Development of the S.T.E.P.S. School Box (WP4/PR6)

Implementation & Dissemination Report

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Lead Partner: SAPLLe | **Co-Leaders:** UBU, GFOSS, APDNE

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Information

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1. Project Overview & Strategic Goals

Package 4 (WP4) serves as a core intervention for the S.T.E.P.S. project, directly aligning with the key Erasmus+ priorities of digital transformation, environmental sustainability, and inclusive education. The initiative aims to modernize, scale, and democratize STEM education across participating regions through three primary strategic goals:

- **Democratization of STEM:** Replacing expensive, proprietary educational robotics gear and license-locked ecosystems with low-cost, open-source hardware—specifically centered around the project's custom FOSSBot platform. This relies on accessible, 3D-printable parts and free, open software. This approach systematically eliminates economic barriers for schools, reduces physical fabrication time and material waste, and guarantees that marginalized or underfunded educational institutions have equal access to high-quality, sustainable technological tools.

- **Teacher Empowerment:** Providing localized, culturally adapted, and ready-to-use digital learning modules alongside the S.T.E.P.S. Instruction Manual and Pedagogical Manual. These step-by-step assembly, connection, and coding resources are designed to help both pre-service and active secondary school educators easily and confidently introduce robotics into their daily classrooms, effectively reducing technology-related anxiety even for teachers with little to no prior coding experience.

- **Cross-Curricular Learning:** Providing localized, culturally adapted, and ready-to-use digital learning modules alongside the S.T.E.P.S. Instruction Manual and Pedagogical Manual. These step-by-step assembly, connection, and coding resources are designed to help both pre-service and active secondary school educators easily and confidently introduce robotics into their daily classrooms, effectively reducing technology-related anxiety even for teachers with little to no prior coding experience.

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2. The Core Deliverable: S.T.E.P.S. School Box (PR6)

The primary output of WP4 is Project Result 6 (PR6): The S.T.E.P.S. School Box. Hosted openly at moocsteps.eu, this digital ecosystem serves as a comprehensive Massive Open Online Course (MOOC) designed as an inclusive, scalable learning hub. It is specifically tailored to guide beginner learners—spanning from primary and secondary school students up to educators and adult learners pursuing lifelong education—through structured, self-paced, or instructor-led learning pathways.

A. Thematic Structure & Interdisciplinary Learning

The platform includes **25 specialized**, highly rigorous **courses** structured to break down silos between academic disciplines. These courses are divided across four main thematic pillars:

- **Programming & Robotics (7 Modules):** Establishes foundational computational thinking and core programming paradigms. It utilizes block-based visual coding environments. Key modules include "Draw with Code! (Geometric Shapes)" to master iteration, loops, and angles; "Time-controlled movement with colours" to understand state-machines and RGB LED actuators; "Measuring velocity" to map physical gear rotations to virtual variables; and the "Observation Game" to develop event-driven programming and logical branching.
- **Environmental Applications & Sustainability (6 Modules):** Directly bridges technical engineering workflows with practical ecological ethics, showing students how robotics can solve environmental crises. Key modules include "Smart Lighting for Environment & Safety" which optimizes electrical grid usage; "Environmental Patrol" where robots detect ambient changes and pollutants; "FOSSBot Waste Warriors" which introduces automatic recycling sorting logic; and "Solar Oven" which teaches principles of thermodynamic modeling and solar tracking using photoresistors.
- **Technology Integration in Education (6 Modules):** Cultivates practical operational workflows to easily weave hardware into daily classroom structures. It includes "Green S.T.E.P.S. with FOSSBot" which acts as a practical guide for using eco-friendly materials; "Navigation through Traffic" to simulate smart municipal infrastructure and autonomous vehicles; "Discovery & Use of Ultrasonic Sensors" to teach the physics of sound reflection and distance calculation; and the "Carbon Footprint Tracker" to model and calculate real-time energy consumption during robotics tasks.

