RESEARCH ANALYSIS:

gathering good practice on STEM clubs establishement and maintainance within STEMclubs project partners experience

S – Science

T – Technology

E – Engineering

M – Mathematics

www.stemclubs.eu

Written by Justina Pluktaite on behalf of the STEMclubs-Partnership.

STEMclubs partners are:

- Odda upper secondary school (Norway, Odda) (coordinator)
- Srednja škola Dugo Selo (Croatia, Dugo Selo)
- The South Bohemian Company for Development of Human Resources (Czech Republic, České Budějovice)
- Solaris FZU gGmbH (Germany, Chemnitz)
- Piarista Gimnazium, Kollegium, Altalanos Iskola es Ovoda (Hungary, Kecskemét)
- t2i – trasferimento tecnologico e innovazione (Italy, Treviso)
- Střední průmyslová škola chemická Pardubice (Czech Republic, Pardubice)

Co-funded by the Erasmus+ Programme of the European Union

STEMclubs is supported by the European Union's Erasmus+ Programme. The European Commission support for this project does not constitute an endorsement of the contents of this publication or the associated web site, which reflect the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

Table of Contents

INTRODUCTION

Erasmus+ "**Clean, green future through STEM sports clubs**" project is a European partnership of seven VET schools and educational organizations who developed "**STEMclubs**" as a new learning and teaching method for STEM based motivation, orientation, preparation and dropout prevention in VET. It is intended as an ongoing leisure activity, as entertaining as sport for young students aged from 10 up to 18 years. All valuable results will be available for other European regions who face comparable challenges.

Within this research STEMclubs project partners wanted to identify best practices, insights of the situation in each partner organization on how to establish and maintain STEM clubs. In particular, aside to practice information, you will find focus on how to sustain long-term motivation of learners and at the same time club leaders to continue activities related to the STEM.

It is also a part of the project created online STEMclub platform and e-learning training material. Follow for more information in the project website: www.stemclubs.eu

STEM CLUB LEARNERS

STEM CLUB LEARNERS - Czech Republic - Pardubice

Details on the research:

Period: Responses indicate the time and date when each participant completed the questionnaire, ranging from February 8th to February 10th, 2023.

Age: Respondents' ages vary, with options including '15-18' and 'More than 18'.

Gender: The majority of respondents identified as male, with at least one female participant.

REVIEW

Membership in STEM Clubs: Responses indicate a range of involvement in STEM clubs, from 'None' to '2-3' clubs, with some individuals being members of one club.

Interest in STEM Subjects: Participants expressed interest in a variety of STEM subjects, including Biology, Chemistry, Physics, Applied Science, Computer Science, Pharmaceutical Science, and Psychology.

Names of STEM Clubs: Names of clubs mentioned include 'Kroužek praktické biologie', with some respondents unsure of their club's name or mentioning generic names like 'Biology club, Chemistry club'.

Motivation for Joining: Motivations for joining STEM clubs are diverse. One respondent said, "I like new experiments that we don't have time for in normal biology lessons." Another shared a simple reason for their interest: "Its interesting". A more detailed response included the desire for a like-minded community: "Mít skupinu lidí, kteří chtějí debatovat na různá témata" (To have a group of people who want to debate various topics).

Challenges and Barriers: Challenges for long-term involvement in STEM clubs include scheduling conflicts, a lack of time, and the difficulty of remaining in a club due to study location changes. Respondents identified several challenges to staying in a STEM club for an extended period. One mentioned, "Maybe sometimes I already have other plans." Another pointed out logistical issues related to their study: "Je jich podle mě málo. A je těžké zůstat v nějakém klubu v průběhu studia (změna místa studia)." (There are few of them, I think. And it's hard to stay in any club during studies [change of study location]).

Tips for Staying Motivated: Tips include participating in new experiments, enjoying a great crew and a passionate teacher, finding the activities interesting and fun, and valuing the opportunity for discussion and learning new things.

Respondents offered various tips for staying motivated in STEM topics. One suggested, "New experiment, great crew, passionate teacher." Another highlighted the importance of the approach to learning: "For me its more fun, because in normal school subject laboratory, it's more like you must do this and this kind of stuff, in the club its the same BUT, it's more in like a fun way."

Reasons for Potential Loss of Motivation: Potential reasons for losing motivation include scheduling conflicts, time constraints due to club activities ending late, and a lack of time for study due to early school the next day.

Promotion of STEM Clubs: Suggestions for promoting STEM clubs to friends include mentioning it in conversations, sharing experiences related to shared interests in biology or chemistry, and inviting friends to see what happens in the club, both online and face-to-face. One respondent stated, "I occasionally mention it when we have a normal conversation." Another shared a strategy based on shared interests: "It depands on situation, if I'm with friends somewhere and they talk about biology or chemistry, I tell them to try this club, same with online situations."

Other Comments: No additional comments were provided by the respondents in this section.

STEM CLUB LEARNERS – Czech Republic – Ceske Budejovice

Details on the research:

Period: Responses indicate that the questionnaire was completed by participants on November 25, 2022.

Age: All respondents fall within the '15-18' age group.

Gender: All respondents identified as male.

Membership in STEM Clubs: The responses vary, with some participants indicating they are not members of any STEM clubs ('None'), while others are members of 1 club.

REVIEW

Interest in STEM Subjects: Participants showed interest in a diverse range of STEM subjects, including Design and Technology, ICT, Computer Science, Electronics, Psychology, Arts, Maths, Engineering, and various engineering specializations. One participant listed interests that include "Design and technology, Information and communications technology (IT or ICT), Computer Science, Arts," showcasing a blend of technical and creative fields. Another expressed interest in "Computer science, Electronics, Psychology, Arts," further highlighting the diverse interests among participants.

Names of STEM Clubs: The names of STEM clubs provided were quite varied, including specific names like "3D printing and 3D modeling in CAD", while others simply identified as not yet part of the club.

Motivation for Joining STEM Club: Motivations were mixed, ranging from personal interest in hobbies such as "To learn more about my hobby" to non-specific responses like '-', 'Xx', '*', and ' '.

Challenges and Barriers: Identified challenges include lack of time, with one respondent stating, "Time is the biggest barrier.", alongside non-specific responses like '-', 'Don’t know', '*', and ' '.

Tips for Staying Motivated: Tips for motivation in STEM include finding a club that aligns with personal interests and not forcing oneself into activities that are not enjoyable. One respondent advised, "Find your own STEM club that you enjoy, if you don't like it anymore, you can join a different club."

Reasons for Potential Loss of Motivation: Reasons for losing motivation include "Not enough time, loss of interest" and "Not interested in the topic that the STEM club is focused on.", along with non-specific responses.

Promotion of STEM Clubs: Suggestions for promoting STEM clubs to friends include talking about it or sharing sources, as well as sharing experiences within interested communities both online and offline. On promoting STEM clubs to friends, a respondent suggested, "I would probably just talked about it or send them the sources," indicating a casual approach to sharing information about club activities. Another respondent proposed a more proactive approach: "I would share it with the community that is interested in the topic of the STEM club. I would present it online and even offline, I would talk about the actual activities that we do in the STEM club that I enjoy the most," highlighting the use of both online and offline platforms to engage potential new members.

Other Comments: No additional comments were provided by the respondents.

STEM CLUB LEARNERS - Croatia

Details on the research:

Period: The responses indicate that the questionnaire was filled out on November 20, 2022.

Age: The age range of the respondents is '15-18'.

Gender: The gender distribution among respondents includes both 'Ženski' (Female) and 'Muški' (Male).

REVIEW

Interest in STEM Subjects: Interests span a wide range of STEM subjects including Mathematics, ICT, Computer Science, Engineering, and Electronics among others.

Names of STEM Clubs: The names of STEM clubs mentioned include 'Foto-video klub, Robotika' (Photo-video club, Robotics), '3D klub' (3D club), with some respondents indicating they do not belong to any STEM clubs.

Motivation for Joining STEM Club: Motivations include interest in specific STEM fields, desire to travel and meet people from other cultures, and learning new things. Some responses were not specified ('.').

Challenges and Barriers: Challenges include lack of time, too many obligations, and personal problems. Some responses were again unspecified ('.') or indicated no challenges ('Nema').

Tips for Staying Motivated: Tips include engaging in practice, making new acquaintances, seeking out areas of interest, and never giving up. The importance of curiosity and the desire to acquire knowledge were also highlighted. Advice for staying motivated in STEM includes "Praksa, nova poznanstva, znanje" (Practice, new acquaintances, knowledge), emphasizing the value of hands-on experience, social connections, and learning.

Reasons for Potential Loss of Motivation: Most respondents indicated that they would not lose motivation, with some responses left unspecified ('.').

