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MACEDONIA 2025

"Science and Me"

Growing a Culture of Curiosity: Advancing Science Teaching in Primary Education in Macedonia

Science and Me

A Two-Year Comparative Policy Recommendations and Impact Insights from the "Science and Me" Program's Teacher Development Efforts

Skopje, July 2025

1. Background and Context

The **"Science and Me"** project, implemented by Macedonia2025 with the support of Johnson Matthey Community Impact Program, was initiated in response to systemic challenges in science education in Macedonia, including low student performance in international assessments, limited teacher support, and minimal use of innovative teaching methods. Macedonian students perform significantly below international averages on assessments such as PISA. In the 2022 PISA, North Macedonia's 15-year-olds scored approximately 389 in math, 359 in reading, and 380 in science, significantly below the OECD averages (roughly 472–485 points). These results placed the country near the bottom of participating nations (61st in math, 71st in reading, 68th in science out of 81), making it one of the lowest performers in Europe and the Western Balkan region[1].

With science subjects consolidated into an integrated curriculum for grades 6–9 and increasing demands on teachers to inspire and engage diverse learners, this project aimed to enhance teacher confidence, motivation, and practical classroom strategies. Central to this approach were two professional development workshops, mentorship for young teachers, science fairs, and the provision of classroom science kits. The trainings were conducted in cooperation with the state-level organizations (Bureau for Development of Education and Ministry of Education and Science) and covered topics related to: Classroom management; Creating a positive learning climate; Effective science teaching methods, including inquiry-based learning, hands-on experiments and project-based learning, all aligned with national and international standards. The teachers implemented activities in the schools, whereas the peak of the activities were the three Science Fairs, which had a regional character, where the students from the different schools had the opportunity to get to know each other and present their completed projects to their peers from the host school and neighboring schools from their municipality.

2. Research Methodology

To evaluate the impact of the **"Science and Me"** project on participating teachers, we employed a consistent and structured research methodology for the second consecutive year. This continuity was intentional and strategic - designed to ensure the reliability of the findings and enable year-to-year comparisons that could inform the project's long-term development.

As in the 2023/2024 cycle, the evaluation employed a pre/post survey design, utilizing both quantitative and qualitative methods to capture changes in teachers' confidence, motivation, and instructional practices. The instruments used were adapted from well-established international research tools, including: The OECD's Teaching and Learning International Survey (TALIS 2018), Skaalvik & Skaalvik's teacher self-efficacy framework (2007), and The Tschannen-Moran & Woolfolk Hoy model of teacher confidence (2001).

The pre-intervention survey, conducted before the workshops and science fairs, assessed teachers' baseline attitudes and behaviors across several dimensions:

[1] https://www.balcanicaucaso.org/eng/Areas/North-Macedonia/North-Macedonia-education-system-in-disarray-229818#:~:text=%E2%80%9CI%20see%20no%20reason%20why,last%20until%20the%20coming%20elections%E2%80%9D

✓ Confidence in using modern and inquiry-based teaching methods
✓ Motivation and professional satisfaction
✓Frequency of applying student-centered strategies in science instruction

The post-intervention survey, administered at the end of the academic year (June 2025), revisited key questions from the baseline tool while adding reflective components related to:

✓ Satisfaction with project activities (workshops, science fairs, mentoring)
✓ Frequency of new teaching practices being applied
✓ Perceived impact of resources such as the science set and digital tool.

To ensure clarity and inclusiveness, all survey questions were offered in both Macedonian and Albanian, presented bilingually. Data was collected anonymously through an online form and analyzed using descriptive statistics and thematic content analysis for open-ended responses.

This year's methodology was further enhanced by integrating questions on the teacher-mentor relationship, a new element in the 2024/2025 cycle. These additions enabled the research team to assess not only pedagogical outcomes but also the role of peer support in sustaining instructional change.

By maintaining methodological consistency while adapting the tools to reflect program innovations, we have created a robust framework for tracking progress over time and drawing meaningful comparisons between cohorts.

3. Survey Design and Participation

To evaluate the impact of the **"Science and Me"** project in its 2024/2025 implementation cycle, Macedonia2025 employed a structured pre- and post-intervention survey methodology, mirroring the evaluation approach successfully used in the 2023/2024 cycle. This consistency ensures comparability and reliability of findings, allowing for evidence-based analysis of year-on-year progress.

All participating teachers had previously completed the baseline (pre-intervention) survey and were actively involved in the full project lifecycle, which included:

A. Professional Development Workshops
These two events brought together 46 enthusiastic science teachers (over 60 participants together with teacher mentors and trainers) from primary schools across Macedonia.