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- **Engineering Principles & Practices (6 Modules):** Explores physical mechanics, kinetics, and structural design challenges. This features "Edge detection & safe robot navigation" which utilizes infrared sensors to prevent falls; "From Relative to Absolute positions" to teach Cartesian coordinate systems and spatial telemetry; "Probability Adventure with FOSSBot" to demonstrate mathematical randomness, variance, and data collection; and "Sustainable Road Transport Management" to teach optimal route planning and vehicle load balancing to reduce fuel/energy waste.

Open & Durable Assets: To ensure maximum sustainability, all curricular guides, multimedia content, quizzes, and software scripts are published as Open Educational Resources (OER) under Creative Commons licenses (CC BY-NC-SA). This approach guarantees that European educators can freely download, modify, translate, and re-distribute the material indefinitely, safeguarding the project's long-term impact independent of future public or private funding lifecycles.

B. Hardware Driver: The FOSSBot

The physical and virtual centerpiece of the entire School Box is the **FOSSBot**—an innovative, open-source educational robot designed collaboratively by educational, research, and open-source experts. The FOSSBot is built to be highly accessible: its chassis is completely 3D-printable to reduce manufacturing costs and plastic waste, while its electronic component list (BOM) relies on low-cost, off-the-shelf microcontrollers and sensor units. Functioning as a hands-on pedagogical bridge, it allows students to visually see abstract programming logic, physical kinematic equations, and mathematical calculations manifest directly in the robot's physical movements during standard classroom periods. For schools lacking immediate hardware resources, FOSSBot features a fully synchronized "digital twin" simulation. This web-based virtual simulator runs the exact same code on a virtual model of the robot, ensuring maximum equity and access for students both in the lab and at home.

C. Localization Matrix

To ensure seamless integration across highly diverse European school networks, the S.T.E.P.S. platform completely bypasses the errors of automated machine translation. It provides deep, context-aware localized user interfaces, menus, lesson frameworks, and software code comments translated by educational experts for five primary language regions:

- **EN**: Pan-European Dissemination and international school networks
- **FR**: France, adapted for the national French educational frameworks and curricula
- **ES**: Spain, aligning with regional educational laws and linguistic requirements

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- **TR**: Turkey, customized to meet local secondary school technical standards
- **EL**: Greece, integrated directly with Greek school networks and national STEM orginisations.

D. Dissemination Milestones

A major milestone in spreading the project's reach was **Multiplier Event 4 (E4)**, titled "S.T.E.P.S. School Box: An Open Digital Environment for STEM Education". This event successfully built upon the momentum of the previous national training seminar, "S.T.E.P.S. in the Classroom: A Trainer's Guide to Educational Robotics".

- **Host & Date:** Organized virtually via the Zoom platform by the lead partner, the Scientific Association for the Promotion of Lifelong Learning (SAPLLe), on Monday, April 27, 2026, from 16:00 to 18:00 CET time.
- **Language & Audience:** Conducted both in Greek and English, successfully attracting and actively engaging **78 external participants**. The diverse attendee profile comprised primary and secondary school educators, adult trainers, university pre-service teacher-training students, STEM researchers, and academic policymakers seeking scalable national training frameworks.
- **Event Outcomes:** The webinar served as the official public launch of the moocsteps.eu platform, providing a thorough pedagogical walkthrough of its interactive, asynchronous design. Beyond introducing the thematic modules, transnational experimented educators from all participant consortium countries demonstrated four localized classroom implementation scenarios based on actual test cases in Greece, France, Spain, and Turkey. Participants were shown how to navigate the platform's ready-to-use lesson plans, interactive quizzes, and project-based learning (PBL) rubrics. The live showcase effectively proved that teachers can immediately deploy these high-impact STEM and robotics activities without needing any prior computer science background, programming experience, or specialized technical robotics training.