Promotion of STEM Clubs: Suggestions for promotion include sharing online, showcasing works, using social media platforms like TikTok, and talking about club activities and opportunities to bond with others and learn new things.

Other Comments: No additional comments were provided by the respondents.

STEM CLUB LEARNERS - Hungary

Details on the research:

Period: The responses indicate that the questionnaire was filled out on December 12-16, 2022.

Age: The age range of the respondents is '15-18'.

Gender: The gender distribution among respondents includes 3 'Ženski' (Female) and 8 'Muški' (Male).

REVIEW

Interest in STEM Subjects: Interests span a wide range of STEM subjects including:

- 7 students: biology, chemistry
- 3 students: biology, chemistry, math, geography, engineering
- 1 student: math

Names of STEM Clubs: The names of STEM clubs mentioned include 'Foto-video klub, Robotika' (Photo-video club, Robotics), '3D klub' (3D club), with some respondents indicating they do not belong to any STEM clubs.

Motivation for Joining STEM Club: They would like to achieve a higher lever of education, and also to communicate more fluently in English. They really wanted to know more about the subjects that the STEM club presents. They are curious about experiments and facts about them too. They want to meet with new people, learn more about those subjects which they are interested in, and of course improve their English skills. They think they can use the knowledge they get form this club in their future, and they would like to go on as many field trips as possible because they love traveling.

Challenges and Barriers: Time is always a problem. Sometimes maybe you have to study a lot and if you arrive home later then you can study until late at night. Some of them mention that they are lazy and not persistent. Challenges: To get to know as much information as they can. Barrier: Time

New things mostly mean new challenges, that's how they can grow.

Tips for Staying Motivated: Tips include:

- Interesting presentations,experiments, new friends.
- Be open to new things, be curious and explore more of our amazing world.
- Beautiful sightseeing, Free, Entertaining
- Just do your thing it's very interesting, listen to the facts, and enjoy the experiments
- Be persistent; Don't give up; Remember that this program will provide lots of helpful things
- This program helps you improve your skills in those subject which you are interested in; if you work hard, you can go to another country, to take part in a science project; be open to new things
- To begin with, it's really fun and really interesting. The community is really friendly and we have really good conversations. Secondly the field trips have lots of potential although I've never been to one, I look forward to going on as many as I can. Lastly I believe I will be able to use the things I learn here in my further education
- New friends, study tour, knowledge expansion
- Be consistent, have undivided attention and feel good

Reasons for Potential Loss of Motivation: Main reasons were indicating:

- Because we've fallen behind with our studies with the other subjects.

- Like I said before I study until night, so time is a big problem. Or maybe you are tired and can't listen or pay attention. Or maybe that lesson is just not exciting for you

- I get tired easily, and I would lose motivation

- Not having enough time

Promotion of STEM Clubs: There have been several interesting suggesstions how to promote a STEM clubs for friends:

- Our life is in the future and the future is in STEM
- I would share it online, because it is more effective For example: Do you want to participate in a great experiment? Join to us, and have fun with STEM, and you are going to achieve great opportunities
- I would definitely tell them online and in real life too. I would say I enjoy it and we do cool experiments or make interesting presentations to each other
- I would promote it on the internet
- I would share it online, and offline too. I would tell them what we are doing under the flag of the STEM Project. (doing chemical experiments, thinking about what WE can do for our environment... Etc.)
- Offline, showing them a presentation
- I'd tell them my opinion about it. I think that would be enough for the to at least think about coming
- I would promote STEM in person.

Other Comments: No additional comments were provided by the respondents.

STEM CLUB LEARNERS - Italy

Details on the research:

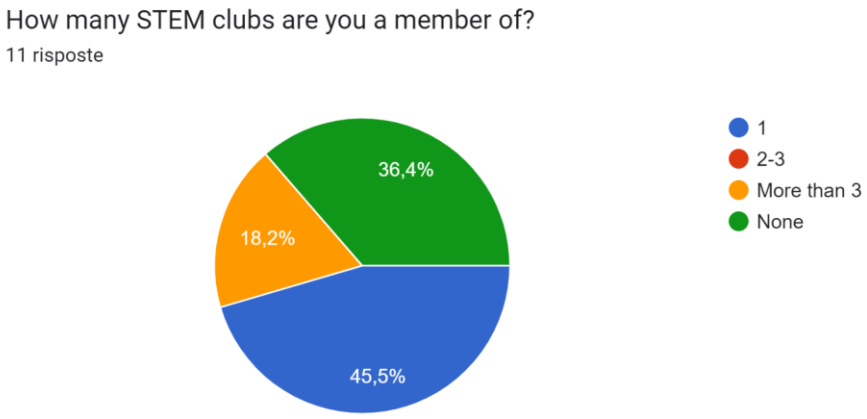
Period: Responses indicate the time and date when each participant completed the questionnaire, ranging from December 7th to February 22nd, 2022.

Age: The students who answered the questionnaire relating to the proposed STEM Clubs experiences are for the vast majority between the ages of 15 and 18 (with a single case of an adult student). Below is a graph showing how many Stem Clubs one is member of:

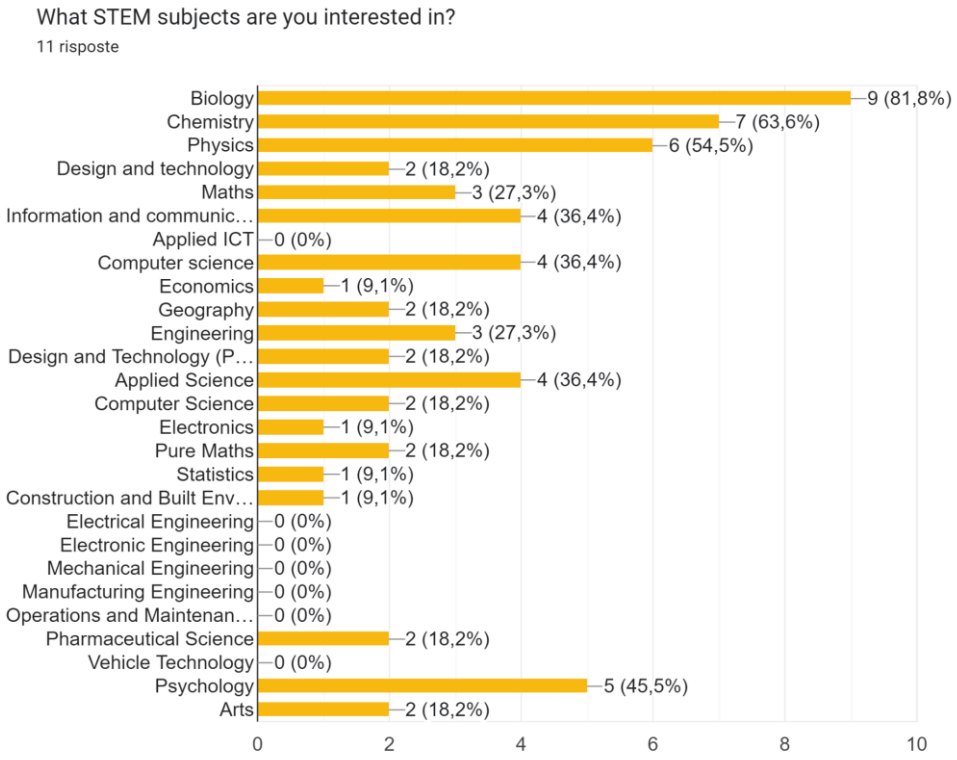
Gender: All of Italian nationality of which: 7 females, 3 males and a student who prefers not to answer the question on gender.

REVIEW

Membership in STEM Clubs: Below is a graph showing how many Stem Clubs one is member of:



This table, on the other hand, summarizes the subjects in which those answering the questionnaire are most interested:



We report the students' answers to the questionnaire keeping their translation in English

Interest in STEM Subjects: Participants expressed interest in a variety of STEM subjects, including Biology, Chemistry, Physics, Applied Science, Computer Science, Pharmaceutical Science, and Psychology.

Names of STEM Clubs: Names of clubs mentioned include 'Kroužek praktické biologie', with some respondents unsure of their club's name or mentioning generic names like 'Biology club, Chemistry club'.

Motivation for Joining: Motivations for joining STEM clubs are diverse:

- I want to found the motivation of everything
- advice from my teacher
- meet new people and speak with them to know their culture
- The willingness to learn about other cultures.
- If the question is why I participated in the week with stem club the answer would it sounded interesting and I was asked to
- The idea of doing something different and the opportunity to see other cultures. This about the C2 mobility Verona project
- I want to learn something interesting
- I want to know other people with my interests and passions
- I wanted to be involved in something practical; I wanted to learn more on the things I am interested in
- I'm interested in funding new ways to reduce plastic production and pollution in the seas
- learning something different and challenging, meeting some of my friends, testing my limits.