- ✓ The training specifically targeted teachers of science, geography, biology, chemistry, and physics working in grades 6 to 9, with less than five years of professional experience.
- ✓ The curriculum emphasized modern, inquiry-based, and experiential teaching methods, and included sessions on fair testing in physics, hands-on experiments in biology and chemistry, environmental education, project-based learning, classroom management, and critical and creative thinking.
- ✓ Of the participating teachers, 13 came from rural schools, while 33 were based in urban areas, ensuring broad geographic representation.
- ✓ 17 teachers reported working in schools where ethnic minority students comprise the majority or up to 30% of the student body; the remaining participants teach in schools with predominantly Macedonian students.
- ✓ Teachers estimated that over 25% of their students come from socially vulnerable backgrounds, and confirmed balanced gender representation in their classrooms.
- ✓ The workshops were generously hosted by **Primary School "Jan Amos Komenski"** and **Primary School "25 Maj"** in Skopje, both of which played a key role in creating a welcoming and professional learning environment. The workshop included the involvement of 10 experienced teacher-mentors, who offered peer support, shared real classroom practices, and guided lesson planning.

Teachers rated the training highly, with 92% giving a score of 5/5 for knowledge gained and practical application.

- ✓ The teachers trained through this component are expected to reach over 8,600 students in the 2024/2025 academic year.




B. Participation in Regional Science Fairs

- ✓ Three science fairs were held (**Primary school "Vlado Tasevski" Skopje** - October 2024, and **Primary school "Ljuben Lape" Skopje** and **Primary school "Goce Delchev" Prilep** - May/June 2025), involving 125 students from 19 schools who presented projects in biology, chemistry, geography, and physics.
- ✓ These events attracted over 1,050 visitors and directly impacted more than 1,200 students from grades 6-8.

Teachers described the fairs as "transformational" and "student-centered," with increased confidence in applying public communication and teamwork skills.

C. Mentorship Collaboration

- ✓ A notable enhancement in this year's program - thanks to the support of the Ministry of Education and Science of RNM - was the inclusion of 10 experienced teacher-mentors, all seasoned educators in science-related subjects and recognized as school and national mentors. Their contributions were instrumental and included:
- ✓ Sharing practical classroom strategies and real-world implementation experiences from their own teaching.
- ✓ Facilitating peer-to-peer learning, offering support to less experienced teachers in developing classroom practices and science project ideas.
- ✓ Presenting successful science fair examples and approaches to engaging students through hands-on, curiosity-driven learning.
- ✓ Their mentorship significantly bridged theory and practice, reinforcing the project's long-term goal of building a sustainable, collaborative network of empowered science educators.

64% of teachers rated the mentorship experience as "excellent," and 32% as "very good."

Testimonials described mentorship as crucial for translating theory into practice and overcoming classroom-specific challenges.

D. Utilization of Donated Science Equipment

- ✓ 21 teachers received customized science kits with materials, lab equipment, and digital content for science instruction.
- ✓ All 21 teachers confirmed the kits were actively used, and 100% reported that the resources significantly improved lesson quality and student engagement.

E. Study Visits to Scientific Institutions

As part of the experiential learning model, two high-impact field trips were organized in May 2025:

a) Johnson Matthey Plant Visit:

- ✓ A total of 24 students and several teachers from 6 schools visited the factory in Skopje.
- ✓ Students observed cutting-edge manufacturing, robotics, and environmental technologies, and engaged with STEM professionals.

Teachers and students rated the visit as a "life-changing experience," reporting increased interest in STEM careers and a deeper understanding of applied science.

b) Visit to the Faculty of Natural Sciences and Mathematics:

- ✓ A smaller group of 10 students and 2 teachers toured university laboratories, observed experiments, and were introduced to modern research practices.

The post-intervention survey was designed to capture this multifaceted participation and was conducted in both Macedonian and Albanian to ensure inclusivity. It employed:

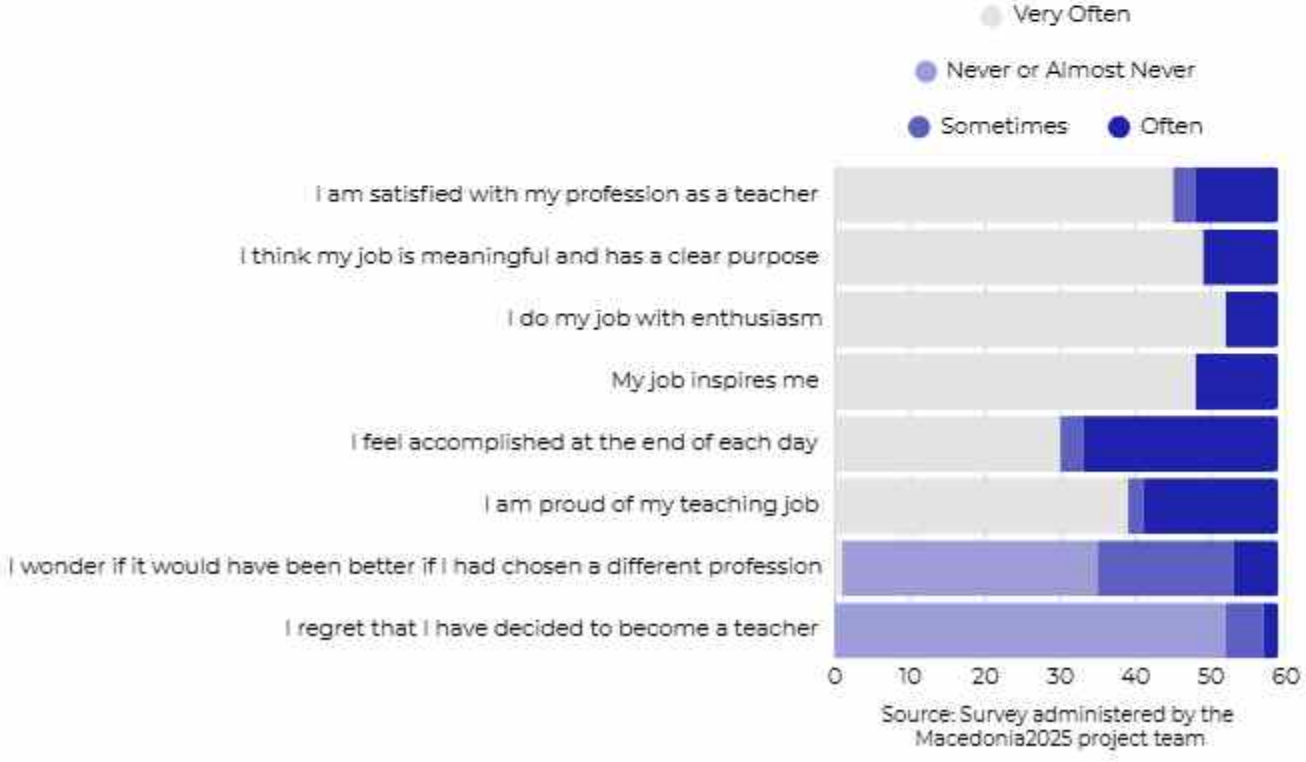
- ✓ Likert scale evaluations of satisfaction and confidence
- ✓ Frequency-based reporting to track adoption of new teaching practices
- ✓ Open-ended reflection prompts to gather qualitative insights

The survey results provide a reliable, comprehensive picture of the intervention's impact and guide the strategic recommendations outlined in this policy brief.

A. Teachers' Attitude Towards the Profession

The data suggests a predominantly positive and motivated teaching workforce, with many teachers demonstrating strong emotional and professional commitment to their role. The main findings of the evaluation are the following:

- ✓ A significant portion of teachers reported feeling satisfied with their profession and believing that their work holds meaning and purpose. These responses fall overwhelmingly in the "Often" and "Very often" categories. This aligns with the broader narrative that, despite challenges, science teachers remain dedicated and mission-driven.
- ✓ Responses show that most teachers experience inspiration and enthusiasm in their work frequently. Statements such as "My work inspires me" and "I do my job with enthusiasm" received strong positive scores, suggesting that emotional engagement with teaching remains high. This is a key indicator of teacher well-being and long-term commitment.
- ✓ Teachers largely feel a sense of daily fulfillment, with many indicating that they feel "realized at the end of the day." This speaks to a level of intrinsic reward found in the teaching profession, particularly in the context of science education, where interactive lessons and visible student engagement can contribute to satisfaction.
- ✓ There is also a clear expression of professional pride - many teachers report frequently feeling proud of their work. This highlights a strong professional identity among science educators, which is crucial to reinforce in future policy and professional development initiatives.
- ✓ Importantly, the statements that measure regret or doubt about choosing the teaching profession received very low scores, mostly in the "Sometimes" or "Never" range. This indicates that the majority of teachers do not question their career choice and show a strong commitment to remaining in the profession.



Source: Survey administered by the Macedonia2025 project team

These findings are encouraging and indicate a solid foundation of motivated and proud educators. However, it is important not to overlook the external factors that could gradually erode this motivation, such as resource limitations or workload pressures (as revealed in other parts of the survey). Teachers' professional attitudes are resilient, but they also need to be nurtured through continued support, recognition, and systemic improvement.

B. Factors Limiting Teaching Implementation

The results from the survey reveal several key insights into the challenges faced by primary science teachers in Macedonia. When asked to what extent various factors limit their ability to effectively implement teaching, the responses highlighted systemic and structural barriers that impact daily classroom practices.

A large number of teachers reported that student knowledge gaps - specifically the lack of appropriate prior knowledge and skills among students - are a frequent obstacle, with many rating this as a "partially" or even "highly" limiting factor. This points to a need for greater vertical alignment in curricula and targeted support mechanisms for students who fall behind.