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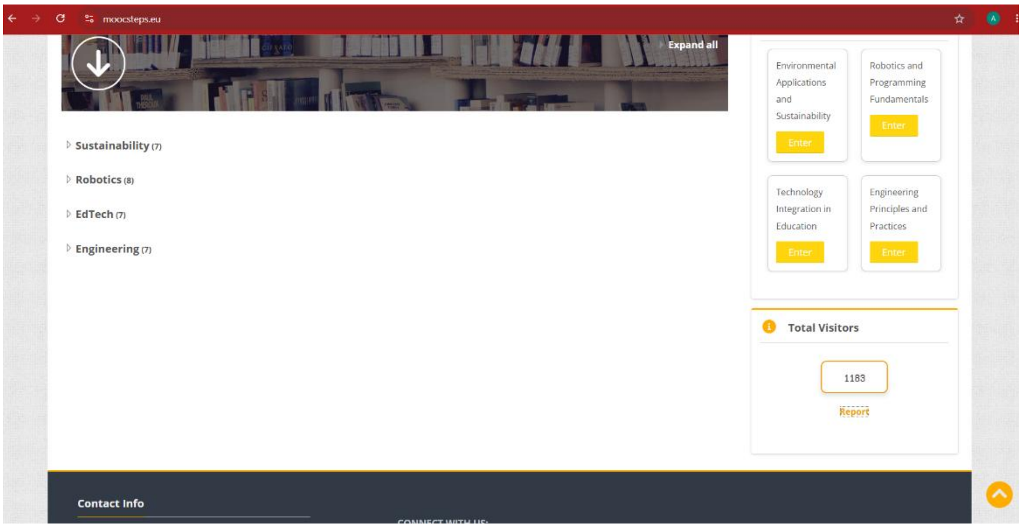
4. Evaluation Data & Field-Testing Metrics

Data collected on July 14, 2026, showcases the performance, impact, and reach of the School Box ecosystem.

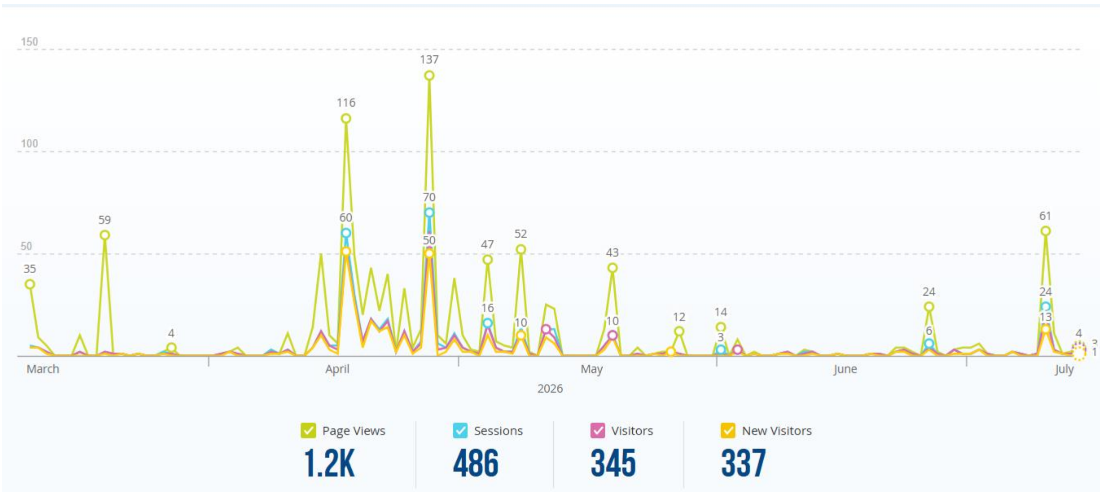
Platform Analytics (March – July 2026)

Driven heavily by localized rollout events, the MOOC platform experienced strong initial deployment traction:

- **Total Page Views:** 1,128 page views, showing high initial engagement with the platform's new interactive course contents.



- **Total Sessions:** 486 active user sessions, indicating repeat visits and sustained learning periods rather than brief accidental clicks.
- **Unique Visitors:** 345 individual registered learners and guest educators accessing the digital modules.



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Geographic Traffic Share: Greece led with 82.4% of traffic, followed by Turkey (5.3%), France (3.9%), Brazil (2.4%), United Kingdom (2.0%), Spain (1.0%), and miscellaneous global hits.