Challenges and Barriers: Challenges for long-term involvement in STEM clubs include:

- Passion
- I think nothing because it is a very formative project where you learn many things and know new people
- Being able to coordinate everything and finding intresting topics
- Time management
- I don't know because I'm not in a STEM club but maybe loss of motivation, the people,...
- organization of my homeworks
- I have to deal with my homeworks and general lack of time
- time and distance issues; too many homeworks to do
- It is difficult to find in my area a STEM Club that lasts longer than some weeks. In general, if they are private (not in my school) they are limited to some specific topics and they propose few meetings.
- Time management (a lot of school homeworks to do), I also do sports, I want to meet my friends in my free time.
- There is no knowledge about which STEM clubs are available in my area.

Tips for Staying Motivated: Tips include participating in new experiments, enjoying a great crew and a passionate teacher, finding the activities interesting and fun, and valuing the opportunity for discussion and learning new things.

Respondents offered various tips for staying motivated in STEM topics:

- Never give up
- yeah, join it!
- to speak to other people, be curious of what you are doing and to think that every experience make you growing personally
- Investing into new technologies, finding new solutions and cooperating for a common goal
- Be curious, only this one
- be curiuos, stay with other people, invest into new technologies
- be curious, invest your time in something useful for your job, stay with interesting people
- learn something you like; study some subject matter of the future; stay with interesting people
- you can learn something different from what your teachers do in the classroom. What you do is more practical and you can meet new people that are interested in the same subjects.
- it's fun, you can follow your passion and test yourself (challenge); personal and satisfing challenge , you can see the result

Reasons for Potential Loss of Motivation: Potential reasons for losing motivation include:

- Sometimes I am not able to find a why
- nah
- Maybe one reason is that it takes much time but it is a fantastic experience

- Cause I wouldn't feel motivated
- Time management
- When some subjects are particularly difficult or I don't like the arguments
- lack of time
- my interests could change
- I have to check if I have time enough to do everything; we have a very busy day
- if they become too theorical, like some subjects at school
- logistic problems (I live far from the center); as it is not a job esperience, my parents didn't give it so much importance. I need a car to reach the place or someone that brings me there.

Promotion of STEM Clubs: Suggestions for promoting STEM clubs to friends include:

- Advertising
- a good chance for learning to speak english very well
- I reccomend that offline to my friends because it is an interactive experience where you can learn many things about science and so on.
- I would talk about them in person, so I can explain them better
- More offline, I don't use social media very much. But maybe if I find some interesting news about STEM I share it with my friends. Anyway, more by talking
- I could talk directly with my friends telling them that it is funny and important
- I will post some photos on Instagram
- I will explain that it is important to learn science and its application
- I can ask some friends to come with me and try.
- Posting the outcome on my social "today I've done this"

Other Comments: there were some additional comments:

- I would have liked to do all of the activities at the 331 Verona
- I don't know if I've written right things
- I'd like to participate into more laboratories
- I did enjoy my experience in Verona mobility
- I like to participate in any computer science practical activities
- I would like to do something for climate change, maybe some specific clubs can help.

STEM CLUB LEARNERS - Germany

Details on the research:

Period: Respondents filled out the questionnaire on various dates: 24-30.11.2022.

Age: Respondents range from "11-14" to "younger than 10 years".

Gender: From 15 participants: 14 identified as "männlich / ein Junge" (male / a boy) and one as "weiblich / ein Mädchen" (female / a girl).

REVIEW

Membership in STEM Clubs: Responses indicate a range of involvement in STEM clubs, from 'None' to '2-3' clubs, with some individuals being members of one club.

Interest in STEM Subjects: Interests are diverse, including "Information Technology / Informatics, Electronics, Electrical Engineering" and other fields such as "Chemistry, Physics, Mathematics".

Names of STEM Clubs: Named clubs include "AG Elektronik-Informatik" (Electronics and Informatics Club) and "AG Lego Mindstorms".

Motivation for Joining: Motivations range from "I am interested in it and glad to learn new things among like-minded people" to enjoying "Soldering and technology".

Challenges and Barriers: Challenges mentioned include "Hopefully nothing", "Lack of time due to school", and scheduling conflicts with other activities.

Tips for Staying Motivated: Tips include "Try, try, try", and highlighting the fun aspects of programming and building:

- Continuous Experimentation: A recurring theme in the responses was the importance of trying and experimenting. One participant succinctly advised, "AusprobierenAusprobierenAusprobieren" (TryTryTry), highlighting the value of hands-on experience and learning through doing. This approach encourages active involvement and discovery, which can be highly motivating in STEM fields.
- Pursuing Personal Interests: Another tip centered around following one's interests within the vast array of STEM topics. For instance, "Ići za onime što vas zanima" (Follow what interests you) suggests that staying motivated is easier when engaging with subjects or projects that personally resonate with the individual. This personal connection can fuel a sustained interest and drive to explore deeper.
- Emphasizing Fun and Enjoyment: Some responses focused on the fun aspect of STEM activities, with one participant noting, "Es macht Spaß! Du lernst was! Du wirst schlauer!" (It's fun! You learn something! You become smarter!). Highlighting the enjoyment and personal growth that comes from engaging in STEM can be a powerful motivator, reminding learners that education can be enjoyable and rewarding.
- Leveraging Competition and Collaboration: The idea of participating in competitions or collaborative projects was also mentioned as a way to stay motivated. For example, "Interessant und Teilnahme an Wettbewerben" (Interesting and participation in competitions) points to the excitement and challenge of competing, which can spur individuals to push their limits and engage more deeply with STEM subjects.
- Breaking Down Preconceptions: Encouraging friends to give STEM a chance despite any preconceptions was another tip, "erst probieren um Vorurteile abzubauen" (first try to break down prejudices). This advice suggests that reluctance or lack of interest in STEM might stem from misconceptions, and that direct experience can change one's perspective, leading to greater motivation and engagement.

Reasons for Potential Loss of Motivation: Reasons include "Too little free time due to school", and "Nothing" indicating some participants do not foresee losing interest.

Promotion of STEM Clubs:

- Trial Sessions for School Friends: One respondent suggested offering trial sessions specifically tailored for school friends ("Schnupperstunde für Schulfreunde"). This approach allows potential new members to experience the club's activities firsthand, making it easier for them to decide if they want to join based on their interest and enjoyment.
- Use of Social Media: Another participant mentioned utilizing social media platforms like WhatsApp to spread the word about the club ("WhatsApp oder Schule"). This method leverages the widespread use of social media among young people to reach a broader audience quickly.
- Spectacular Videos of Programmed Robots: A respondent proposed creating and sharing spectacular videos showcasing programmed robots, which could capture the excitement and possibilities within the club ("spektakuläre Videos von programmierten Robotern"). Videos can be a powerful tool to visually demonstrate the club's projects and achievements, making it more appealing to potential members.
- Offline Presentations and Discussions: Another method mentioned was presenting the club and its activities offline, through direct conversations and presentations ("Offline vorstellen und reden"). This personal approach allows for immediate feedback and interaction, making it a compelling way to engage potential new members.
- Open House Days with Cool Programs and Projects: One suggestion involved organizing open house days or events where cool programs and projects are showcased ("Schnupperstunde/Tag der offenen Tür mit coolen Programmen und Projekten um Interesse zu wecken"). Such events provide an immersive experience, allowing guests to see the club's work up close and interact with current members.

Other Comments: No additional comments were provided by the respondents in this section.

STEM CLUB LEARNERS – SUMMARY

The responses from STEM club learners across the Czech Republic (Pardubice and Ceske Budejovice regions), Croatia, Hungary, Italy, and Germany provide insightful snapshots into the experiences and perspectives of students engaged in STEM-related extracurricular activities. Here's an overarching summary that highlights key findings and compares insights across these diverse geographic regions:

Demographics and General Involvement

Age Groups: Most respondents fall within the 15-18 age range, indicating that high school students are the primary participants in STEM clubs.

Gender Distribution: There's a notable male predominance in STEM club participation, with exceptions in some countries like Italy, where a more balanced gender distribution or even female predominance is observed.

Membership and Interests

STEM Club Participation: Membership ranges from no involvement to participation in multiple (2-3) clubs, reflecting varying levels of engagement among students.

Subject Interests: Students express diverse interests across traditional STEM fields like Biology, Chemistry, Physics, and Computer Science, extending into applied sciences, engineering specializations, and even incorporating creative fields like Arts and Design in some cases.

Motivations for Joining STEM club

Personal Interest and Curiosity: A strong personal interest in STEM subjects and a desire for hands-on experiments and new experiences are common motivators.

Community and Learning Environment: Many students are drawn to the community aspect of STEM clubs, seeking a group of like-minded individuals for discussion and collaborative learning.

