an ongoing system of evaluation and feedback is crucial for refining and improving sailing-based STEAM education. Regular assessments of student outcomes, teacher effectiveness, and program impact can help educators make data-driven adjustments and share successful practices more widely.

5. Recommendations and conclusion

Integrating sailing into the STEAM curriculum stands at the crossroads of innovation and tradition, offering a pathway to engage students with a hands-on learning experience that marries the practical aspects of sailing with the theoretical underpinnings of science, technology, engineering, arts, and mathematics. This endeavour, while full of potential, is not without its challenges. Insightful feedback from comprehensive surveys of educators and sailing coaches has shed light on the enthusiastic reception of this interdisciplinary approach, as well as the hurdles that must be overcome to ensure its successful implementation.

The surveys identified critical gaps that need addressing to fully realise the integration of sailing into STEAM education. Notably, logistical constraints emerged as a significant challenge, with schools and sailing clubs grappling with how to incorporate sailing activities into the existing curriculum amidst tight schedules and limited access to suitable water bodies. A lack of resources was another major concern highlighted by the surveys, pointing to the need for both physical materials for sailing and STEAM activities, and for financial support to sustain such programs.

Moreover, the surveys underscored a pressing need for professional development among educators and sailing coaches. There's a gap in current offerings that prepare these professionals to effectively blend sailing with STEAM education, indicating a lack of tailored training programs that equip them with the necessary skills and knowledge.

Drawing inspiration from established programs such as the REACH initiative and the STEM Crew programme, this white paper recommends a strategic approach to curriculum development that considers the unique needs and contexts of the Balkan region. Despite the success of these models, a direct replication may not be entirely suitable due to geographical, cultural, and infrastructural differences in the Balkans. Instead, an adapted curriculum that leverages local technological advancements and educational strategies is advocated.

To address the survey-identified needs and gaps, this white paper proposes several strategies. Developing targeted STEAM modules that utilise sailing as a platform for experiential learning could bridge the gap between theory and practice. Facilitating collaborations between schools and local sailing clubs can help overcome logistical challenges, providing students with access to sailing experiences that complement their classroom learning. Additionally, promoting professional development opportunities for educators and sailing coaches is crucial in equipping them with the skills to integrate sailing into STEAM education effectively.

Building upon the foundation of existing programs and addressing the identified needs and gaps, the future of STEAM sailing education in the Balkans looks promising. By embracing innovative, cost-effective strategies and tailoring the approach to local realities, educators can offer students a holistic learning experience that not only educates but also inspires. This multifaceted approach will not only enrich the

STEAM curriculum but also prepare students to navigate the challenges and opportunities of the 21st century with confidence and creativity.

As we move towards the conclusion of this white paper, it is imperative to emphasise the critical role of sustainability in shaping future educational frameworks. Integrating sustainability into STEM education through sailing not only enriches the learning experience but also prepares students to become conscientious global citizens. We must ensure that our educational systems evolve to include sustainability as a core component, reflecting the urgency of environmental issues and the need for innovative solutions. By revising curricula to integrate environmental science within sailing modules, we can provide students with a rich understanding of sustainable practices. Supporting this with policy changes that incentivize sustainability in educational programs will further enable schools to develop innovative projects that connect students with real-world environmental challenges. Additionally, fostering partnerships with local environmental groups and sailing clubs can enrich students' practical learning experiences. Investing in professional development will ensure that educators are well-equipped to guide this new generation of conscientious global citizens effectively. Lastly, establishing resource-sharing networks among educational institutions will facilitate the broad dissemination of best practices and collaborative learning, enhancing the overall impact of these initiatives.

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Annex 1: Summarised Analysis of School Teachers' Survey

To accurately assess the integration potential of sailing within the STEAM framework, a methodical survey was conducted targeting a tripartite audience: students, educators, and sailing coaches. The objective was to elucidate the direct application of STEM principles within the context of sailing and to identify the unique educational opportunities it presents. By soliciting comprehensive feedback, the endeavour aimed to pinpoint the prevailing perceptions, the educational efficacy, and the nuanced needs associated with sailing-based STEM education. The resulting insights from this detailed inquiry are instrumental in sculpting an enriched STEAM curriculum that not only embraces sailing as an innovative educational medium but also aligns seamlessly with educators' objectives while captivating and maintaining student interest.

Assessment and Insights from the "Sailing as a STEAM Educational Platform - Survey for Educators"

Within the ambit of evaluating the integration potential of sailing into the STEAM curriculum, a survey titled "Sailing as a STEAM Educational Platform - Survey for School Teachers" was conducted. This initiative aimed at capturing comprehensive feedback from a targeted demographic of educators, facilitating an in-depth understanding of the current state, challenges, and opportunities presented by embedding sailing principles within STEAM education. The survey solicited educators' perspectives on the applicability of STEM concepts through sailing, the viability of such programs within the existing educational structures, and the anticipated educational outcomes. The resultant insights serve as a cornerstone for tailoring sailing-based STEAM educational modules, ensuring they are both pedagogically sound and aligned with the educators' and learners' needs. The analysis delineates the key findings from the survey, shedding light on the educators' perceived needs, preferences, and the overarching readiness for the adoption of sailing as an effective STEAM teaching tool.

Demographics and Background of Respondents

The survey encompassed educators from the partner countries, predominantly from Serbia, with a diverse age range from 23 to 59 years, averaging 41 years. These educators bring a wealth of experience, averaging 17 years, with the spectrum ranging from 1 to 35 years of teaching experience. The subjects taught span a broad range, including general subjects for primary schools and specialised subjects for higher grades. The grades taught vary significantly, covering the full spectrum of primary education and touching on early adolescence, showcasing a broad representation of the educational landscape.

Involvement in Extracurricular Activities

The survey highlights a notable involvement of educators in extracurricular activities, with experiences ranging from participation in Erasmus projects, robotics, international eco-school programs, ecological and biological sections, to workshops on historical topics and Serbian cinematography. This diverse engagement outside the standard curriculum indicates a readiness among educators to extend learning beyond traditional classroom settings, potentially facilitating the integration of sailing into STEAM education.

Perceived Relevance of Sailing to STEAM:

Drawing from the feedback provided by educators from Croatia, Serbia, and Slovenia, the perceived relevance of sailing to STEAM education encompasses a wide array of concepts that can be seamlessly integrated into the curriculum, offering rich, practical examples to enhance student understanding and engagement. Here are specific examples as identified by the educators:

Geometry and Mechanics

- Geometry of Sails: The basic geometry involved in sail design, such as the types of triangles, provides a tangible way to teach geometric principles.
- Mechanics of Sailing: Motion, waves, wind dynamics, and the principles explaining why a boat floats (buoyancy) or doesn't sink offer real-world applications of physics.