Similarly, lack of access to adequate teaching materials and equipment remains a significant challenge. Even though the **Science and Me** project provided basic science kits, the findings suggest that long-term resource planning and replenishment mechanisms are needed to sustain impact beyond the project scope.

Another recurring theme was the lack of time for preparation and innovation, as well as insufficient support for professional development. While many teachers expressed enthusiasm and commitment to their role, these limitations create a strain that can hinder both motivation and innovation in teaching methods.

Lastly, some teachers noted that inadequate infrastructure and classroom conditions also affect their ability to deliver interactive and engaging science education.

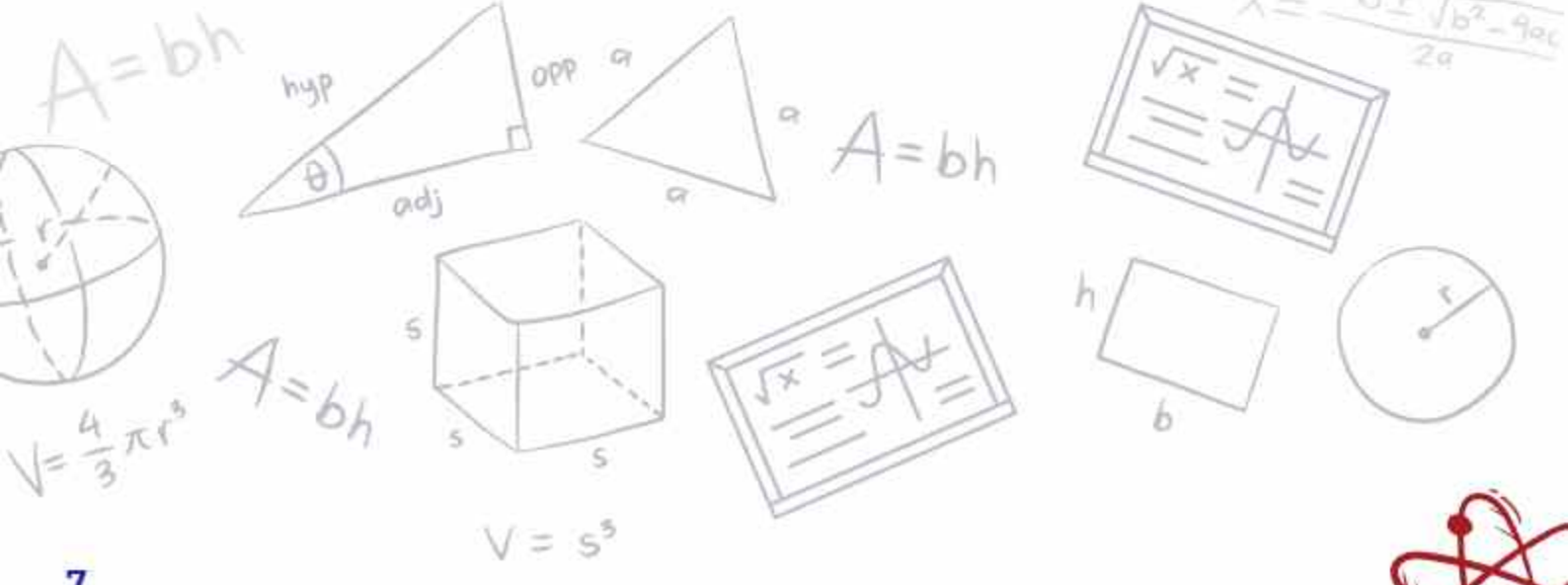


Table 1

Factors that limit teaching implementation	Not Limiting	Partially Limiting	Highly Limiting
Lack of adequate prior knowledge and skills of students	16	39	4
Malnourished (hungry) students	34	19	6
Insufficient sleep in students	13	36	10
Students' absences from classes	12	30	17
Disruption of teaching by certain students	16	34	9
Disinterested students	7	39	13
Students with certain mental, emotional and psychological difficulties	23	34	2
Lack of support for the use of ICT	20	29	10
Lack of educational materials (such as: textbooks, ICT equipment, an equipped library and laboratory)	11	34	14
Inadequate or poor quality educational materials (e.g., textbooks, ICT equipment, library and laboratory equipment)	14	30	15
Inadequate or poor quality physical infrastructure (for example: the building, the school grounds, the heating and cooling system, lighting and acoustics, etc.)	24	32	3
Lack of cooperation with parents/guardians	22	31	6
Lack of cooperation with other teachers	32	23	4
Language barriers in communication with students	43	13	3
Limited opportunities for teachers' professional development	26	26	7
A large number of students in one class	33	17	9
Limited time for curriculum implementation	25	27	7
Limited budget for providing classroom resources	8	37	14

Source: Survey administered by the Macedonia2025 project team

The findings suggest several implications for improving the teaching and learning of science in primary education:

✓ Student Preparedness Requires Attention
Teachers frequently encounter gaps in students' prior knowledge and skills. This highlights the need for better alignment between curricula across grades and more structured support mechanisms (e.g., diagnostic tools, remedial programs) to ensure students are ready to engage with science content.