Educational and Career Aspirations: Some learners are motivated by the potential educational and career benefits of deepening their STEM knowledge and skills.

Challenges and Barriers

Time Constraints: The most frequently cited challenge across regions is the conflict between club activities and other academic or personal commitments.

Accessibility and Awareness: In some areas, the lack of available clubs or awareness of existing clubs poses barriers to participation.

Staying Motivated

Engagement in Activities: Fun, interesting, and varied club activities that differ from standard classroom learning are key to sustaining student interest.

Social and Community Aspects: The social environment of the club, including peer interaction and mentorship opportunities, plays a significant role in maintaining motivation.

Promotion of STEM clubs

Word-of-Mouth and Personal Recommendation: Sharing personal experiences and discussing club activities within peer networks are common promotional strategies.

Utilization of Digital Platforms: Online platforms, social media, and school networks are utilized for club promotion, with variations in effectiveness across different regions.

Unique Regional Insights

Croatia and Hungary: Show a focus on specific technology and engineering fields, with clubs centered around robotics and 3D printing.

Italy: Demonstrates a broader integration of STEM with creative fields and an emphasis on practical applications for addressing real-world issues, such as plastic pollution and climate change.

Germany: Highlights a younger demographic with interests in Information Technology, Electronics, and hands-on activities like soldering and programming.

Overall Observations

Across all regions, the intrinsic interest in STEM subjects, the desire for a collaborative and engaging learning environment, and the pursuit of personal and professional growth emerge as universal themes driving student participation in STEM clubs. Challenges related to time management and accessibility require creative solutions, while the promotion of clubs relies heavily on personal interactions and increasingly, digital platforms. The diversity in club themes and activities underscores the multifaceted nature of STEM education and its ability to cater to a wide range of interests and aspirations.

Recommendations

Based on the comprehensive overview of STEM club learners' responses across STEMclubs project partners countries, here are some tailored recommendations to enhance STEM club participation, engagement, and overall effectiveness:

ENHANCING ENGAGEMENT AND PARTICIPATION

Broaden Club Accessibility:

- Increase the visibility and awareness of STEM clubs through school assemblies, open days, and digital platforms like school websites and social media.
- Establish partnerships with local organizations, libraries, and community centers to host STEM club activities and reach a wider audience.

Diversify Club Offerings:

- Integrate interdisciplinary subjects that blend STEM with arts, design, and humanities to attract a more diverse group of students with varying interests.
- Regularly update club activities to include cutting-edge topics in technology and science, ensuring content remains fresh and relevant.

Flexible Scheduling:

- Offer sessions at various times, including weekends or during school holidays, to accommodate students' busy schedules.
- Implement a hybrid model with both in-person and online activities to provide flexible participation options.

SUSTAINING MOTIVATION

Student-Led Projects and Clubs:

- Encourage students to propose and lead their own projects or even specific sessions, fostering a sense of ownership and leadership.
- Create a mentorship program where older or more experienced students guide newcomers, enhancing peer learning and community feeling.

Showcase and Celebrate Achievements:

- Organize annual showcases where students can present their projects to peers, parents, and the local community, celebrating their hard work and achievements.
- Participate in regional, national, or international STEM competitions to provide students with goals and recognition for their efforts.

Real-World Connections:

- Collaborate with local businesses, universities, and professionals to provide workshops, guest lectures, and site visits, linking club activities to real-world applications and career opportunities.
- Engage students in community service projects that utilize STEM skills to solve local problems, emphasizing the societal impact of their work.

PROMOTING STEM CLUBS

Leverage Social Media and Digital Platforms:

- Create engaging content such as videos, tutorials, and success stories to share on platforms popular among students, like Instagram, TikTok, and YouTube.
- Utilize school digital platforms and email newsletters to regularly highlight club activities and achievements.

Inclusive and Targeted Recruitment:

- Conduct targeted outreach to underrepresented groups in STEM fields, including girls and students from diverse backgrounds, to foster inclusivity.
- Implement buddy systems or introductory sessions for new members to make the club environment welcoming and less intimidating for newcomers.

Community and Parental Involvement:

- Involve the wider community and parents in club activities and showcases, increasing visibility and support for the club.
- Organize workshops or sessions for parents and community members to learn about STEM alongside students, fostering a supportive STEM culture.

By implementing these recommendations, STEM clubs can become more accessible, engaging, and relevant to students' interests and aspirations, ultimately fostering a vibrant and inclusive STEM community that nurtures future innovators and problem-solvers.

CLUB LEADERS

This questionnaire was seeking to understand different aspects of how educational clubs are run, the challenges they face, and the strategies employed for their success within the partner country organisations contexts.

STEM CLUB LEADERS - Czech Republic

Details on the research:

It includes overal both partners: České Budejovice and Pardubice regions.

Number of responders: 3

Timestamp and Country: Conducted in February 7th 2023 in the Czech Republic, Pardubice region.

Organisation's Type: Respondents identify the type of organization they represent, with all sample entries indicating "School."

Organisational Role: Details the role of the respondent within their organization, such as "Teacher at school" and "Enthusiast volunteer."

Experience in Field: Inquires about the respondent's experience in their field, with answers ranging from "1-3 years."

REVIEW

Number of Clubs Run: Asks how many clubs the respondents run, with answers varying from "1" to "2-3."

Club Description: Requests a brief presentation of the club(s) the respondent is involved with, mentioning themes like "Chemistry STEMclub" and "Critical thinking club."

Financial Scheme: Queries about the financial mechanisms supporting the clubs, with some respondents stating they have no current funding, while others mention various funding sources. The financial support for the clubs seems varied, with one respondent admitting, "I dont have any, right now" and another mentioning "Our club is funded by school, parents and local sponsors."

Club Activities and Outcomes: Seeks information on the types of activities undertaken by the clubs and their outcomes, with responses highlighting diverse activities from practical biology to critical thinking exercises, such as "We focus on real life problem solving with maths and physics" and "Students are more motivated to learn new things."

Training and Development Opportunities: Probes for details on training and professional development opportunities available to the respondents, with varied answers indicating the availability and nature of such opportunities.

Collaboration and Networking: Asks about collaboration and networking practices, with answers pointing to interactions with universities, local communities, and other organizations.

Success Metrics: Inquires about how success is measured within the clubs, with responses mentioning student participation, skill development, and achievements in competitions.

Challenges and Motivations: Looks into the challenges faced by respondents and their motivations, citing time constraints, recognition, and student engagement as common issues.

Exemplary Achievements: Requests examples of significant achievements or successful initiatives, with entries highlighting impactful student projects and participation in practical activities. Examples of achievements include "Students who are working on our university cause our projects" and "chemistry club - students on our chemical school solving real life chemistry problem."

Mentoring and Peer-Learning: Questions the use of mentoring or peer-learning methods, with mixed responses on their implementation. The use of mentoring varies, with one respondent stating "No" and another explaining "Yes, I have two students who are now leading in some projects."

Attracting Learners: Asks about strategies to attract learners to the clubs, with techniques ranging from word-of-mouth to formal invitations and social media, including "I let members talk about it" and "Every year from September I inviting our new students to our club."

Effective Advertisement: Queries which types of advertisement have been most effective, with answers including email communication and personal experiences.

Organisational Key Points: Seeks the listing of three crucial points for the organization's operation, with responses emphasizing organizational skills, student motivation, and leadership support.

STEM CLUB LEADERS – Croatia

Details on the research:

Number of responders: 4

Timestamp and Country: Conducted in February 7th 2023 in the Czech Republic, Pardubice region.

Organisation's Type: All respondents represent "Strukovna škola" (vocational schools).

Organisational Role: Each respondent identifies as a "Nastavnik u školi" (Teacher at school).

Experience in Field: Responses vary, with one stating "Novi sam" (I am new) and the others indicating "1-3 godine" (1-3 years) of experience.

REVIEW

Number of Clubs Run: Responses include "Ništa" (Nothing), indicating no clubs currently led, and others stating they lead "1" club.

Club Description: Descriptions vary from hopes of leading a club soon to clubs focused on making devices from idea to implementation, 3D printing for high school students, and activities aimed at high school students without specifying details.

- Respondent 1: Expressed an aspiration rather than a current reality, with a response indicating a hope to lead a club soon: "Nadam se uskoro voditi jedan" (I hope to lead one soon).
- Respondent 2: Provided a description of a club focused on creating various devices from conception to completion. The response highlights a hands-on, project-based approach: "Klub gdje se izrađuju razni uređaji od ideje do realizacije." (A club where various devices are made from idea to realization.)
- Respondent 3: Described a club dedicated to 3D printing aimed at high school students. The club seems to focus on the technical and creative aspects of 3D printing: "Klub 3D print je namijenjen srednjoškolskim uzrastima." (The 3D print club is intended for high school ages.)
- Respondent 4: Mentioned activities targeted at high school students without providing specific details about the club's focus or projects: "Ciljna skupina su učenici srednje škole, a aktivnosti su im..." (The target group is high school students, and the activities are...).

