Community Education and Service Journal
https://scholar.ummetro.ac.id/index.php/cesj/index
Vol. 1, No. 2 (2025), 1-6
e-ISSN 3090-5796 p-ISSN 3090-5613

SKYROCKETING THE SPIRIT OF RESEARCH: WATER ROCKET TRAINING FOR KIR STUDENTS OF SENIOR HIGH SCHOOL 1 PUNGGUR

Ananda Purnomo[1], Velicia Septiana[2], Yulia Puspita Dewi[3], Dedy Hidayatullah Alarifin[4], Friska Octavia Rosa[5*]

[1,2,3,4,5]Universitas Muhammadiyah Metro, Lampung, Indonesia

Article Info

Article history:

Received July 10, 2025
Revised November 06, 2025
Accepted November 30, 2025

Keywords:

constructivism;
extracurricular;
physics education;
scientific literacy;
water rocket

ABSTRACT

This community service activity aims to foster students' interest in science through a hands-on and engaging approach by conducting a water rocket training for members of the Scientific Youth Club (KIR) at SMA Negeri 1 Punggur. The training is designed to introduce physics concepts, particularly pressure, force, and motion, in a practical and enjoyable way. The method used is constructivist-based experiential learning, where students build knowledge through direct experience. The activity consists of coordination, socialization, material delivery, water rocket making, and launching sessions. The results show that all 15 participants successfully built and launched water rockets using functional and symmetrical designs. The activity not only enhanced students' scientific understanding but also improved their problem-solving, teamwork, and creative thinking skills. This program demonstrates that learning by doing is effective in strengthening both theoretical comprehension and practical skills. The training contributed to the development of KIR extracurricular activities and served as an initial platform for future scientific projects. It is recommended that such activities be integrated routinely into school programs to continuously support students' scientific literacy and creativity.

Corresponding Author:

Friska Octavia Rosa
Sains Education Study Program, Postgraduate Program
Universitas Muhammadiyah Metro
Jl. Ki Hajar Dewantara No.116, Metro City, Lampung.
Email: friskaoctaviarosa@gmail.com

INTRODUCTION

The development of science and technology (IPTEK) has experienced a very rapid surge, especially in the 21st century. Science and technology has had a major impact on the way humans live by facilitating various activities and improving the quality of human life (Mulyani F & Haliza N, 2021; Rosa, et.al., 2024). One of the areas positively affected by the development of science and technology is education, where technological advances have brought significant changes in the teaching and learning process as well as access to information and knowledge. Education is a systematic and sustainable process that aims to develop human potential to become intelligent, noble, independent, and responsible individuals in social life (Rahman et al., 2022; Ramadhoni et al., 2025).

In addition, education is a process that changes behaviour, increases knowledge, and provides life experience, so that learners can develop into individuals who are more mature in their ways of thinking and behaving. Education also plays an important role in improving the intelligence of the nation, because it can shape the character and identity of a country (Rohmah et al., 2023). In the modern era of education, one of the main challenges in teaching natural sciences (IPA), especially physics, is to make students interested and understand abstract concepts such as

force, motion, pressure, and energy. One approach that can be used is through project-based learning methods or experiments. By involving students in practical activities, complex concepts can be presented in a way that is easier to understand (Arini, 2024).

Education is key in shaping a skilled and qualified future generation. In an effort to prepare students to face the challenges of an increasingly complex modern world, the implementation of physics in the school curriculum has become a top priority. Physics is not just a scientific subject, but also plays an important role in developing an understanding of concepts and skills relevant to various aspects of life (Puspa Sari et al., 2023; Saputri & Rosa, 2025). Education is also a process that goes beyond acquiring academic knowledge in the classroom. A holistic education also includes activities outside the formal curriculum, known as extracurricular activities (Intan et al., 2023). Extracurricular activities are student development activities that are carried out outside of intracurricular activities. This has been mandated in Permendiknas No. 39 of 2008 concerning student development article 3 paragraph 1 (Narayukti et al., 2019).