✓ Sustainable Resources Are Essential
The availability of science materials significantly impacts teaching quality. While initiatives like Science Sets are appreciated, their long-term impact depends on system-level planning for regular replenishment and equitable distribution across schools.

✓ Time Constraints Limit Innovation
Teachers need space within their weekly schedules to plan, prepare, and reflect - especially for experimental and inquiry-based teaching. Without dedicated time, even well-trained teachers may struggle to implement engaging approaches.

✓ Infrastructure Conditions Matter
Effective science teaching requires not just content and training, but appropriate physical environments. Poor infrastructure - such as inadequate lab space, furniture, or lighting - can undermine the benefits of any educational intervention.

✓ Professional Development Must Be Continuous and Supported
Teachers are motivated and show pride in their profession. However, sustained impact requires ongoing training that is practical, responsive to field realities, and supported by mentoring, especially for early-career educators.

C. Satisfaction with Professional Development

Respondents overwhelmingly rated the training and project components as highly beneficial. On a 1–5 scale (1 = not at all satisfied; 5 = completely satisfied):

92% rated ***"knowledge gained during the workshop"*** as 5

96% rated ***"practical activity implementation"*** as 5

92% rated ***"clarity of instructions for student activities"*** as 5

92% were ***fully satisfied with the organization of the science fairs***

92% ***felt fully supported by the project team***

These results confirm that the workshop design - emphasizing inquiry-based learning, experimentation, and teacher collaboration - was relevant and impactful.

D. Improved Classroom Practice

When compared to pre-intervention data, teachers now report increased use of innovative and interactive methods:

- ✓ Student-led presentations and peer review of assignments are now regularly used in over 70% of classrooms.
- ✓ Science worksheets and visual media are integrated in most classes.
- ✓ Notably, previously rare practices such as guest lectures and field trips are now more frequently applied, suggesting that teachers feel more confident to reach beyond traditional textbook instruction.

These changes indicate that teacher confidence in using active learning techniques has measurably improved, with many attributing this to the project resources and mentorship support. Based on our data, here are the three teaching practices with the greatest positive change (improvement) and three with the least or negative change, along with a brief interpretation:

Top 3 Most Improved Teaching Practices

Teaching Practice	Change	Interpretation
I ask students to decide for themselves which procedures they will apply to solve complex problems	+0.557	Significant improvement - indicates a stronger push toward student autonomy and problem-solving.
Students conduct scientific research	+0.448	Significant improvement - shows increased focus on inquiry-based and research-driven learning.
Students correct each other's homework or test assignments	+0.426	Significant improvement - suggests more peer-to-peer learning and formative assessment.

Top 3 Practices with Least or Negative Change

Teaching Practice	Change	Interpretation
The students copy what is written on the board	-0.194	Moderate decrease - likely reflects a shift away from rote learning.
I discuss the questions that students ask me	-0.073	Slight decrease - may reflect classroom time limits or shifting strategies.
Students solve problems given in the form of a worksheet	-0.044	Slight decrease - possible transition to more dynamic, hands-on methods.

E. Impact of Mentorship

The mentorship component paired younger or less experienced teachers with established mentors. In post-project evaluations:

- ✓ 64% rated their mentorship experience as "excellent"
- ✓ Teachers emphasized the value of feedback, emotional support, and idea-sharing.
- ✓ One teacher noted, "Every young teacher needs a mentor who will guide them, support them, and celebrate their progress."

This confirms the need for more structured, sustained mentorship programs embedded in the professional ecosystem.

F. Usefulness of Donated Science Kits

All 21 teachers who received classroom science sets expressed high satisfaction, citing increased student curiosity and engagement. Teachers reported that:

- ✓ The kits made science more "visible" and less abstract
- ✓ Students became more proactive and excited about experiments
- ✓ Teaching became "less monotonous" and more dynamic

This reaffirms that resource availability is a key enabler of pedagogical innovation.



5. Lessons Learned

The project offers compelling evidence that professional support and practical resources lead to measurable improvements in teaching practice and teacher morale. Several key takeaways emerge:

- ✓ Training must be ongoing and hands-on to drive actual behavior change in the classroom.
- ✓ Mentorship fills a critical gap, especially for early-career teachers, and should be scaled through formal programs.
- ✓ Resources matter - without access to science kits or digital tools, even the best training has limited impact.
- ✓ Teachers are eager to innovate when given autonomy, support, and recognition.