Financial Scheme: Answers range from "/" (indicating no answer or not applicable), voluntary work, using school resources like 3D printers, to having no costs currently but plans to seek sponsorships if needed.

Personal Motivation for Organizing a STEM Club: Responses include personal development, making a positive change, providing opportunities for students, and the joy of working with children and young people.

Organization's Reason for Organizing a STEM Club: Responses highlight the importance of following trends, preparing students for the future, and the personal motivation of the respondents aligning with the organization's goals.

Motivation to Continue Club Leadership: Respondents mention the significance of seeing results, student interest, personal satisfaction, and the club's success in motivating them to continue.

Tools or Methods to Motivate Students for Long-Term STEM Engagement: Methods include setting clear goals, engaging in interesting projects, creating a positive atmosphere, and ensuring students work on tasks they enjoy.

Challenges and Motivations: Identified challenges include the variety of interests among students, the need for continuous engagement and interesting projects, and external factors like other obligations and social media distractions.

Example of a Student with Long-Term STEM Motivation: Descriptions include students who have continued their interest in STEM beyond the club, showing dedication and achieving significant results.

Mentoring and Peer-Learning: Responses indicate the use of group work, peer learning, and direct involvement of students in leading certain activities within the club.

Attracting Learners: Strategies include using the Teams network, direct advertising, involving students at the beginning of the year, and announcements on the school's social media.

- Respondent 1 uses the "Teams mreža" (Teams network), likely referring to Microsoft Teams, as a platform to connect with students and possibly to share information or announcements about the club. This approach suggests a reliance on digital communication tools that are already in use within the school environment.
- Respondent 2 mentions "Direktno oglašavanje" (Direct advertising) as their method. This could involve direct communication with students, such as personal invitations, announcements in classes, or posting flyers around the school, to generate interest in the club.
- Respondent 3 describes a proactive approach by involving students at the start of the year, possibly through introductory sessions or demonstrations: "Na početku godine uključim učenike u 3D klub prezentacijom i demonstracijom" (At the beginning of the year, I involve students in the 3D club with presentations and demonstrations). This method likely helps to spark interest by showcasing what the club does and what students can learn or achieve by joining.
- Respondent 4 uses "Objavom na društvenim mrežama škole" (Posting on the school's social media), indicating the use of the school's social media platforms to reach out to students. This method can be effective in quickly disseminating information and engaging students who frequently use social media.

Effective Advertisement: Visual demonstration methods, addressing specific student interests, utilizing Teams as a platform available to all students, and the school's social media, especially Instagram, are cited as effective.

Organisational Key Points: Points include involving gifted students, providing real-world problem-solving opportunities, developing intellectual abilities, and ensuring interesting and engaging activities for the students.

STEM CLUB LEADERS – Hungary

Details on the research:

Number of responders: 2

Timestamp and Country: Conducted in January 10th – 15th 2023 in the Hungary.

Organisation's Type: Respondents identify the type of organization they represent, with all sample entries indicating "School."

Organisational Role: Their roles include "Iskolában tanító tanár, Egyéb" (Teacher at school, Other) and "Iskolában tanító tanár" (Teacher at school).

Experience in Field: One respondent has "Több, mint 6 év" (More than 6 years) of experience, while the other is "Még új vagyok ebben" (I am still new to this).

REVIEW

Number of Clubs Run: The responses include 1 "2-3" and 1 "1".

Club Description:

We run a program supporting talented children aged about 15-16. We have 90-minute laboratory projects with science experiments every week and we take the gifted pupils on educational trips. At the end of the program we organize a talent day for their peers in the school and an interactive program for families.

The National Talent Programme (NTP) has been running in our institution since 2016, with 10 students participating every year from grade 10. The programme covers complex science skills in 2 lessons each week. The activities have a fixed theme.

LabTour is an optional activity aimed at introducing students to and using the IT tools of the Öveges Students' Lab, such as 3D printer, Dobot, etc. The activity is usually attended by 3-4 students from grades 10-11. There is no fixed theme for the session.

Financial Scheme:

The NTP programme is supported by a grant from the Ministry of Culture and Innovation.

The LaborTour is run on a voluntary basis.

Personal Motivation for Organizing a STEM Club: Giving an opportunity for the talented students to have extra time in the science lab. They are happy with it and improve their skills and abilities a lot.

My aim is to promote and encourage the study of science and to nurture talent. Lab exercises give a high level of knowledge and use of lab equipment.

Through experimentation, students gain practical experience, and what they have learned in theory they can see and understand better in small experiments, which is motivating for them, and for me.

Organization's Reason for Organizing a STEM Club:

To take care of the gifted and talented students.

The Piarist School has always been strong in science education, and the institution aims to maintain this.

Among other things, to broaden students' horizons and provide them with multi-disciplinary/interdisciplinary training.

Motivation to Continue Club Leadership: Science tenders are a great opportunity not only for students, but also to improve the school's laboratory equipment. The tenders help us move towards digitalisation.

I'm motivated by education, and students with learning difficulties and gifted students can benefit from the work done in the lab.

Tools and methods for long lasting motivation of students:

- hands-on experiments, field trips, opportunity to present their work, real life experience in connection with science and technology

- Students will benefit from the lab exercises at university or in connection with a laboratory project. The NTP is built into the students' timetable, so it does not take up their afternoon.

- In addition to lab exercises, there are related field exercises, field trips, exhibitions, projects and presentations.

Challenges and Motivations:

- Very little time for this activity because of other responsibilities at work.

- Teachers are overburdened, teaching long hours. Science teachers do not have time off to set up experiments lesson by lesson. No adequate pay, teachers burn out quickly.

- Lack of time, lack of moral and material dignity in the teaching profession.

Exemplary Achievements:

Learners with a strong interest and a drive to know more and more can maintain a long term motivation.

One of our students participated in the NTP programme, taking part in a short-term mobility in Salzburg for biology. He achieved good results in biology competitions. He is currently studying pharmacy in Szeged.

Mentoring and Peer-Learning:

We use peer-learning methods. Students always work on projects in groups.

As part of the NTP programme, we try to pay more attention to students and talk to them regularly about their plans.

Attracting Learners: Talent day, Researchers' Night. Email, advertised in class

Effective Advertisement: Queries which types of advertisement have been most effective, with answers including email communication and personal experiences.

3 main crucial points why STEM club would become sustainable in a long period:

Motivated teachers, professional respect, adequate financial background

Continuous development (curricula, tools), involving new areas and people.

STEM CLUB LEADERS - Italy

Details on the research:

As regards the STEM Club experience carried out in schools, the target groups are the boys and girls of the school itself, involved in afternoon workshops. The declared aim is to create moments of awareness in extra-curricular activities to bring students closer to innovative and digital subjects and to support the orientation activity in choosing the most suitable training curriculum or professional path.

The activities allow you to experiment with innovative methodologies aimed at identifying innovative solutions in groups, such as service design laboratories, or the Forth methodology for generating ideas.

The teachers and pupils who participate thus have access to new techniques and methods, which they do not encounter in the standard school curriculum.

The key points for the success of the projects are: the awareness of the students, the internal coplanning and the support of the students in the various phases.

Number of responders: 4

Timestamp and Country: Conducted in December 5th – 6th 2022 Italy.

Organisation's Type: The respondents represent either schools or private companies.

Organisational Role: The backgrounds of the respondents vary from school teachers to company workers and others.

Experience in Field: The experience levels range from 1-3 years to 4-6 years.

REVIEW

Number of Clubs Run: Responses vary from running 2-3 clubs to more than 3 clubs.

Description of the Clubs:

- Personalized Guidance: One club emphasizes personal involvement by educators, like Giovanni Scardoni, suggesting a focus on tailored instruction and mentoring to meet individual student needs and interests in STEM.
- Student Involvement: Another club highlights sensitizing students to STEM and involving them in co-designing activities, indicating an interactive and participatory approach where students contribute ideas and help shape the club's direction.
- Curriculum Design: This club focuses on designing engaging content and implementing it effectively, pointing towards a structured educational experience with hands-on projects and activities that bridge theory with practical application.
- Comprehensive Management: The last description outlines a club that not only focuses on STEM education but also on organizational and technical aspects, ensuring smooth operations and enabling complex projects requiring advanced coordination and technical skills.

Financial Scheme: From an economic/financial point of view, the school makes part of the resources available to cover the hours of work in which the teachers are directly involved with the students; the school also covers the cost of materials and other miscellaneous expenses. From the point of view of the teachers involved, the coordination part is not remunerated. In the opinion of some of them, it would be desirable that part of the coordination, organizational and awareness-raising activities of the boys and girls be remunerated, given that they are time-demanding activities.