Interdisciplinary Approaches

Educators emphasised sailing's capacity to bridge various STEAM aspects, suggesting its potential to adapt to different teaching specialties and interests. This flexibility underscores sailing as a versatile educational tool.

Astronomy

- Navigation Using Stars: The traditional art of navigating by the stars introduces students to practical astronomy, enhancing their understanding of celestial navigation and directions.

Environmental Science

- Impact on Wildlife: Exploring sailing's effects on marine life, including birds and fish, can raise awareness about environmental conservation and sustainability.
- Renewable Energy: Utilising wind as a renewable energy source for sailing can lead to discussions on alternative energy, sustainability, and the environmental advantages of wind power.

Arts and History

- Artistic Representations: The depiction of water surfaces, boats, and the sea in art, including styles like Impressionism, provides a unique angle to integrate art into the STEAM curriculum.
- History of Sailing: The historical evolution of sailing and its technological advancements offer insights into human ingenuity and the development of navigation technologies.

Practical Application and Engagement

The consensus among respondents is that sailing serves as an effective, practical example for teaching various STEAM subjects, given its encompassing interaction with elements such as water, land, and notably air (which includes wind and atmospheric conditions). This hands-on approach is seen as beneficial for fostering a deeper understanding of scientific phenomena and enhancing student engagement and curiosity.

Educators also recommended establishing collaborations with educational institutions near navigable waters to facilitate sailing activities, suggesting that early exposure to sailing could increase students' eagerness to learn STEAM subjects.

These examples illustrate the broad spectrum of educational opportunities that sailing can offer, ranging from scientific principles to artistic and historical interpretations, making it a valuable multidisciplinary platform for STEAM education.

Potential for Integration into STEAM Education

Integration into the Standard/regular school Curriculum

The potential of sailing to add value to the STEAM curriculum has been widely acknowledged across the surveyed countries. Educators point to sailing's capacity to bridge the gap between theoretical knowledge and practical application, thereby enhancing students' learning experiences. Suggestions for integration include weekly sessions and block formats, tailored to fit the existing educational frameworks and accommodate the rich content provided by sailing.

However, the integration process is not without its challenges. Schools face significant logistical hurdles, including the scarcity of free periods, densely packed schedules, and the physical and financial constraints of adding new content. Despite these obstacles, there is a consensus on the value of selectively and strategically incorporating sailing into the curriculum, leveraging its potential within existing units or through extracurricular activities, assuming logistical and curricular flexibility can be achieved.

Country-Specific Insights

Croatia

Croatian educators exhibit a positive attitude towards sailing's integration, suggesting its inclusion for 2 to 4 school hours, potentially within extended stay programs. The Croatian curriculum, particularly in Informatics, offers the flexibility needed for new content integration. This openness to innovation is contingent on institutional support and resource availability, reflecting a broader willingness to experiment with new educational practices.

Serbia

The reception in Serbia is varied, with educators pointing out several practical obstacles, including financial and geographical limitations, as well as concerns about institutional readiness. Nonetheless, there is recognition of sailing's educational benefits for schools near water bodies, with proposals for 1 to 2 weekly sessions dependent on student interest and curricular organisation. Despite scepticism, there is a balance of appreciation for the innovation sailing could introduce, deemed feasible through extracurricular or elective programs.

Slovenia

Slovenian educators unanimously support the opportunity to implement sailing courses, preferring extracurricular formats. They emphasise the importance of maintaining course quality and express concerns over non-teachers leading classroom sessions, highlighting the need for careful management of external influences on the educational process.

Extracurricular Activities

There is a unified support among educators for the introduction of sailing as an extracurricular activity, seen as a valuable complement to students' educational journey. This consensus underscores the anticipation of high interest levels from both students and parents, highlighting the activity's potential benefits. Optimal scheduling is a key consideration, with a preference for conducting these activities in the afternoons on weekdays or during weekends to accommodate students' primary academic obligations. For schools with morning-only schedules, the recommendation is to utilise the latter part of the day, post the 6th or 7th period, for sailing activities. The idea of forming partnerships with sailing clubs to facilitate these courses outside the school premises enjoys widespread support, signifying a collective recognition of the importance of students participating in activities beyond the traditional school environment. This approach not only broadens the educational experience but also integrates physical activity with STEAM learning, underpinned by a willingness among teachers to support such initiatives.

Country-Specific Perspectives

Croatia

Croatian educators are particularly enthusiastic about afternoon sessions for extracurricular sailing, starting post-5 PM. This scheduling strategy aims to leverage existing interest among students and parents, further suggesting that collaborations with sailing clubs could significantly enrich students' learning experiences beyond the academic curriculum. Such partnerships are viewed as instrumental in providing students with a practical understanding of STEAM concepts, coupled with the development of life skills such as teamwork and problem-solving.

Serbia

In Serbia, the perspective on introducing sailing as an extracurricular activity is mixed, acknowledging both the potential benefits and the challenges posed by student interest and logistical considerations. Despite these hurdles, there is a proposal for after-school sessions or weekend activities as viable options, contingent upon aligning with student preferences and logistical feasibility. The mixed reception highlights a cautious yet optimistic view on the possibility of integrating sailing into the educational framework, emphasising the need for initiatives that resonate with students' interests and are practically implementable.

Slovenia

Slovenian educators unanimously support the inclusion of extracurricular sailing courses, emphasising the paramount importance of maintaining high-quality standards. The preference for conducting these courses through established sailing clubs or similar external venues reflects an enthusiasm for leveraging community resources to enhance the educational experience. This approach is predicated on the assurance of course quality, indicating a proactive stance towards enriching the student learning journey while safeguarding educational integrity.

Collaboration and Support for STEAM Education through Sailing

The initiative to partner with sailing clubs for conducting these extracurricular courses is lauded for multiple reasons:

- Access to Expertise and Equipment: Sailing clubs offer invaluable specialized knowledge and the necessary equipment, significantly enhancing the educational value of the sailing experience.
- Practical Learning Opportunities: Hands-on sailing experiences facilitated by these partnerships allow students to apply STEAM concepts in real-world settings, bridging the gap between theory and practice.
- Community Engagement: Collaborations with local sailing clubs foster community ties, enriching students' educational experiences with insights into local maritime traditions and practices.
- Enhanced Student Participation: The broad support for engaging students in activities beyond the classroom underscores the belief in the transformative value of sailing for developing life skills and fostering a deeper interest in STEAM subjects.

Educators across these countries are ready to advocate for and support the integration of sailing into the educational framework, recognizing the unique opportunities it provides for broadening students' horizons in STEAM education.