6. Comparative Analysis: 2023/2024 vs. 2024/2025

As the **"Science and Me"** initiative enters its second implementation cycle, it offers a valuable opportunity not only to measure the outcomes of this year's activities but also to evaluate progress over time. A structured comparative analysis between the 2023/2024 and 2024/2025 cohorts allows us to assess how sustained interventions, strategic adjustments, and program innovations - such as the introduction of mentorship and broader geographic outreach - have influenced teacher attitudes, instructional practices, and overall satisfaction.

In the first cycle, conducted in 2023/2024, the project focused on novice science teachers in Grade VI across 19 schools. The results were promising: teachers reported significant improvements in their confidence and ability to apply modern teaching methods, particularly hands-on and inquiry-based approaches. However, the findings also highlighted areas that required further development, including disparities in satisfaction among rural teachers, limited use of digital tools, and a lack of formal mentorship structures.

The 2024/2025 cycle was built directly on these findings. It expanded teacher participation, introduced structured mentorship between experienced and newer educators, and ensured wider distribution of science kits. With these enhancements, the latest post-intervention survey not only measured satisfaction and impact but also provided a means to reflect on what has changed, what has improved, and what challenges persist. The following comparative table summarizes key outcomes across both cycles, highlighting emerging trends and informing evidence-based recommendations for the future.

Area of Change	2023/2024	2024/2025	Observation
Total teachers surveyed (post)	19	35	Expanded reach
Rated "completely satisfied" with training	79%	92%	Notable increase
Use of hands-on experiments	Marked improvement, from 42% to 73.7% in self-assessed ability	Regular use is reported in most classrooms	Sustained and deepened practice
Mentorship included	Not present	Formal pairing with senior teachers	New component, highly valued
Use of real-world examples	52.6% to 78.9% improvement post-training	Consistently integrated across lessons	The positive trend continued
Challenges in rural areas	3 rural teachers are less satisfied (avg. 3/5)	No disparity reported in 2024/2025	Improvement in equitable delivery
Use of digital tools	Still limited, identified as a weak point	Still a secondary focus	Requires targeted support

Overall, the 2024/2025 cycle deepened and institutionalized prior improvements, with the addition of mentorship and more strategic use of teaching resources driving progress further.

7. Teacher and Students' Voices and Reflections

The **"Science and Me"** project was not only about delivering training and resources - it was about inspiring people. Below are authentic voices from teachers and students who participated in key project activities, sharing how their perceptions, practices, and aspirations were shaped through this experience.



A. Teacher Training Workshops

Teachers who attended the professional development workshops emphasized the practical value, collaborative spirit, and motivational impact of the sessions. The training provided them with new approaches and rekindled their enthusiasm for teaching science.

"The training was well organized and gave us new ideas on how to make science more interesting and accessible for students. It was inspiring and offered practical tools. We shared teaching methods and discussed how to adapt them to different classroom environments. These insights made me reflect on how to improve my own teaching practice."

Teacher, Sveti Nikole

"Through practical examples and peer mentoring, I refreshed my own knowledge and learned how to support fellow teachers more effectively. The mentor discussions opened space for collaboration, and I now feel more confident in guiding my younger colleagues."

Teacher, Negotino

"This training motivated me to be more creative and dedicated as a teacher. I feel empowered to approach science education more engagingly. It gave me the tools to present complex topics in a more approachable and fun manner, helping students stay curious and motivated."

Teacher, Vinica

"Participating in the training within the project 'Science and Me' was a great motivation and inspiration for me. Through practical examples and interactive exercises, I learned new approaches to bringing science closer to students in an interesting and understandable way. The training encouraged me to be more creative, more dedicated as a teacher."

Teacher, Skopje

B. Regional Science Fairs

The science fairs offered a platform where students took center stage - presenting their experiments, engaging with peers, and celebrating science in a lively, inclusive atmosphere. Teachers reflected on the powerful boost in student motivation and creativity, while students expressed a sense of wonder and pride.

"The science fair was an amazing experience filled with energy and teamwork. Students learned how to present confidently, work in teams, and express creativity. They were proud to show their work to peers and guests, and many of them said they felt like real scientists for the first time."

Teacher, Kičevo

"It was inspiring to see how enthusiastic the students were. They proudly showcased their projects and were thrilled to receive feedback from visitors. The event created a spirit of cooperation among schools and ignited new ideas for future experiments and cross-school collaboration."

Teacher, Skopje

"My students felt like real scientists! They were thrilled to be part of such a large event and said it motivated them to explore science even more. They asked when the next event would be and already have ideas for future projects. This was a powerful confidence boost for them."

Teacher, Radovish

"I had a really interesting and fun time at the Science Fair – it was like entering a world full of ideas and discoveries! I learned new things I didn't know before, and I was most impressed by the experiments and modern equipment at Johnson Matthey. I would recommend all students to go, because it is a unique and unforgettable experience!"