Personal Motivation for Organizing a STEM Club:

- The possibility of providing boys and girls with opportunities to experiment with STEM activities that they could not do in the classroom

- It is an opportunity to 'raise their heads' and encourage the level of involvement of boys and girls
- To feel useful for their students
- Intellectual and professional curiosity
- Attention to all the news
- Explore new areas in the management of working groups
- Activation on the territory with an attempt to involve local administrations (municipalities) and citizens of unusual age groups (elderly).

Organization's Reason for Organizing a STEM Club:

- The school has a lot of demand for extracurricular activities, from local institutions and associations.
- The school adheres more easily to initiatives foreseeing a limited duration in time: in this way it is easier to involve the students.
- The school carries out robotics, computer science and physics laboratories because it is having a good adhesion of students on STEM subjects.
- The school is interested in bringing young students closer to innovative technological environments.
- Doing difficult things as a team helps to do them better.
- For the dissemination of technical issues, to encourage the creation of new technological companies
- and to increase the number of possible users of the services of innovative companies in the area.

Motivation to Continue Club Leadership:

- The presence of financial coverage – being able to achieve something that cannot be achieved in the classroom, with the many hours of frontal lessons school.
- Delving into innovative topics in working hours that are paid extra
- the Stem Club encourages you to be increasingly innovative and to explore new approaches.
- Working in a Stem Club is a continuous enrichment and an observatory on realities economic and social aspects of the area
- To encourage the development of the area where I live and for the possibility of seeing a more digital culture born in my area - because I'm paid extra

Tools and methods for long lasting motivation of students:

- In this post-COVID period, kids need more concreteness and with the Stem Clubs they can check how to put their skills into practice. Children lack "real life": it is necessary to help participants deal with STEM subjects and with the demands of companies that expect certain skills from them. In other words, it is necessary to show how laboratory activities and experimentation are a real thing, which allows them to get involved.
- Make them understand that technical and digital skills are necessary for their professional life.
- Children fear the skills gap they may experience when they leave school. By also involving
- companies in the Stem Club, an attempt is made to include dual activities, specific needs to be met, even if it is often difficult.
- Intrigue the kids, making them protagonists with the possibility of having credits
- The projects, in addition to being short, must be targeted in content and close to the interests of the participants.
- The presence of financial coverage – being able to achieve something that cannot be achieved in the classroom, with the many hours of frontal lessons school.
- Delving into innovative topics in working hours that are paid extra - the Stem Club encourages you to be increasingly innovative and to explore new approaches. - working in a Stem Club is a continuous enrichment and an observatory on realities
- Set intermediate activities and goals in each workshop to stimulate involvement and a sense of self efficacy, both as individuals and as work groups

- To obviate the risk that "the usual students" always participate, it is necessary to try to reach other boys and girls as well, to reach the largest audience of interested parties
- Showing how they can make their technological passions models of business

Challenges to retain student's motivation:

- A big challenge is that the pupils remain interested in long or dilated activities in the time course: medium / short-term activities and interventions are required.
- The projects, in addition to being short, must be targeted in content and close to the interests of the participants
- Need for the involvement of the children with practical activities, trying to clarify the objective, its usefulness and its effects/advantages for the children
- We must try to reconcile the school commitment with the calendar of meetings afternoons of the innovation lab
- A critical point is that the student workgroup is not stable, resulting in loss of motivation and sense of belonging to the group

Challenges to retain your motivation being a club leader:

- The economic motivation is important to cover at least part of the investment time
- The support from the school is essential to maintain a strong motivation over time of the staff who collaborate in the various activities of the STEM clubs
- There are often too many overlapping commitments for teachers, even difficult to forecast
- The composition of the working group must be consistent with the challenge of the project. Sometimes the group is lacking in knowledge and skills and this makes the job frustrating for everyone.
- The involvement of territorial stakeholders: it takes commitment to obtain the necessary support. Sometimes there is little support from local authorities, who don't take the opportunity.
- The lack of a practical result of the work: if I participate in a STEM laboratory I would like to "create" or "see" something created

Exemplary Achievements:

- Very often the same group of male and female students join STEM initiatives. This denotes a certain personal maturity, a greater awareness of the objectives of these initiatives, which have an orientation and professional impact, even for those of them who will continue with their university choice.
- One group worked each time at a student's home and gave their best with great enthusiasm
- A retired lady who tried to participate throughout the process by getting involved with the boys and bringing her point of view

Mentoring and Peer-Learning:

- For each workshop there is an agenda with moments of sharing, moments of individual work, intermediate outputs and energizers to keep attention high.
- In the service design workshops created with t2i, the facilitator had the students work both in small groups and in plenary, on very concrete tasks for the conception and evaluation of potential solutions. Some of the tools used were Trello and PowerPoint presentations
- In particular, many boys were particularly motivated to work on Trello.
- The moments of strong involvement are important, such as the initial and final presentation of the project output by the students.

Attracting Learners:

- As far as the involvement of the children is concerned, it is necessary to propose activities that they cannot actually do alone and for which a group workshop is needed. The seminar / workshop formula sometimes doesn't work because the kids are already overloaded with proposals. The boys must see what 'work' means and have concrete experiences, such as dual ones; in this way you can "get your hands dirty". It would therefore be desirable to

integrate STEM laboratory activities with dual experiences, perhaps with the interest of partner companies.
- Word of Mouth is a channel that still works very well. The presentation of the workshops in plenary to all the students also worked, so that they can learn about the activity and decide whether and how to participate.
- Facebook had little impact.

Effective Advertisement:

- As far as the promotion of activities is concerned, the most popular members are those that are reached through word of mouth.
- Direct testimonials from students and teachers who have already participated in previous similar experiences.
- School circulars are also an effective tool
- Word of mouth among local groups (Whatsapp, etc.)

3 main crucial points why STEM club would become sustainable in a long period:

Create a virtuous circuit between school-companies-community with multiple levels of approach.

- Basic level: repeat what was done in the innovation lab. Intermediate level: follow up of the various projects developed. High level: creation of ad hoc projects with local stakeholders.
- Long-term activities are supported if there is a working group of teachers and tutors who share the problems.
- From an economic point of view, the financial involvement of companies or the willingness to engage in dual activities.
- The involvement of several schools in the network. Involvement of local and private associations interested in intercepting young people and disseminating technical aspects to increase the number of possible customers.

STEM CLUB LEADERS – Germany

Details on the research:

Number of responders: 2

Timestamp and Country: Conducted in November 1st -15th 2022 in the Germany, Chemnitz region.

Organisation's Type: Respondents identify the type of organization they represent, with all sample entries indicating "School."

Organisational Role: The first respondent represents a private company, while the second is involved in a voluntary capacity.

Experience in Field: The first respondent is employed in a company or other organization, with 4-6 years of experience in STEM activities, engaging in 2-3 STEM activities for children/youth. The second respondent is involved in voluntary work, with more than 6 years of experience, and engages in 1 STEM activity.

REVIEW

Club Description: The first respondent mentions two groups: one focused on programming Lego robots with the goal of participating in the World Robot Olympiad, targeting 9-13 year-olds; the other involves programming with Lego robots, Arduino, 3D printing, and digital media, aimed at 7th and 8th graders (approx. 13-15 year-olds). The second respondent's group focuses on supporting interested and talented students in electronics, computer technology, and informatics through projects, including annual specialized camps, for students in grades 5-12.

Financial Scheme: The first respondent utilizes grants and participation fees, while the second uses a monthly parental contribution, cooperation with solaris FZU gGmbH, and partially prize money.

Personal Motivation for Organizing a STEM Club:

The first respondent is motivated by the desire to show that STEM can be enjoyable and necessary, countering the perception of STEM as annoying and unnecessary among children and youth. The second respondent, having been a participant in the STEM group as a child, finds it sensible to excite children and adolescents about technology and to pass on knowledge.

Organization's Reason for Organizing a STEM Club:

The first respondent states that their organization is a STEM institution aiming to inspire children and youth in STEM, partly due to the acute shortage of skilled workers in the STEM field. The second emphasizes long-standing work with children and youth, projects for career orientation, and the support of competition entries, such as "Jugend forscht.".

Motivation to Continue Club Leadership:

For the first respondent, motivated participants, the availability of rooms and materials, substitutable guidance partners, and compensation for expenses are key factors. The second values interesting, practice-related tasks or projects that result in usable products, like a plant pot that sends emails when the soil is dry.

Tools and methods for long lasting motivation of students:

The first respondent uses interesting topics without lengthy lectures, trial offers during holidays to attract new participants, and goal-setting. The second emphasizes varied tasks, a sense of achievement through functional electronics projects, the differentiation from regular classes, exciting company excursions, and special camps.