Analysis of Educator Profile Preferences for the SAIL into STEAM Course

The responses collected from Croatia, Serbia, and Slovenia regarding the most suitable educator profiles for leading a SAIL into STEAM course reveal a diverse range of opinions and preferences. These preferences underscore the multidisciplinary nature of the course, which aims to integrate sailing (SAIL) with Science, Technology, Engineering, Arts, and Mathematics (STEAM) education. Below, we analyze these responses to identify trends, commonalities, and unique perspectives across these countries, offering a comprehensive view of preferred educator profiles for such an innovative educational program.

Key Findings

- High Preference for Practical Experience: Across the responses, there is a clear emphasis on the importance of practical experience in sailing. Instructors with direct sailing experience, such as sailing instructors and experienced sailors, are frequently mentioned as top choices. This preference highlights the value placed on practical, hands-on knowledge and skills in sailing as essential for effectively leading the course.
- The Role of Specialized Educators: Specialised educators, particularly those with a background in STEAM subjects, are highly valued. This indicates a recognition of the need for instructors who can adeptly integrate STEAM principles with sailing concepts, suggesting a preference for educators who can bridge the gap between theoretical knowledge and practical application.
- Inclusion of School Teachers: School teachers, especially those familiar with STEM activities or with additional training in sailing, are considered suitable for the course. This choice reflects an appreciation for educators who understand the pedagogical approaches and learning needs of school-age children, as well as the curriculum.
- Collaborative Educational Approaches: Some responses suggest a collaborative approach, combining different types of educators (e.g., sailing instructors and school teachers) to leverage their respective strengths. This approach is seen as a way to enrich the learning experience by providing both practical sailing skills and a solid STEAM educational foundation.
- Diverse and Innovative Teaching Methods: Particularly in Slovenia, there is an openness to experimenting with various teaching and learning methods, including peer-to-peer and social learning. This suggests a desire for innovative educational strategies that can engage students and enhance their interest in both sailing and STEAM subjects.

Recommendations

- Leverage Mixed Expertise: Develop a teaching team that includes sailing instructors, specialised STEAM educators, and school teachers. This blend of expertise can provide students with a well-rounded, comprehensive educational experience.

- Emphasise Professional Development: Offer professional development opportunities for educators, especially for sailing instructors to learn pedagogical skills and for school teachers to gain practical sailing experience. This can enhance the effectiveness of the educational team.
- Incorporate Innovative Teaching Strategies: Explore and implement diverse teaching methods, such as experiential learning, project-based learning, and peer learning, to foster student engagement and deepen their understanding of STEAM concepts through sailing.
- Focus on STEAM Integration: Ensure that the course curriculum thoughtfully integrates sailing with STEAM subjects, demonstrating the real-world application of STEAM principles through the context of sailing.
- Monitor and Adapt: Regularly assess the effectiveness of the chosen educator profiles and teaching strategies, and be willing to adapt based on feedback and outcomes. This agile approach can help continuously improve the course and its impact on students.

The analysis reveals a consensus on the value of practical sailing experience, specialised STEAM knowledge, and pedagogical expertise in educators leading the SAIL into STEAM course. By combining these elements, the course can offer a rich, engaging, and effective educational experience that not only teaches sailing but also deepens students' understanding and appreciation of STEAM subjects.

Analysis of Didactic Methods and Required Equipment for SAIL into STEAM Course

The responses to the inquiry about the most suitable didactic methods for teaching scientific, technical, mathematical, and artistic aspects within a sailing course reveal a preference for hands-on, experiential, and interactive approaches. These methods are considered most effective in engaging students and facilitating a deep understanding of the multifaceted disciplines integrated within the STEAM framework. Additionally, the necessity for specific equipment and materials to successfully implement these didactic methods is emphasised, indicating a requirement for both traditional educational resources and specialised sailing gear.

Didactic Methods

- Experiential Learning: A common theme across responses is the emphasis on practical, hands-on experiences, such as sailing practice, model building, and simulations. This approach allows students to directly apply theoretical knowledge in real-world contexts, enhancing comprehension and retention.
- Project-based Learning: Many responses advocate for project-based learning, where students collaborate on designing and executing projects related to sailing. This method fosters teamwork, problem-solving skills, and the application of STEAM principles in creative ways.

- Problem-solving and Inquiry-based Learning: Encouraging students to tackle real-world problems, such as optimising sailing routes or designing efficient sailboats, engages critical thinking and applies scientific and mathematical concepts in practical scenarios.
- Integration of Technology: The use of technological tools, including simulations, GPS devices, and software, is highlighted as essential for modern STEAM education. These tools provide students with opportunities to experiment and learn in interactive and innovative ways.
- Artistic Expression: Incorporating artistic activities, such as drawing, painting, and photography, supports the "A" in STEAM, allowing students to explore the aesthetic dimensions of sailing and express their interpretations creatively.
- Collaborative Learning: Methods that promote social learning, peer-to-peer interactions, and teamwork are valued for their role in building communication skills and enhancing the learning experience through shared insights and ideas.

Required Equipment and Materials

- Sailing Gear and Equipment: Practical sailing exercises necessitate access to sailboats and related equipment, emphasising the importance of partnerships with sailing clubs or schools.
- Technological Tools: Computers, software for simulations and design, GPS devices, and other digital resources are crucial for implementing technology-integrated learning experiences.
- Educational and Experimental Sets: Materials for model building, experimental kits for physics and engineering tasks, and art supplies support a wide range of activities from scientific experiments to creative projects.
- Learning and Teaching Resources: Books, video materials, smartboards, and other educational aids enhance theoretical learning and support diverse teaching methods.
- Specialized Classroom Equipment: Items such as water tanks, fans for simulating wind, and laboratory equipment enable practical experiments and demonstrations within a classroom setting.

The responses indicate a consensus on the effectiveness of interactive, experiential, and project-based learning methods for teaching the STEAM aspects of sailing. The successful implementation of these methods requires a blend of traditional educational materials, specialised equipment, and technological tools. Engaging students through practical experiences, collaborative projects, and the integration of technology stands out as a holistic approach to STEAM education within the context of sailing. This approach not only fosters a deeper understanding of scientific principles but also nurtures creativity, teamwork, and a connection with the natural world.

Analysis of Environmental Awareness and Practices in Schools

The responses from schools across Croatia, Serbia, and Slovenia reveal a significant awareness and implementation of environmental sustainability practices within the educational context. These practices encompass a broad spectrum of activities ranging from recycling initiatives to energy conservation programs, highlighting a comprehensive approach to ecological responsibility in schools.