Extracurricular activities are an important component of the school experience beyond academic learning. It provides an opportunity for students to gain valuable experience outside of the classroom, mould their character, and uncover potential that may not have been seen (Marpaung et al., 2024; A'yun & Rosa, 2025). Extracurricular activities at school contribute to creating a high level of intelligence. With extracurricular activities, students can take part in activities that they are interested in every week they practice and get good habituation, thus emphasising that humans can be formed through habituation or conditionalisation of a supportive environment (Hakim, 2020). Extracurricular activities that are carried out effectively and organised can not only support the success of intracurricular programs, but can also support the success of education at large (Ernawati et al., 2024). The development of students' personalities is at the core of the development of extracurricular activities. Therefore, a mature personality profile is the main goal of extracurricular activities (Nuryanto, 2017; Hastuti, Rosa & Alarifin, 2025). One form of extracurricular activity that can support the development of creativity and scientific interest of students is Youth Scientific Work (KIR).

KIR are groups of teenagers who carry out a series of activities that produce a result called scientific work. Scientific work itself has the meaning of a work produced through thinking according to logical, systematic, rational reasoning rules and there is coherence between its parts (Muchson et al., 2022). From this understanding, it is very clear that the skills of writing scientific papers can not only be obtained during class hours, but also in extracurricular KIR activities, knowledge about writing scientific papers can be obtained (Herlyn et al., 2018). The objectives that must be achieved by KIR members individually are the development of scientific attitudes, honesty in solving natural phenomena encountered with high sensitivity with systematic, objective, rational and procedural methods so that competence will be obtained to develop themselves in life (Ilman, 2019). However, there are still many schools that have not optimised the role of KIR as a structured and inspiring space for scientific exploration. SMA Negeri 1 Punggur is one of the schools that has utilised extracurricular KIR very well and actively, but still needs a variety of applicable and fun activities to encourage student interest in science, especially physics. One activity that is considered interesting and educational is the making of water rockets. Water rockets are simple rocket models that utilise basic physics principles (Agus et al., 2024). The working principle of a water rocket is similar to the experience of flying a balloon in the air. The water rocket produces a large force on the ejected gas, which in turn exerts a comparable reaction force in the opposite direction, pushing the water rocket upwards. The thrust received by the water rocket from the gas is proportional to the force applied to the gas, which transfers from the water rocket to the gas, but in the opposite direction (Julviansyah et al., 2024). Water rockets are also a simple approach in the process of developing space rockets (Haryani et al., 2016). Making water rockets can improve students' critical thinking skills, cooperation, and creativity. In addition, this activity provides direct experience in applying science concepts such as pressure, force, and motion (Mardiansya et al., 2016)

As an effort to encourage students' interest in science through extracurricular activities, an activity in the form of "*Water Rocket Making Training*" was designed. This training activity was designed as a form of university contribution to society to improve science and technology literacy

at the secondary education level, especially through water rocket making training for KIR members of SMA Negeri 1 Punggur. This activity not only aims to introduce the basic concepts of physics through fun methods, but also helps to develop soft skills in terms of problem solving and collaborative work. A great interest in learning a particular subject, coupled with a positive attitude, will make students enjoy the lesson more, so that their learning outcomes become more optimal. With the water rocket competition, students are expected to develop a high interest in physics (Tia Setiawan et al., 2023). This training is designed with a constructivism approach, where students build knowledge based on their experiences and environment (Masgumelar & Mustafa, 2021)

IMPLEMENTATION METHOD

The implementation of this training activity is systematically designed with a constructivism and experiential learning approach. This method was chosen to provide an active and meaningful learning experience for students who are members of the Youth Scientific Work (KIR) extracurricular program. The stages of this training activity began with the initial coordination of the implementation team with the school to discuss the schedule, technical implementation, preparation of facilities and infrastructure and the availability of the school as a place for water rocket making training. This coordination is carried out so that training activities run smoothly, are integrated with school programs, and are in accordance with student needs.

The next stage is the socialization stage to students who are members of KIR. This socialization was carried out to introduce the objectives, benefits and overview of the water rocket training activities. At this stage, interviews were also conducted with students regarding their understanding of water rockets. The results of these interviews were used as the basis for developing a training plan in order to achieve the planned objectives.