Challenges to retain student's motivation:

The first respondent identifies leisure activities competing with STEM, the increasing difficulty and time requirement of schoolwork, and friendships leading to new hobbies as challenges. The second notes the time commitment, difficulty in recruiting new members for the group, and waning interest from children and youth.

Challenges to retain your motivation being a club leader:

The first respondent lists participant recruitment, professional development leading to less time, and voluntary activities as challenges. The second points out the time commitment, difficulty in finding new members, and decreasing interest among children and youth.

Exemplary Achievements:

The first respondent shares a story of a child who stayed with the program through COVID-19 disruptions and regained motivation with a clear plan and goals. The second emphasizes the AG's concept where children join in 5th grade and stay until the end of their schooling, thus maintaining long-term involvement.

Mentoring and Peer-Learning:

The first respondent confirms that experienced participants support new ones with their knowledge and experiences. The second does not mention using such methods.

Attracting Learners:

For recruiting participants to their STEM activities, the first respondent utilizes a mix of modern and traditional methods. They capitalize on online visibility by advertising trial offers during holidays on their organization's website, ensuring a digital footprint that attracts potential participants. Word-of-mouth recommendations play a significant role in their strategy, leveraging the personal networks of existing members to bring in new faces. This grassroots approach is further enhanced by encouraging children to bring their friends to sessions, fostering a community-driven growth model. Through these channels, the respondent effectively reaches out to a wider audience, both within and outside their organization, to sustain and expand their STEM initiatives.

Effective Advertisement:

To attract participants to their STEM activities, the first respondent emphasizes the effectiveness of "Schnupperangebote in den Ferien welche online auf unserer Internetseite beworben werden" (trial offers during holidays advertised online on our website) alongside "Mund-zu-Mund-Propaganda" (word-of-mouth advertising). These methods, combining digital outreach with personal recommendations, enable them to effectively reach a broad audience and maintain engagement in their programs.

3 main crucial points why STEM club would become sustainable in a long period:

The first respondent highlights three essential factors for the long-term sustainability of a STEM club: maintaining a consistent team of instructors to avoid overwhelming children with changing teaching styles, ensuring secured funding for materials to facilitate continuous learning, and the constant recruitment of new participants to fill any vacancies. These elements are critical in creating a stable and engaging environment that encourages ongoing participation and interest in STEM activities, ultimately contributing to the club's longevity and success.

STEM CLUB LEADERS – Norway

On the time of the research Norwegian partner – Odda vgs – still did not have any experience with STEM clubs. Overall it is reflected in the answers.

Details on the research:

Number of responders: 1

Timestamp and Country: Conducted in January 16th 2022 in the Norway - Odda.

Organisation's Type: Respondents identify the type of organization – VET school.

Organisational Role: The respondent is a school teacher.

Experience in Field: new to the concept of STEM clubs, indicating no prior experience in running or managing such clubs.

REVIEW

Number of Clubs Run: Currently, there are no STEM clubs being run by the respondent, as indicated by the responses "None" and "No club yet" across several questions.

Club Description: There's no existing STEM club, but the motivation behind wanting to start one is clear. The respondent aims to increase student interest in vocational subjects, highlighting the importance of vocational education in ensuring a sufficient number of skilled professionals in the future.

Financial Scheme: Since there's no club yet, no financial scheme is in place for sustaining club activities.

Personal Motivation for Organizing a STEM Club:

The respondent's personal motivation for organizing a STEM club revolves around making more pupils interested in vocational subjects, with the hope that new equipment and sufficient funds for training people would continue to motivate them as a club leader.

Organization's Reason for Organizing a STEM Club:

The VET school's interest in organizing a STEM club is to ensure there are enough students for future vocational professions, suggesting a strategic approach to addressing skill shortages in certain industries.

Motivation to Continue Club Leadership:

The respondent believes that recognition for students' efforts and feeling that they are contributing to something important are critical for sustaining their motivation. The lack of these factors poses a challenge.

Tools and methods for long lasting motivation of students:

Although there's no existing club or specific examples provided, the respondent mentions the importance of having milestones that make students feel they are progressing towards something significant.

Challenges to retain student's motivation:

The first respondent identifies leisure activities competing with STEM, the increasing difficulty and time requirement of schoolwork, and friendships leading to new hobbies as challenges. The second notes the time commitment, difficulty in recruiting new members for the group, and waning interest from children and youth.

Challenges to retain your motivation being a club leader:

The challenge mentioned is the need for "New equipment and enough funds for training people." This implies that the leader foresees potential obstacles in maintaining their enthusiasm and drive for leading the club due to resource constraints.

In detail, this challenge encompasses two main aspects:

New Equipment: The need for new and possibly advanced equipment suggests a desire to provide high-quality, hands-on learning experiences for students. This equipment could range from basic STEM kits to more sophisticated tools and machinery relevant to vocational training. The absence of such resources could hinder the ability to deliver engaging and effective STEM activities, potentially diminishing the leader's motivation due to limitations in what they can offer to the students.

Funds for Training: Adequate funding is crucial not only for procuring equipment but also for facilitating the professional development of the club leader and possibly other staff involved. Training might be necessary to stay updated on the latest STEM education practices, safety protocols, and the use of new technologies. Insufficient funds for such training can lead to a gap in knowledge and skills, making it challenging for the leader to maintain high standards of club activities and, consequently, their motivation to continue.

Exemplary Achievements:

No comments.

Mentoring and Peer-Learning:

Not implementing.

Attracting Learners:

Not implementing yet.

Effective Advertisement:

No club yet.

3 main crucial points why STEM club would become sustainable in a long period:

No club yet.

STEM CLUB LEADERS – SUMMARY

The overview of STEM club leaders' responses across multiple countries—Czech Republic, Croatia, Hungary, Italy, Germany, and Norway—reveals both unique and shared aspects in their approaches to managing STEM clubs, their motivations, challenges, and successes.

Commonalities across STEMclub project partner countries (focused on responses from partner organisations):

- **School-Based Leadership:** Across all the countries, the majority of respondents are associated with schools, highlighting the educational setting as a primary environment for STEM clubs.
- **Varied Experience Levels:** Experience among club leaders ranges from newcomers to those with several years under their belt, indicating a mix of fresh perspectives and seasoned expertise in the field.
- **Diverse Club Themes:** Clubs cover a wide range of STEM subjects, from specific focuses like Chemistry and Robotics to broader themes like critical thinking and problem-solving, showing the multidisciplinary nature of STEM education.
- **Funding Challenges:** A recurring theme across responses is the issue of funding, with some clubs lacking financial support while others rely on a mix of school funding, parental contributions, and local sponsors.
- **Personal Motivation:** Leaders are commonly driven by a desire to enhance student engagement with STEM, bridge the gap between theoretical knowledge and practical application, and contribute to the development of future skilled professionals.
- **Student Engagement:** Attracting and retaining student interest is a key focus, with clubs employing various strategies from word-of-mouth and direct invitations to digital platforms like social media and Microsoft Teams.

Distinctive features by country

- **Czech Republic:** Emphasis on real-life problem-solving and diverse activities, suggesting a hands-on, applicative approach to STEM learning.
- **Croatia:** Aspirations to lead clubs with a hands-on, project-based approach are evident, alongside the use of school resources and voluntary efforts.
- **Hungary:** Highlights include well-structured programs like the National Talent Programme and LabTour, focusing on gifted students and practical laboratory experience, supported by grants and voluntary work.
- **Italy:** The STEM club experience is characterized by a focus on innovative methodologies and extra-curricular awareness activities, with detailed planning and community engagement being key success factors.
- **Germany:** Clubs here are noted for their practical applications, such as programming and robotics, with a blend of grant and participation fee funding. Motivations revolve around countering STEM apprehensions and enhancing practical skills.
- **Norway:** Reflects a nascent stage in STEM club development, with intentions to start clubs that increase interest in vocational subjects, albeit with concerns about funding and resources.

Overall observations

- The integration of STEM clubs into the educational landscape is widespread, yet the stages of development and implementation vary significantly.
- Financial and resource constraints are common challenges, underscoring the need for sustainable funding models.
- Personal motivation among club leaders is high, driven by educational goals and the desire to make a tangible impact on students' engagement with STEM.

- The methods for attracting and retaining students in STEM clubs are diverse, leveraging both traditional approaches and digital platforms to reach wider audiences.
- Despite the challenges, the exemplary achievements and ongoing efforts of club leaders showcase the potential of STEM clubs to enrich students' educational experiences and prepare them for future careers in STEM fields.