Student, Skopje

"I really liked the Science Fair - like a paradise of science with new experiences and discoveries! So many creative things that I saw for the first time. A place to learn and discover new scientific breakthroughs! You really should visit it at least once, because that energy is invaluable. I had a wonderful experience!"

Student, Skopje

"The science fair was a great opportunity to promote scientific curiosity, critical thinking and teamwork among students, who presented their experiments to the audience with great dedication. I would like to express my special gratitude to the organizers of the 'Science and Me' project and the Macedonia2025 team for their support, professionalism and vision, which enabled us to be part of a true celebration of knowledge and inspiration. Their work was crucial in creating an encouraging and inclusive atmosphere, where science became accessible and exciting for all participants."

Teacher, Shemshevo

C. Mentorship Collaboration

Mentorship proved to be a key pillar of support in the **"Science and Me"** project. By pairing experienced educators with younger colleagues, the initiative fostered professional growth, confidence, and collaboration. These relationships not only enhanced the preparation for science fairs but also created lasting connections that extend beyond the project. Teachers shared how mentorship enriched their practice and inspired them to continue building a supportive teaching community.

"I had a wonderful collaboration with my mentor. They were always available to share ideas and feedback, which meant a lot to me throughout the science fair preparation process. I believe that mentor teachers play a crucial role in helping young educators gain experience across all aspects of our profession. We've stayed in touch even after the fair, and I look forward to future collaborations."

Teacher, Strumica

"Through the exchange of experiences with advisors and other mentors, the training gave me fresh ideas on how to make natural sciences more interesting and accessible for students. It encouraged me to rethink my approach and try out new strategies in the classroom."

Teacher, Sveti Nikole

D. Visit to Johnson Matthey Plant in Skopje

Seeing science applied in a real-world context left a lasting impression on students and teachers alike. The visit to Johnson Matthey's factory brought school science lessons to life, inspiring interest in STEM careers and showcasing industry's role in sustainability.

"Visiting the Johnson Matthey factory was an unforgettable experience. We saw advanced technologies and real-world applications of science in action. We were fascinated by how school subjects like chemistry and physics play a role in environmental protection and product innovation."

Student, Sveti Nikole

"The lab was my favorite part - seeing physical and chemical tests up close was incredible. It showed us the precision required in modern industry. It made me appreciate how science is not just theory but a key part of how the world works."

Student, Radovish

"This visit showed how scientific knowledge translates into high-tech production and environmental protection. It truly connected classroom theory to practice. We left with a better understanding of STEM careers and the role of industry in sustainability. I would love to bring more students in the future."

Teacher, Skopje

8. Policy Recommendations

Based on the evaluation findings and participant feedback from the **"Science and Me"** project, we propose the following policy actions to sustain and scale its impact:

A. Institutionalize Professional Development in Science Education

Recommendation	Elaboration
Integrate the Science and Me teacher training curriculum into the national framework for continuous professional development (CPD) for primary science educators.	Hands-on, inquiry-based training has proven to significantly boost teacher confidence and motivation. By institutionalizing at least one mandatory annual science-focused workshop per teacher, the Ministry of Education and Science can ensure that educators stay up to date with effective methodologies. Training content should align with the national curriculum but allow for contextual adaptation by schools and municipalities. These sessions should be accredited and offer CPD credits to encourage participation.

B. Establish a National Mentorship Framework for Science Teachers

Recommendation	Elaboration
Develop and roll out a structured national mentorship program for early-career science teachers, especially those in their first five years of service.	Pairing novice teachers with experienced mentors not only strengthens classroom practice but also builds professional identity and resilience. The framework should include clearly defined mentor roles, mentorship tools and resources, and incentives such as CPD points, monetary bonuses, or public recognition for mentors. This model can also be piloted in collaboration with teacher education faculties and regional education centers.

C. Allocate Dedicated Budgets for Science Resource Kits and Maintenance

Recommendation	Elaboration
Ensure every primary school science teacher has access to essential science teaching toolkits through a nationally funded procurement program.	Practical science cannot thrive without appropriate materials. Governments and local authorities should allocate dedicated annual budgets for purchasing, maintaining, and replenishing basic experimental kits, safety gear, and digital resources. Resource planning should include support for storing and sharing equipment at the school or municipal level to ensure cost-efficiency and sustainability.

D. Promote Best Practice Through Recognition and Peer Exchange

Recommendation	Elaboration
Expand regional science fairs and establish digital platforms to showcase successful teaching practices and student-led projects.	Teachers and students thrive when their work is valued. Science fairs serve as powerful public recognition tools that inspire others to innovate. Beyond in-person events, an online repository of best practices, video demonstrations, and teacher blogs can be launched to facilitate continuous peer learning. Awards or certification programs for "Innovation in Science Teaching" can also encourage widespread adoption of proven practices.