Key Findings

- Recycling and Waste Management: A common thread across responses is the emphasis on recycling beyond paper, indicating a robust approach to waste segregation and management. This practice is foundational to fostering an environmentally responsible culture among students and staff.
- Bicycling Infrastructure and Car Sharing: Several schools have implemented secure bicycle storage areas, promoting cycling as a sustainable mode of transportation. Additionally, car-sharing initiatives among staff further reflect a commitment to reducing carbon emissions associated with commuting.
- Sustainability Education: The organisation of sustainability-themed lectures and activities is prevalent, suggesting a strong educational focus on environmental concepts. This is crucial for developing students' understanding of ecological footprints and the importance of sustainable living.
- Green Spaces Maintenance: The maintenance of green spaces within school premises is a common practice, serving not only as a practical application of sustainability principles but also as a means of enhancing the school environment and providing students with direct contact with nature.
- Energy Conservation Awareness: While there is awareness of the school's ecological footprint and some schools have established energy-saving programs, the ratings indicate varying degrees of implementation and effectiveness in actively reducing heating costs and overall energy consumption.

Comparative Analysis

- Croatia: Schools demonstrate a high level of engagement with environmental practices, including recycling, green space maintenance, and sustainability education, with mixed responses on energy conservation effectiveness.
- Serbia: The responses highlight a strong commitment to recycling, green spaces, and sustainability education, with a notable emphasis on reducing heating costs and implementing energy-saving programs.

- Slovenia: There's a general awareness of ecological issues among teachers, but the challenge lies in translating this awareness into practical action, particularly in areas such as recycling and energy conservation.

The survey responses underscore a significant level of environmental consciousness within schools in Croatia, Serbia, and Slovenia, manifested through various sustainability practices. However, the effectiveness of these practices, especially in energy conservation, varies, indicating opportunities for further improvement and the need for comprehensive implementation strategies. Encouragingly, the commitment to education on sustainability suggests a positive trajectory towards embedding ecological responsibility into the fabric of school culture, laying a foundation for future generations to champion environmental stewardship.

Interest in implementing SAILintoSTEAM activities in Schools

Responses from educators across Croatia, Serbia, and Slovenia offer insights into the interest level regarding the implementation of Sailing into STEAM activities, including extracurricular activities and collaboration with sailing clubs. The feedback underscores a general openness towards integrating these options into school activities, though it also highlights the need for careful consideration of project quality and relevance to the school's educational goals.

Interest by Country

- Croatia: The enthusiasm among Croatian respondents is evident, with a unanimous interest in the mentioned options. However, there's an acknowledgment of the need to present and discuss these projects with school leadership to gauge official interest and support.
- Serbia: The responses from Serbia present a mixed picture, ranging from uncertainty and personal interest to conditional interest dependent on logistical considerations and the potential for integration into the school's existing activities. The mention of personal limitations and the transient nature of some educators' roles suggests a cautious approach to committing to new initiatives.
- Slovenia: Slovenian educators express a collective willingness to recommend such courses as extracurricular activities, contingent on the quality and suitability of the course content. The cautionary note regarding the inclusion of external personnel in teaching reflects a broader concern about maintaining educational integrity and avoiding external influences.

Key Considerations

- Project Presentation to Leadership: The importance of detailed project presentations to school leadership is a recurring theme, indicating that the decision-making process involves careful evaluation of project merits and alignment with school objectives.
- Quality and Relevance: The quality of the proposed initiatives and their relevance to the school's curriculum are crucial factors influencing interest. Educators are mindful of the educational value and practical feasibility of integrating new activities.fff
- External Influence: There's a cautious stance towards involving non-teaching personnel in educational settings, reflecting concerns about ensuring the impartiality and integrity of the educational content.
- Logistical and Temporal Constraints: Some educators express reservations based on logistical challenges and personal circumstances, highlighting the need for flexible and adaptable implementation strategies.

The feedback from educators across Croatia, Serbia, and Slovenia reveals a nuanced perspective on the adoption of environmental and sustainability initiatives within schools. While there's a discernible interest in exploring these options, particularly as extracurricular activities, the decision to proceed is contingent on a comprehensive evaluation of project quality, relevance, and alignment with educational standards. The responses also underscore the importance of securing support from school leadership and addressing logistical considerations to facilitate successful implementation.

Annex 2: Summarised Analysis of Coaches' Survey

Exploring the intricate relationship between sailing and the STEAM framework, a detailed survey was launched, targeting a specialised group of sailing coaches across Croatia, Serbia, and Slovenia. The purpose of this initiative was to delve into the perspectives of those at the helm of sailing instruction, to unravel how sailing, a sport deeply intertwined with natural elements and physical laws, could serve as a dynamic conduit for STEAM education. This inquiry was designed to capture a holistic view of sailing as an educational platform, probing into the coaches' backgrounds, their instructional methodologies, the challenges they encounter in weaving STEAM concepts into their coaching, and the overall receptiveness towards this innovative educational fusion. By engaging coaches directly involved in the sport, the survey aimed to garner rich, frontline insights into the practicalities of integrating STEAM principles into sailing instruction.

Assessment and Insights from the "Sailing as a STEAM Educational Platform - Survey for Sailing coaches"

The exploration of sailing's potential as an educational tool within the STEAM framework extends beyond the confines of traditional classrooms, engaging sailing coaches in a unique dialogue about its educational viability. In this vein, the "Sailing as a STEAM Educational Platform - Survey for Sailing Coaches" was initiated to garner insights from those with firsthand experience in coaching sailing across various age groups and skill levels. This survey aimed to understand the practical aspects of integrating sailing into STEAM education from the perspective of sailing coaches, who are pivotal in translating theoretical concepts into experiential learning opportunities. The questions focused on the demographics of the coaches, their tenure in sailing instruction, the clubs they are associated with, and the range of ages and skill levels they have coached. This initiative provided a valuable lens through which the feasibility, challenges, and benefits of such an integration could be assessed, directly informed by the experiences and observations of sailing coaches.

Demographics and Background of Respondents

The survey drew responses from sailing coaches across Croatia, Serbia, and Slovenia, presenting a rich tapestry of experiences and backgrounds. These coaches, ranging in age from 25 to 75 years, bring a wealth of knowledge from their tenure in sailing instruction, which varies from 1 to 32 years. Their affiliations span a diverse array of sailing clubs, indicating a broad engagement with sailing at multiple levels of competition and recreation.

Croatian coaches highlighted their experience with age groups from 7 to 27 years, coaching from beginner to Olympic cycle levels, including state champions and medalists at world and European championships.