Country	Page Views	Percentage
Greece	418	82.4%
Turkey	27	5.3%
France	20	3.9%
Brazil	12	2.4%
United Kingdom	10	2.0%
Spain	5	1.0%
Cyprus	3	0.6%
United States	2	0.4%
Malta	2	0.4%
China	2	0.4%
South Africa	1	0.2%
Singapore	1	0.2%
Netherlands	1	0.2%
Lithuania	1	0.2%
Italy	1	0.2%
Germany	1	0.2%

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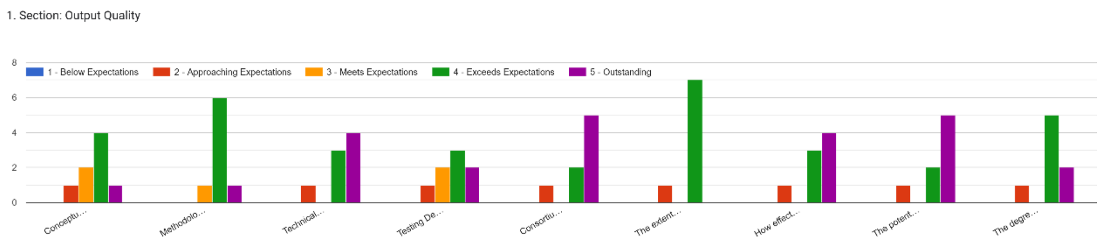
5. Lesson plans evaluation

Internal Quality Review (Consortium Experts)

https://docs.google.com/forms/d/1dF13DuxdFnOnes5Yudrt9L75w6lyY4BXbMSq5TnbgGU/preview

An audit conducted by 8 internal partner experts gave outstanding marks across all development categories:

- *Consortium Cooperation* and *Potential Impact* scored the highest, dominated by **Outstanding (5)** ratings. This highlights the successful cross-border collaboration within the consortium and the strong belief in the project's long-term structural influence on national school systems.
- *Methodological Quality* and *Degree of Innovation* safely met or exceeded expectations, concentrating heavily in the **Exceeds Expectations (4)** tier, validating the pedagogical choice of combining open hardware with practical, sustainability-focused educational modules.



1. Qualitative Justification

The evaluation concludes that the S.T.E.P.S. project successfully delivers high-quality educational resources that closely align with the objectives outlined in the project proposal. The ratings are based on the strong consistency between WP2 outputs, the School Boxes, the FOSSbot activities, and the Moodle-based MOOC platform.

The **MOOC platform (moocsteps.eu)** effectively serves as an open-access, multilingual learning environment for pre-service and in-service secondary school teachers. It offers structured courses across the project's four main STEM themes—Programming, Technology, Environmental Protection, and Engineering—and includes lesson plans, quizzes, interactive content, and project-based activities that support the School Box methodology.

The project demonstrates a strong commitment to **accessibility, inclusion, and sustainability** through free access, multilingual support, Open Educational Resources (OER), and the use of the low-cost, open-source FOSSbot. These features reduce

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financial barriers, promote inclusive STEM education, and enable educators to reuse and adapt the materials beyond the project's lifetime.

The **School Boxes** provide well-structured, activity-based learning scenarios that support interdisciplinary STEM teaching and educational robotics. Pilot workshops and testing further refined the materials, contributing to their pedagogical quality and practical relevance.

Overall, the evaluation finds that the S.T.E.P.S. project delivers a robust, scalable, and sustainable educational ecosystem. Its combination of high-quality learning resources, accessible technology, and strong pedagogical design not only meets but, in several areas, exceeds the original project specifications, demonstrating significant potential for long-term educational impact.

2. Refinement suggestions

The evaluation identifies several practical enhancements that could further improve the School Box's quality, usability, and long-term impact.

Key recommendations include adding **short video walkthroughs** of learning scenarios and FOSSBot activities to better support teachers with limited experience in robotics or programming. The assessment framework could also be strengthened by introducing **competency-based evaluation tools**, such as rubrics and student self-assessment checklists, to complement existing quizzes and better measure practical and transversal skills.

To improve usability, the platform should make **age-specific learning pathways and progression levels** (e.g., beginner, intermediate, advanced) more visible within its navigation, reducing reliance on the Pedagogical Manual. Further standardizing the structure of lesson plans and teacher guides, while expanding STEM topics and problem-solving resources, would also enhance consistency and usability.