E. Institutionalize Impact Monitoring with Continuous Feedback Loops

Recommendation	Elaboration
Scale the small-scale survey model into a national monitoring system for science education reform, collecting data regularly from participating teachers and students.	The project's pre- and post-intervention surveys have shown the value of data in tracking motivation, teaching behavior, and student outcomes. A streamlined digital survey system could be implemented in all participating schools, enabling policymakers and stakeholders to make evidence-informed decisions. Annual reports summarizing trends in motivation, practice, and engagement should be made publicly available to foster transparency and accountability.

9. Conclusion

The 2024/2025 iteration of the **"Science and Me"** project has demonstrated a measurable impact on teaching practice, student engagement, and institutional collaboration in science education across Macedonia. Through a targeted combination of professional training, mentorship, resource provision, and experiential learning opportunities, the program has succeeded in:

- Enhancing the confidence and motivation of science teachers, particularly those working in under-resourced environments.
- Shifting classroom instruction toward more frequent use of inquiry-based and student-led methods.
- Fostering a stronger culture of peer collaboration, both among educators and students.
- Building bridges between education and industry through factory visits and real-world STEM exposure.
- Increasing the visibility and perceived value of science among students, many of whom reported this as a transformative learning experience.

The qualitative testimonials and positive feedback from both teachers and students reinforce the human impact of this program: children feeling like "real scientists," teachers feeling empowered and inspired, and schools engaging in science communication like never before.

Annex 1

Question	Pre-Intervention Mean	Post-Intervention Mean	Difference	Interpretation
I invite guest lecturers, i.e. experts in a specific field	1.7797	2.2000	0.4203	Slight improvement
Students discuss the teaching content in the textbook	2.6949	2.9200	0.2251	Moderate improvement
I explain the connection between old and new topics	3.5763	3.6000	0.0237	Slight improvement
I encourage students to explain their ideas	3.4237	3.6000	0.1763	Moderate improvement
I encourage and participate in discussions with the whole class	3.4915	3.5200	0.0285	Slight improvement
Students correct each other's homework or test assignments	2.2542	2.6800	0.4258	Slight improvement
Students present to the rest of the class	2.5932	2.6400	0.0468	Slight improvement
I include a certain number of field visits	1.9153	2.2000	0.2847	Moderate improvement
Students watch videos	2.6271	2.9200	0.2929	Moderate improvement
Students perform calculations using formulas	2.8136	2.8800	0.0664	Slight improvement
I use an interactive whiteboard or other ICT equipment	3.0847	3.2000	0.1153	Moderate improvement
I discuss issues that have practical application	3.3559	3.5200	0.1641	Moderate improvement
I encourage student discussion in small groups	3.2034	3.3600	0.1566	Moderate improvement
I give students similar tasks to practice until I am sure that the students have understood the teaching content	3.3051	3.3600	0.0549	Slight improvement
I ask students to decide for themselves which procedures they will apply to solve complex/complex problems	2.7627	3.3200	0.5573	Slight improvement
I encourage students to conclude from the experiments they have performed	3.2203	3.4800	0.2597	Moderate improvement
Students perform practical work	2.8305	3.0400	0.2095	Moderate improvement

I explain scientific ideas	3.0678	3.1200	0.0522	Slight improvement
I give examples from everyday life to demonstrate the applicability of what is being taught	3.5085	3.7200	0.2115	Moderate improvement
I discuss the questions that students ask me	3.5932	3.5200	-0.0732	Decrease in usage
I involve students in demonstrations and experiments during class	3.1695	3.2800	0.1105	Moderate improvement
I am showing/demonstrating a particular idea	3.0000	3.2400	0.2400	Moderate improvement
Students read content from textbooks	2.1356	2.2800	0.1444	Moderate improvement
I give students project assignments that require at least a week to complete	2.4068	2.8000	0.3932	Slight improvement
I organize the work of students in small groups so that they can come to a joint solution to the problem or task	3.1017	3.3600	0.2583	Moderate improvement
Students write a report on the completed laboratory tasks	2.6102	2.8800	0.2698	Moderate improvement
The students copy what is written on the board	3.0339	2.8400	-0.1939	Decrease in usage
Students conduct scientific research	2.7119	3.1600	0.4481	Slight improvement
I show/demonstrate tasks for which the solution is not obvious	3.1017	3.2800	0.1783	Moderate improvement
Students solve problems given in the form of a worksheet	2.6441	2.6000	-0.0441	Decrease in usage
Students use the internet	2.3898	2.7200	0.3302	Slight improvement
We discuss current scientific developments with students	3.2034	3.1600	-0.0434	Decrease in usage

Source: Survey administered by the Macedonia2025 project team

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