Their engagement spans from basic to intermediate-advanced skill levels, covering a wide spectrum from pre-school to university-aged students.
Serbian respondents reflected a similarly diverse coaching experience, training children and adults ranging from 6 to 47 years old. Their coaching experience includes working with beginners to national champions, demonstrating versatility in catering to various skill levels from club to national and international competitions.
The two sole respondents from Slovenia reported one a decade and the other 3 of them of coaching experience, working with children and young adults from 6 to 21 years, further enriching the survey's insights into the sailing coaching landscape in the region.

Primary Training Methods and Materials Used in Current Practice

The responses from sailing coaches in Croatia, Serbia, and Slovenia offer a comprehensive view of the diverse coaching methods and materials currently employed in sailing instruction. These insights not only highlight the variety of approaches to teaching sailing but also underscore the blend of traditional and modern techniques in conveying sailing skills and knowledge.

Coaching Methods and Materials by Country

Croatia:

- Video Analysis & Presentations: Croatian coaches extensively use video analysis and presentations, indicating a preference for visual and digital tools in teaching.
- Theoretical and Practical Blend: There is a strong emphasis on combining theory with practical experience, using models such as IOM class yachts to explain sailing concepts.
- On-Water Training: Preferring hands-on experience on the sea, complemented by prior classroom instructions and analyses, suggests a holistic approach to learning.
- Situational Sea Trainings & ISAF Rules: The use of situational training on the sea and adherence to ISAF rules highlights a focus on real-world applications and regulations.

Serbia:

- Diverse Methodological Combination: Serbian coaches combine various methods tailored to different age and skill levels, indicating a flexible and adaptive teaching approach.
- Use of Technology and Practical Experiments: The incorporation of chalkboard drawings, presentations, video clips, and practical experiments reflects a multifaceted approach to instruction.
- Foreign Materials & Personal Contributions: The reliance on foreign materials and personal adaptations, such as a graduate thesis on sailing, shows the effort to contextualise and personalise learning content.

- Peer Exchange & YouTube Tutorials: Engagement with professional literature, online tutorials, and peer exchanges with coaches from neighbouring countries points to a collaborative and continuous learning process.

Slovenia:

- Video Analysis & Visual Aids: Similar to Croatian coaches, the Slovenian approach includes video analysis, whiteboard drawings, and the use of pictures, emphasising visual learning strategies.
- Sailing Strategy and Tactics: The focus on strategy and tactics through specialised books and materials indicates a detailed and analytical approach to sailing education.
- Coaches work individually by own experience and intuition; there is no systemic support in methods or materials. The cause for this is a “very steep pyramid” with several world-class athletes but no broad basis of youth starting with sailing like in more popular sports. So success comes from coaches adopting to individual athletes over longer periods in 1 on 1 training settings and not from systemic work with youth (groups and talent search).

Analysis and Implications

The coaching methods and materials used across these three countries reveal several key trends and implications for sailing instruction:

- Blending Theory and Practice: There's a consistent emphasis on integrating theoretical knowledge with practical sailing experience. This blend is crucial for developing well-rounded sailors who understand both the principles behind sailing and their practical application.
- Visual and Digital Learning Tools: The widespread use of video analysis, presentations, and online resources highlights the importance of visual and digital tools in modern sailing instruction. These tools can enhance understanding and engagement among learners, particularly in a sport where visualising manoeuvres and conditions is vital.
- Personalization and Adaptation: The adaptation of materials (e.g., graduate theses) and the use of diverse teaching methods tailored to different learners underscore the need for personalised instruction in sailing. This approach acknowledges the varied learning styles and needs of individuals.
- Collaboration and Continuous Learning: The exchange of knowledge and methods among coaches and the use of online platforms like YouTube for tutorials reflect a culture of collaboration and continuous professional development among sailing instructors.

Analysis of Training Challenges in Sailing Courses

The survey question aimed at identifying the most challenging concepts to explain in sailing training sessions or courses reveals significant insights into the educational hurdles faced by sailing coaches across

Croatia, Serbia, and Slovenia. These challenges not only highlight the diverse nature of learning difficulties in sailing but also underscore the complexity of translating theoretical knowledge into practical skills, especially for younger sailors.

Croatia

- Sensing Wind and Waves: Croatian coaches find it particularly challenging to impart an intuitive understanding of wind patterns and wave behaviour, especially when sailing downwind. This difficulty underscores the nuanced skills required to navigate natural elements effectively, which often rely on an experiential learning process rather than straightforward theoretical teaching.
- Complex Racing Rules: Explaining the more intricate aspects of racing rules to the youngest sailors presents a notable challenge. This indicates a gap in accessible educational materials or methods that can simplify these concepts for younger audiences.
- Engagement with the Natural Environment: A recurring theme is the struggle to motivate children to appreciate and engage with the physical experience of sailing amidst the distractions of modern technology. This points to a broader societal challenge of reconnecting youth with outdoor activities and the natural world.
- Understanding of Basic Sailing Rules: Even the fundamental rules of sailing can be a hurdle, highlighting the need for innovative teaching strategies that can make these foundational concepts more accessible.

Serbia

- Apparent Wind Perception: The concept of apparent wind is notably difficult to convey, illustrating the complex interplay between natural forces and sailing techniques.
- Visualisation and Execution of Manoeuvres: Translating a planned manoeuvre from concept to execution is a common challenge, emphasising the cognitive gap between understanding a theory and applying it in practice.
- Physical Coordination and Movement: For younger children, motor skills and the physical coordination required in a sailing context pose significant learning barriers, pointing to the need for tailored physical education components in sailing training.
- Wind Direction and Behavior: Educating about invisible elements like wind direction and behaviour is inherently challenging, requiring creative approaches to make these abstract concepts tangible.
- Sail Adjustment Relative to Wind: The intricate relationship between wind conditions and sail adjustments is a complex area, highlighting the sophistication of sailing as a skill that integrates knowledge of natural forces with technical proficiency.

Slovenia

- Mathematics and Physics in Sailing: The Slovenian response uniquely points out the difficulty of explaining mathematical and physical principles, such as angles and the effects of wind shifts, to

children. This challenge reflects a broader educational theme of making STEM (Science, Technology, Engineering, and Mathematics) concepts accessible and engaging to younger students.

- Physical Condition: the older coach pointed out that the physical condition of children coming to train sailing is constantly descending with new generations not capable of doing an appropriate front roll any more (few years ago only the harder, backwards roll was a problem)

Implications and Educational Strategies

The insights from sailing coaches across these three countries illuminate several key areas for educational development within sailing training:

- Tailored Learning Materials: There's a clear need for innovative educational resources that can simplify complex sailing concepts for younger learners, possibly through gamification or interactive learning tools.
- Engagement Strategies: Coaches are challenged to find ways to engage children deeply with the physical and tactical aspects of sailing, suggesting a need for strategies that can compete with the allure of digital entertainment.
- Physical Education Integration: Addressing the motor skills and physical coordination challenges requires integrating specific physical education exercises tailored to sailing into training programs.
- STEAM Integration: The difficulty of teaching mathematics and physics concepts highlights an opportunity for integrating sailing with STEAM education, using practical sailing scenarios to teach abstract principles.