Finally, incorporating **evidence from pilot implementations**, including classroom case studies and examples of student work, would demonstrate the practical application of the School Box and support its adoption across different educational contexts.

Overall, these improvements would enhance the coherence, accessibility, inclusiveness, and sustainability of the School Box, while further aligning it with Erasmus+ objectives and strengthening its potential for widespread implementation.

Field-Testing Implementation (59 Classrooms & 18 Teacher Audits)

https://docs.google.com/forms/d/1FzumVhSOkjHvSBvBLlZVWZfGIunSLeMSR4tXuTb3J2A/preview

https://docs.google.com/forms/d/1Qwa4p7GszwMMxRW9IbL4LPr5khymNyviISHkHfrNBKA/preview

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When deployed directly within active classrooms, feedback loops from 62 implementing classrooms and 20 intensive teacher audits provided encouraging metrics:

- **Subject Support:** The materials were rated "Highly Effective" (Score 5) by an absolute majority for Information Technologies and Physics, proving that visual physical robotics simplifies complex abstract concepts. Meanwhile, Math split its ratings between Neutral and Highly Effective, suggesting a solid foundation with minor adjustments needed to better tie algorithmic loops with school arithmetic.
- **Pedagogical Clarity:** 72.9% of educators rated the flow of the provided Lesson Plans as excellent (scoring them a 4 or 5), proving that the step-by-step structures significantly lower the lesson preparation times for overworked teachers.
- **Ease of Adoption:** 55.6% of audited teachers rated the platform a 4 or 5 for user intuition, confirming it delivers on its promise of an immediate, low-barrier entry point even for non-expert educators with zero previous programming or robotics experience.
- **Infrastructure Fit:** The vast majority of teachers reported that the setup matched their existing equipment easily without requiring extra school budget, demonstrating that the platform's browser-based virtual simulators and low-cost hardware approach mesh perfectly with typical European public school classrooms.

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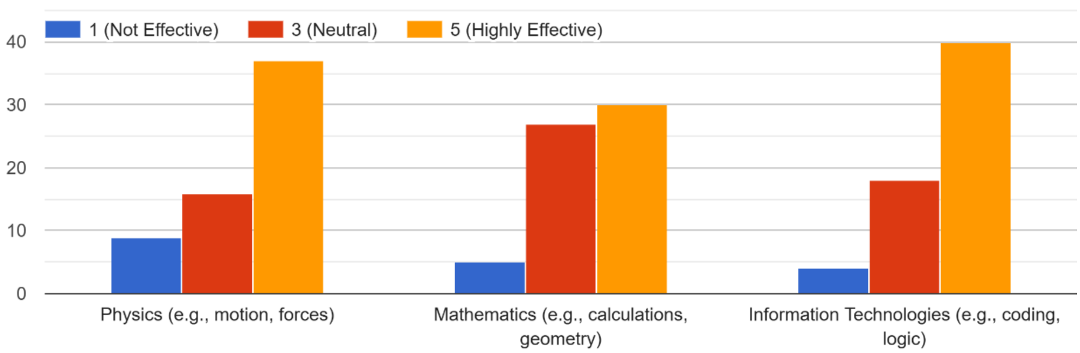
6. Perspectives from the Classroom: Teachers & Students

The Student Experience: Distraction vs. Facilitator

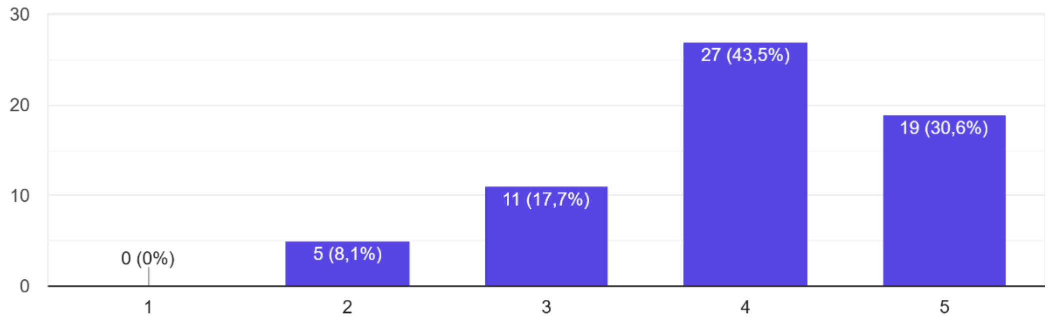
An overwhelming majority of students recognized the FOSSBot as a valuable **learning facilitator** rather than a distraction. Students noted that the robot turned boring coding logic into an engaging "living experiment". Seeing velocity or watching an if-then statement control an obstacle-avoidance maneuver made abstract concepts highly concrete. It pushed them to care about the math behind the movements and acted as a shared problem-solving tool that brought teams together.