Recommendations

Based on the summarized responses from STEM club leaders across various countries, here are some recommendations to enhance the effectiveness, sustainability, and impact of STEM clubs:

DIVERSIFY FUNDING SOURCES

To address financial challenges, STEM clubs should explore multiple funding avenues, including:

- School budgets and educational grants.
- Sponsorships from local businesses and industry partners, particularly those in STEM fields.
- Crowdfunding and community fundraising events.
- Membership fees or contributions, where feasible.

LEVERAGE COMMUNITY AND INDUSTRY PARTNERSHIPS

Building relationships with local industries, universities, and community organizations can provide valuable resources, such as:

- Guest speakers and mentors from STEM professions.
- Access to specialized equipment and facilities.
- Real-world projects and internships for students.

ENHANCE PROFESSIONAL DEVELOPMENT FOR LEADERS

Investing in the continuous learning of club leaders can keep clubs innovative and responsive:

- Attend workshops and conferences related to STEM education and club management.
- Engage in online courses and webinars to learn new teaching methods and technologies.
- Share best practices and challenges with a network of STEM club leaders.

INCORPORATE STUDENT-LED INITIATIVES

Empowering students to take on leadership roles within the club can increase engagement and ownership:

- Allow students to propose and lead projects or topics of interest.
- Implement peer-mentoring programs where older or more experienced students mentor newcomers.
- Organize student-led presentations and demonstrations to share their work with the school and community.

ADAPT TO STUDENT INTERESTS AND NEEDS

Regularly soliciting feedback from students and adapting club activities to their interests can sustain long-term engagement:

- Conduct surveys or discussions to understand students' interests and career aspirations.
- Introduce varied themes and projects to cater to a broad range of interests within STEM.
- Incorporate current trends and advancements in STEM fields to keep the content relevant.

UTILIZE DIGITAL PLATFORMS FOR OUTREACH AND ENGAGEMENT

Digital tools can enhance learning experiences and reach more potential club members:

- Create an online presence for the club through a website or social media channels to showcase projects and activities.
- Use digital platforms like Microsoft Teams or Google Classroom for collaboration, communication, and sharing resources.
- Explore online STEM competitions and virtual events for broader participation.

FOCUS ON REAL-WORLD APPLICATIONS

Connecting club activities to real-world problems and applications can make STEM more tangible and engaging:

- Design projects that address local or global challenges, encouraging students to apply STEM concepts to find solutions.
- Partner with local businesses or community organizations for projects that have direct community impact.
- Highlight career paths and skills in demand in the STEM industry to provide context for club activities.

By implementing these recommendations, STEM clubs can enhance their sustainability, enrich the educational experience for students, and foster a deeper interest in STEM fields that extends beyond the classroom.

ORGANISATION'S MANAGERS - SUMMARY

Each partner organization has reviewed feedback from their managers. Managerial level influence a lot in establishing, maintaining and overall organizing STEM club activities within the partner organizations: Norway, Germany, Czech Republic, Italy, Croatia and Hungary.

Following is presented overview of all the partners feedback from all respondents.

There were 12 responders in total. They all have managerial role in the partner organisations.

It was conducted in the period of 10.10-12.22.2022.

Type of organization

Schools and Private Companies are explicitly mentioned, reflecting the involvement of both educational institutions and private sector entities in STEM education.

Other Types might include non-profits, community organizations, or government-affiliated clubs, although specifics aren't provided, indicating a range of environments where STEM clubs operate.

Financial schemes

- Donations and Parental Contributions suggest community support and parental investment in STEM education, common in school-based settings.
- Public Funding and Paid Programs highlight different sustainability models, from relying on governmental support to generating revenue through club activities or services, showing varying degrees of financial independence and sources of funding.

STEM club leader experience

Educators and Company Workers as club leaders suggest a mix of educational expertise and industry experience, potentially enriching the club experience with both academic rigor and practical insights.

Volunteer Involvement indicates passion and personal commitment as driving factors, which can be crucial for the club's vibrancy and appeal to students.

Motivation for STEM club leaders

Enthusiasm and Meaningful Work reflect intrinsic motivators, emphasizing personal fulfillment and the impact on children's lives as key reasons for leaders' continued involvement.

New Technologies and Continuous Support highlight the importance of keeping the content engaging and providing leaders with the resources and recognition they need to sustain their motivation.

Reason for organizing STEM club

Extracurricular Interest Realization points to STEM clubs as platforms for students to explore beyond the standard curriculum, catering to diverse interests and potential talents.

Competency Development for employment or education advancement underlines the practical value and real-world applicability of STEM club activities.

Challenges and barriers

Student Disinterest and Small Numbers indicate common engagement challenges, possibly related to competition with other activities or lack of awareness about the club's value.

Organizational Challenges might encompass resource limitations, logistical issues, or broader institutional support, affecting the club's sustainability and growth.

Examples of long-term motivation

Employment-Relevant Skills and Teamwork emphasize the clubs' role in preparing students for future opportunities and fostering essential soft skills, linking club activities to tangible outcomes.

Personal Development highlights the holistic impact of STEM clubs, potentially nurturing a lifelong interest in STEM fields.

STEM club structure

Divided Responsibilities among leaders for different aspects of the club ensure operational efficiency and clarity, with some clubs having clearly defined roles that might contribute to their effectiveness.

Detailed Roles in some responses suggest a more complex or formal organizational structure, possibly reflecting the club's size, scope, or institutional backing.

Key points for sustainability

Teamwork, Cooperation, and Practical Work are seen as foundational for sustaining engagement and success, emphasizing the importance of collaborative environments and hands-on experiences.

Financial Support and Promotion are critical for visibility and viability, with some clubs highlighting the need for multiple responsible individuals and genuine partnerships with stakeholders to ensure longevity.

Attracting students

Digital and Print Channels are widely used for promotion, leveraging modern communication platforms alongside traditional media to reach potential members.

Innovative Spaces and Activities serve as unique selling points, with clubs using modern facilities or engaging events to draw interest, reflecting the need for clubs to differentiate themselves and offer value to attract and retain members.

Similarities and differences among countries

Similarities

All countries emphasize the importance of practical activities, teamwork, and the use of modern technologies and channels to attract students and sustain interest. Financial sustainability is a common concern, addressed through various funding sources.

Differences

The structure of STEM clubs, the roles within organizations, and specific motivational strategies show variability, reflecting the local contexts, resources, and educational systems.

Recommendations

ESTABLISHING STEM CLUBS

- Define Clear Objectives: Establish clear, achievable objectives for the STEM club that align with the organization's broader educational goals and the interests of the target audience (students, community members, etc.).
- Assess Resources and Needs: Conduct a resource assessment to understand the available space, funding, equipment, and human resources. Identify gaps and develop strategies to address them, considering partnerships, grants, and community support.

- Recruit Passionate Leaders: Recruit educators, industry professionals, or enthusiastic volunteers with a passion for STEM and the ability to inspire and engage club members. Prioritize diversity in backgrounds to bring a range of perspectives and expertise.
- Curate Engaging Content: Design a curriculum that balances educational rigor with fun, hands-on activities that appeal to various interests. Incorporate current STEM advancements and real-world applications to keep content relevant and exciting.
- Establish Partnerships: Build partnerships with local businesses, universities, and community organizations to access additional resources, expertise, and opportunities for club members, such as guest speakers, field trips, and internships.
- Promote Inclusivity: Ensure the club is inclusive and accessible to all interested participants, regardless of their background or skill level. Consider offering scholarships or free memberships to underrepresented or disadvantaged groups.

MAINTAINING STEM CLUBS

- Foster a Supportive Community: Cultivate a supportive, collaborative environment where members feel valued and motivated. Encourage teamwork, peer mentoring, and the sharing of ideas and experiences.
- Provide Continuous Training and Support: Offer ongoing professional development opportunities for club leaders and volunteers to keep them engaged and up-to-date with the latest STEM teaching methodologies and content.
- Evaluate and Adapt: Regularly assess the club's activities, participation, and outcomes against its objectives. Gather feedback from members and leaders to identify areas for improvement and adapt the program accordingly.
- Celebrate Achievements: Recognize and celebrate the achievements of club members and leaders, both internally and in the wider community. This can include showcasing projects, participating in competitions, and sharing success stories through various media.
- Ensure Financial Sustainability: Develop a sustainable financial model through a mix of funding sources, such as membership fees, grants, sponsorships, and fundraising events. Maintain transparency in financial management to build trust with stakeholders.
- Leverage Technology: Utilize digital tools and platforms for club management, communication, and learning. Online resources can complement in-person activities and help reach a wider audience.
- Build a Network: Connect with other STEM clubs and organizations to share resources, ideas, and best practices. Participating in a network can provide support, collaboration opportunities, and a sense of belonging to a larger community.

By following these recommendations, organizations can establish and maintain vibrant, impactful STEM clubs that inspire and nurture a love for science, technology, engineering, and mathematics.