Overall, the survey underscores the multifaceted nature of sailing education, pointing to the need for multidisciplinary approaches that combine physical training, engagement strategies, and STEAM education to overcome the diverse challenges faced in teaching sailing.

Integrating STEAM Concepts in Sailing Training: Coaches' Perspectives and Experiences

The integration of STEAM (Science, Technology, Engineering, Arts, and Mathematics) concepts into sailing training is viewed with varying degrees of importance across Croatia, Serbia, and Slovenia, with coaches sharing a range of experiences and attitudes towards the relevance of these principles in sailing instruction. These insights provide a glimpse into the innovative ways sailing can serve as a multidisciplinary educational platform, emphasising the potential for enriching the learning experience of sailors with a deeper understanding of the underlying scientific principles.

Croatia

- Advanced Sailors: Croatian coaches believe that understanding scientific principles is primarily relevant for advanced sailors. Examples include teaching 12-15-year-olds about sail trimming, lift and drag forces, demonstrating the practical application of physics to improve sailing performance.

- STEM Programs through Sailing Models: Implementation of STEM programs through model sailing projects has been a long-standing practice, illustrating concepts of physics and engineering through the construction and testing of IOM class yachts.
- Collaboration with Academic Institutions: One coach highlighted the collaboration with kinesiology faculties to measure and test children in Optimists and Lasers, emphasizing the importance of STEAM in higher-level training.
- Skills Development and Teamwork: Another approach focuses on developing children's skills and teamwork, comparing sailing tactics to chess and emphasizing the importance of strategic thinking.

Serbia

- Foundational Skills for Children: Serbian coaches often apply STEAM concepts at foundational levels, using practical experiments with model boats to teach young sailors about forces and motion without resorting to complex physics formulas.
- Hydrodynamics and Aerodynamics: The application of engineering and science is evident in the treatment of hydro and aerodynamic surfaces, including polishing boats and adjusting mast angles, demonstrating a deep integration of STEAM principles in sailing.
- Art and Sensory Experience: Some coaches view sailing as an art form, emphasizing the aesthetic and sensory relationship with nature, wind, and competition.
- Advanced Sailors and STEAM Integration: For advanced sailors, detailed examples were provided on integrating aerodynamics, technology in sail design, engineering through prototype creation, and mathematical performance analysis to enhance sailing performance.

Slovenia

- Daily Basis Integration: Slovenian coaches find STEAM concepts useful across all age groups, integrating them into coaching techniques daily. An example given illustrates using the art component by comparing downwind sailing to dancing, highlighting the importance of rhythm and smooth movements akin to a dancer.

Analysis and Educational Strategies

The feedback from sailing coaches across these countries underscores the multifaceted nature of sailing as a sport that seamlessly integrates various STEAM concepts. The degree to which these concepts are emphasised varies, with a general consensus on their increased relevance for advanced sailors. However, even at foundational levels, there are innovative ways to introduce these principles to enhance understanding and performance.

- Adapting to Learner Levels: The complexity of STEAM concepts introduced depends on the sailors' age and comprehension levels, suggesting a tailored approach to education in sailing.

- Practical Application of Science: The practical application of physics, through experiments or real-life sailing scenarios, helps sailors understand the forces at play, enhancing their tactical and technical skills.
- Interdisciplinary Learning: Sailing provides an interdisciplinary learning experience, where technology, engineering, arts, and mathematics converge, offering a rich educational opportunity beyond traditional classroom settings.
- Enhancing Performance through STEAM: For advanced sailors, a deeper understanding of STEAM principles directly correlates with improved performance, emphasising the importance of a comprehensive educational approach.

Vision for Implementing a STEAM-Based Sailing Curriculum

The responses from Croatian, Serbian, and Slovenian coaches provide a clear consensus on the preferred methods for implementing a STEAM-based sailing curriculum. The emphasis is on integrating sailing with the STEAM (Science, Technology, Engineering, Arts, Mathematics) educational framework through both structured educational settings and informal activities. These insights suggest a flexible approach to incorporating sailing into STEAM education, catering to varying educational systems, resources, and geographical contexts.

Common Themes and Proposals:

- Extracurricular Activities: A dominant theme across all responses is the proposition to introduce sailing as an extracurricular activity, either within school environments or through sailing clubs. This approach underscores the recognition of sailing not only as a sport but as a valuable educational tool that can enhance students' understanding of STEAM concepts in a practical, engaging manner.
- Integration into Existing Educational Activities: Particularly noted in responses from Serbia, there's a strong advocacy for integrating sailing-based STEAM education into the existing curriculum. This suggests a seamless blend of sailing with traditional academic subjects, providing a multidisciplinary learning experience that leverages the natural synergy between sailing and STEAM fields.
- Independent Courses: Another suggested avenue is the organisation of independent courses dedicated to sailing within the STEAM framework. This option allows for specialised, intensive learning experiences that can cater to students with a keen interest in both sailing and STEAM disciplines.
- Accessibility and Inclusion: Responses from Serbia specifically mention the importance of making sailing-based STEAM education accessible in regions where geographical conditions permit, such as areas near lakes, rivers, and seas. This highlights a commitment to inclusivity and the recognition of geographical diversity as a factor in educational planning.

Optimal Duration and Timing for STEAM-Integrated Sailing Activities

The responses from Croatia, Serbia, and Slovenia offer varied perspectives on the ideal length and scheduling for activities within a STEAM-integrated sailing program. These insights highlight the need to consider several factors, including age, prior knowledge, and the context of the program (whether it's a one-time course or part of a continuous activity). Balancing these considerations can help in designing a program that maximises engagement and learning outcomes without overburdening participants.