Note: Feedback was overwhelmingly positive, with only isolated exceptions—such as a student who described it as "dreadful" and one who noted a temporary distraction simply due to the robot's initial novelty.

How effectively did the SchoolBox materials support the following subject areas during your learning situation?



How would you rate the clarity and flow of the Lesson Plans provided in the SchoolBox?
62 απαντήσεις



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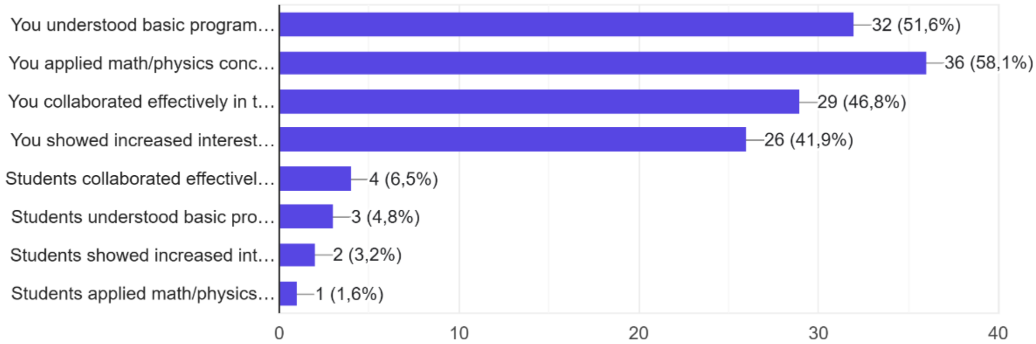
Which of the following objectives do you feel were successfully met in today's session? (Select all that apply)

62 απαντήσεις



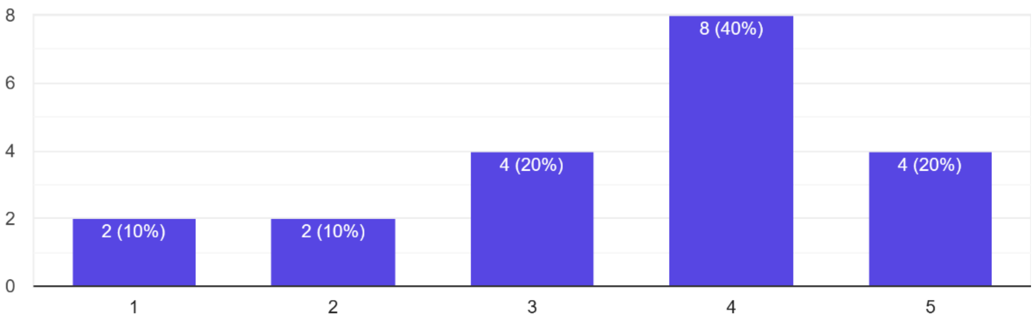
The Teacher Experience: High Engagement & "Spark" Moments

Teachers reported that student engagement was vastly superior to traditional, passive STEM lessons, describing a state of "flow" where students actively managed their own knowledge. Key "spark" moments occurred when:

- Students tackled real-world challenges, like imagining a zero-waste week at school.
- Abstract code instantly transformed into physical robotic movements.
- Students physically tested principles of physics or calculated light thresholds to simulate an automated street lighting system.

How intuitive was it to integrate the FOSSbot into today's specific subject (Math/Physics/IT)?

20 απαντήσεις



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