Summary of Recommendations:

- Duration Before or After Sailing: In Croatia, a common suggestion is to schedule STEAM-related activities for 30-45 minutes either before or after practical sailing sessions. This allows for a direct application or reflection on the concepts discussed, reinforcing learning through practical experience.
- Frequency and Length of Sessions: There's a preference for conducting these sessions twice a week for about an hour each or once a week for two hours, especially for younger participants aged 7 to 12. The emphasis is on shorter, more frequent sessions to accommodate the attention spans of younger learners.
- Age-Specific Considerations:
    - For children under 12-13 years, activities should not exceed two school hours with breaks, mirroring their regular school routine to leverage their existing habits for better learning.
    - Adolescents (13-18 years) can handle longer sessions, up to three hours, reflecting their increased capacity for concentration.
    - Adults (18 and older) and high-level sailors might engage in intensive training for up to four hours, but with breaks to maintain focus and effectiveness.
- Factors Influencing Duration:
    - Age Group: Younger children (7-10 years) might best engage with sessions lasting 45 minutes, while older children (10-12 years) can concentrate for up to an hour, and teenagers (12-18 years) for up to 90 minutes.
    - Program Structure: The overall duration of a program could span three months, with activities scheduled weekly. The practical components might be best suited for weekends (up to 3 hours), with theoretical parts and discussions during the week.
- Integration within Existing Training: The Slovenian response suggests incorporating STEAM concepts into regular sailing training sessions, indicating a preference for a seamless integration that complements the practical sailing experience.

Analysis and Recommendations:

The feedback underscores the importance of tailoring the duration and scheduling of STEAM-integrated sailing activities to the specific needs and capacities of different age groups. A flexible approach that considers individual and contextual factors can enhance the effectiveness of the program. Here are some tailored recommendations:

- Customised Session Lengths: Adjusting session lengths according to age and attention span can help maintain engagement and ensure that the material is absorbed effectively.
- Balanced Scheduling: Combining theoretical and practical aspects within the same timeframe (e.g., weekends for practical and weekdays for theoretical) offers a balanced approach that reinforces learning through direct application.
- Continuous Program Design: For long-term programs, a phased approach that gradually increases the complexity of concepts and the duration of sessions can accommodate growing familiarity and engagement with both sailing and STEAM content.
- Integration with Regular Activities: Embedding STEAM education within the existing structure of sailing training can streamline the learning process and enhance the relevance of theoretical concepts by immediately applying them in a practical context.

Identifying the Ideal Educators for a STEAM-Integrated Sailing

The inquiry into who is best suited to teach a STEAM (Science, Technology, Engineering, Arts, Mathematics)-based sailing course elicited diverse opinions from respondents across Croatia, Serbia, and Slovenia. The consensus leans towards a collaborative teaching model that involves individuals with a comprehensive understanding of both sailing and STEAM disciplines. However, preferences vary, highlighting the complexity of effectively integrating these fields into a cohesive educational program.

Summary of Responses

- Sailing Coaches and Experienced Sailors: A common viewpoint is that sailing coaches or experienced sailors possess the practical knowledge and firsthand experience necessary to convey sailing concepts effectively. Their deep understanding of the sport's intricacies allows them to relate STEAM principles to sailing through simple, relatable examples.
- Technical Teachers and STEM Professionals: Another suggested group includes teachers of technical subjects who have a background in sailing or students in advanced stages of studies in physics, mathematics, naval architecture, or computing who also sail. This reflects the belief that a strong foundation in STEAM subjects, combined with sailing experience, is crucial for teaching this interdisciplinary course.

- Collaborative Teaching Teams: The idea of team teaching, involving both a sailing coach and a STEAM expert, emerged as a preferred approach. This model is based on the premise that the complementary expertise of both instructors can enrich the learning experience, providing a balanced perspective that encompasses both theoretical knowledge and practical skills.
- Sailors Nearing the End of Their Competitive Careers: The suggestion to involve sailors transitioning out of competitive sailing into coaching roles underscores a strategy for fostering a new generation of instructors. This approach values the relatability and recent experience of younger sailors in connecting with junior participants.

Requirement for Additional Training: The need for sailing coaches to acquire additional skills and knowledge in STEAM disciplines suggests a recognition of the evolving role of instructors in this integrated curriculum. It points to the importance of continuous professional development to meet the demands of teaching a STEAM-based sailing course.

Analysis and Recommendations

The varied responses indicate a multifaceted approach to teaching STEAM-based sailing courses, emphasising the importance of a diverse set of skills and knowledge. Based on the feedback, several key recommendations can be formulated for implementing such a program:

- Interdisciplinary Teaching Teams: Encouraging collaboration between sailing coaches and STEAM experts can provide students with a comprehensive learning experience that bridges theoretical knowledge with practical application. This model can help overcome the limitations of instructors who may specialise in one area but lack depth in another.
- Integrating Sailing Experience with STEAM Expertise: Instructors with a background in both sailing and STEAM fields are ideally positioned to teach these courses. Educational institutions and sailing clubs might consider developing criteria for selecting instructors that balance these competencies.
- Professional Development for Sailing Coaches: Offering professional development opportunities for sailing coaches to enhance their understanding of STEAM concepts can elevate the quality of instruction. This could involve workshops, courses, or collaboration with educational institutions.
- Leveraging the Potential of Young Sailors: Young sailors transitioning from competitive sailing to coaching roles represent a valuable resource. Their recent experience and ability to relate to younger learners can make them effective instructors, especially if supported by additional training in STEAM education.

In conclusion, the ideal instructors for a STEAM-based sailing course are those who can effectively integrate sailing expertise with a robust understanding of STEAM disciplines. A collaborative approach, involving interdisciplinary teams or individuals with dual expertise, is key to delivering a comprehensive and engaging educational experience. Continuous learning and adaptation are essential for instructors to remain effective in this dynamic field.

Recommended Training Methods and Essential Resources for a STEAM-Integrated Sailing Program

The feedback from Croatia, Serbia, and Slovenia on training methods and necessary resources for a sailing program that incorporates STEAM elements (Science, Technology, Engineering, Arts, Mathematics) provides a wealth of ideas for creating an engaging and educational sailing curriculum. These recommendations highlight the importance of practical applications, the use of technology, and the integration of theoretical concepts to enrich the sailing experience with STEAM learning.

Recommended Training Methods

- Practical Application with Different Sail Trims: Using multiple sailboats that require sailors to adjust and experiment with various sail trims encourages critical thinking about how different adjustments affect sailing performance. This hands-on approach forces learners to apply theoretical knowledge in real-world settings.
- Use of Sailing Models for Theory and Practice: Incorporating models, such as those from the International One Metre (IOM) class, in both theoretical discussions and practical demonstrations helps bridge the gap between abstract concepts and tangible experiences.
- Balanced Theory and Practice: A 50/50 split between theoretical instruction and practical application is suggested to maximise learning. This balance ensures that time spent in the classroom is directly applied in practical settings, reinforcing the interconnectedness of STEAM concepts and sailing skills.
- Competitive and Collaborative Activities: Organising short training courses followed by competitions and long-duration regattas promotes teamwork, strategic thinking, and the application of learned concepts in a competitive environment.

Essential Resources

- Technological Tools: GPS units, compasses, speedometers, cameras, and drones are among the recommended technological tools to facilitate quality analysis and teaching. These tools can enhance the learning experience by providing real-time data and visual feedback.
- Classroom Equipment: Basic classroom resources like whiteboards, projectors, laptops, and educational models are deemed necessary for effective teaching, especially for the theoretical components of the program.
- Simulators and Experiments: The use of simulators and hands-on experiments can simulate sailing conditions and scenarios, allowing for a deeper understanding of sailing dynamics and STEAM principles.
- Specialized Sailing Equipment: Specific boats, such as microtoners or Optimist class boats, are suggested for practical training, catering to various age groups and skill levels.

- Support Vehicles and Transportation: The provision of support vehicles, such as rubber boats with motors and trailers for transporting sailing equipment, is crucial for the logistical aspects of the program.
- Interactive and Visual Learning Aids: Video presentations, interactive experiments, and models are recommended to engage younger participants, making complex concepts more accessible and enjoyable.

Analysis and Recommendations

The combination of hands-on sailing experiences, competitive activities, and theoretical instruction grounded in STEAM principles offers a comprehensive approach to sailing education. This methodology not only enriches the participants' understanding of sailing but also enhances their appreciation and knowledge of the broader STEAM fields.

To implement such a program effectively, a combination of practical sailing equipment, technological tools for analysis and feedback, and classroom resources for theoretical instruction are essential. The integration of these elements can create a dynamic and interactive learning environment that encourages curiosity, critical thinking, and a deeper understanding of the natural and technological world through the lens of sailing.

Investing in both the physical resources and the development of a curriculum that intertwines sailing skills with STEAM education can provide a unique and enriching educational experience. This approach not only prepares participants for the technical aspects of sailing but also equips them with a broader set of problem-solving and critical-thinking skills applicable in various domains.

Evaluation of Ecological and Sustainable Practices at Training Sites

The responses from Croatia, Serbia, and Slovenia provide an insightful perspective on the current state of ecological and sustainable practices within sailing training environments. These responses, rated on a scale from 1 to 5, cover three key areas: recycling and waste management, energy conservation efforts, and the promotion of sustainable practices.

Summary of Ratings

- Recycling and Waste Management:
  - Croatia shows strong performance, with ratings mostly at 4 and 5.
  - Serbia displays a wider range, from a low of 1 to a high of 5, indicating variability in practices across different locations.
  - Slovenia indicates a need for improvement, with a rating of 2.
- Energy Conservation Efforts:

  - Croatia's ratings vary between 3 and 4, suggesting moderate to good practices but room for improvement.
  - Serbia again shows a broad spectrum from 1 to 5, reflecting diverse levels of commitment and implementation.
  - Slovenia, consistent with its recycling and waste management rating, scores a 2, highlighting areas for development.
- Promotion of Sustainable Practices:
  - Croatia demonstrates strong engagement, with ratings primarily at 4 and 5.
  - Serbia's responses range widely from 2 to 5, indicating that while some places are making significant efforts, others lag behind.
  - Slovenia's rating of 2 suggests limited activity in promoting sustainability within the sailing community.

Analysis

The data reveals a notable commitment to ecological and sustainable practices within certain Croatian and Serbian sailing training locations, particularly in promoting sustainable practices and managing waste effectively. However, the variability, especially within Serbia, indicates that the adoption of these practices is not uniform, suggesting potential areas for targeted improvement and increased awareness.
Slovenia's consistent rating of 2 across all categories points to a significant opportunity for enhancing ecological and sustainability initiatives. This could involve adopting more rigorous recycling programs, increasing efforts in energy conservation, and elevating the promotion of sustainable practices through community engagement and educational activities.

Recommendations for Improvement

- Standardisation of Practices: Developing and implementing standardised sustainable practices across all training sites could help improve the lower-rated areas. This might include establishing clear guidelines for waste management, energy use, and the promotion of sustainability.
- Education and Training: Offering educational programs and workshops for trainers, sailors, and staff at sailing centres could raise awareness and understanding of the importance of sustainable practices and how they can be implemented effectively.
- Community Engagement: Organizing community clean-up events, sustainability awareness campaigns, and other activities could enhance the promotion of sustainable practices, fostering a culture of environmental responsibility within the sailing community.
- Sharing Best Practices: Encouraging sites with higher ratings to share their strategies and successes with those scoring lower could facilitate improvement through collaborative learning and support.

The assessment of ecological and sustainable practices at sailing training locations highlights both achievements and areas for growth. By focusing on education, standardisation, and community engagement, sailing centres can enhance their environmental stewardship and contribute to broader sustainability goals.

Interest and Support for STEAM-Integrated Sailing Program Implementation Methods

The responses from Croatia, Serbia, and Slovenia indicate a strong interest and willingness among individuals and organisations to participate in or support the implementation of sailing programs integrated with STEAM (Science, Technology, Engineering, Arts, Mathematics) education. This enthusiasm suggests a recognition of the value that such interdisciplinary programs can bring to sailing instruction and education in general.

Overview of Responses

- Croatia: The responses show a mixed level of commitment, ranging from definitive interest to considerations that depend on further discussions within organisational leadership. Notably, there is mention of existing efforts to expand instructor training and spread the STEAM-integrated sailing program nationally, indicating an active engagement with the concept.
- Serbia: The unanimous "Yes" from all respondents highlights a widespread interest in STEAM-integrated sailing programs across the board. This unanimous support suggests a strong consensus on the potential benefits and a collective willingness to explore or enhance such educational initiatives within the sailing community.
- Slovenia: The straightforward affirmative response indicates a clear interest in participation or support for STEAM-integrated sailing programs, aligning with the general positive sentiment observed in other countries.

Analysis and Implications

The overwhelming interest in STEAM-integrated sailing programs across the three countries underscores a growing recognition of the importance of interdisciplinary education within the sailing community. This enthusiasm can serve as a foundational pillar for the development and expansion of such programs, offering potential benefits such as:

- Enhanced Educational Value: Integrating STEAM principles with sailing instruction can significantly enrich the educational experience, providing learners with a more comprehensive understanding of both sailing and STEAM disciplines.

- Increased Engagement: The innovative approach of combining practical sailing skills with STEAM education could attract a broader audience, including individuals who may not have previously considered sailing as an educational or recreational activity.
- Collaborative Opportunities: The widespread interest creates opportunities for collaboration among sailing clubs, educational institutions, and STEAM professionals. Such collaborations can lead to the development of more robust and diverse programs that leverage the strengths of each participating entity.
- Resource Sharing: Interest from multiple organisations could facilitate the sharing of resources, expertise, and best practices, enhancing the quality and accessibility of STEAM-integrated sailing programs.