The core stages of the activity consisted of three main sessions, namely the material delivery session, the water rocket making practice session, and the water rocket launch session. In the first session, students were given a conceptual understanding related to water rockets such as how to make them, what materials are needed, how to design the tool, and how the working principle of water rockets. Furthermore, in the manufacturing practice session, students were divided into three small groups of five members each. Each group was given materials and procedures for making water rockets and launchers. The training team was tasked with guiding students in the process of planning, making, and testing. This session aims to train students' skills, cooperation and provide students with hands-on experience in physics. The last session is the launch session, where all groups take turns testing the water rocket. Students are invited to reflect and evaluate what they have made, namely in the form of rocket performance, design effectiveness, and provide improvement solutions.

RESULTS AND DISCUSSION

The water rocket-making training activity conducted at SMA Negeri 1 Punggur successfully involved 15 participants from the KIR extracurricular club, this activity is depicted in Picture 1. The activity took place over three days, consisting of an introductory session, rocket construction, and rocket testing. The physical outcome of this activity was one set of water rocket equipment, consisting of two water rockets, one launcher, and one air pump. The success of the activity was measured by the students' ability to construct the water rockets. Two main indicators of success were whether the rockets could be launched stably using an air pump, and whether the physical structure of the rockets, such as the fins, body, and stabilizers, were arranged functionally and symmetrically according to the agreed specifications.

The participants' success in constructing the water rockets demonstrated that they were able to translate theoretical concepts into tangible forms through hands-on practice. The assembly process, which involved measurement, fin assembly, pressure adjustment, and launch testing, demonstrated the students' ability to think systematically, collaborate, and independently solve technical problems in small groups. This also shows that students have the potential to develop basic technical skills if facilitated through a conceptual, creative, and collaborative approach. This success also serves as evidence that the learning by doing approach is effective in

promoting students' understanding and skills. In this activity, the water rocket not only serves as a practical tool but also as a fun means of scientific exploration. Water rockets can increase students' motivation to learn physics because students not only learn theoretically but also learn by doing (experiments).

Picture 1. Activity Documentation

This success also marks an important initial achievement for strengthening KIR at SMA Negeri 1 Punggur, as this extracurricular activity has traditionally focused more on theoretical discussions and has not involved many practical activities. The training was highly beneficial for students, as they gained positive experiences in designing and creating simple scientific works, which can serve as inspiration for developing other scientific projects in the future. Although this activity was limited in terms of time and stage of development, the results provide a strong foundation for the development of more complex follow-up programs. In other words, the students' success in making water rockets is not just an end result, but the beginning of broader and more integrated scientific learning.

CONCLUSIONS AND SUGGESTIONS

The water rocket training activity for KIR extracurricular students at SMA Negeri 1 Punggur has been successfully implemented and achieved its set objectives. The main achievement of this activity is that all students successfully assembled and launched water rockets, reflecting an improvement in practical skills and an understanding of basic physics concepts in an applied manner. This training also fostered enthusiasm, cooperation, and a spirit of scientific exploration among the students. The hands-on, project-based approach of this activity provided meaningful learning experiences and strengthened the integration between theoretical knowledge and practical skills. Overall, this training successfully served as a means to enhance the quality of KIR extracurricular activities at the school, particularly at SMA Negeri 1 Punggur.

Given the positive outcomes of this activity, it is recommended that the water rocket-making training be made a regular agenda in KIR extracurricular activities. Additionally, the participation of mentors and collaboration between schools can be expanded to strengthen the development of science at the student level. For future initiatives, it would be beneficial to prepare structured learning modules. The sustainability of such programs is expected to foster a generation of young people who are not only proficient in theory but also skilled and creative in scientific practice.

ACKNOWLEDGMENTS

We would like to express our deepest gratitude to SMA Negeri 1 Punggur, especially the coaches, mentors, and principal for their support, permission, and facilities provided, which enabled this activity to run smoothly. We would also like to express our appreciation and gratitude

to the KIR student members who actively participated throughout the activity, enabling it to achieve its objectives. We also extend our gratitude to the lecturer in charge of the Extracurricular Studies course for their guidance and direction throughout the activity, and we sincerely thank our team members who collaborated to successfully carry out the water rocket training activity.

REFERENCES

Agus, J., Broto, P. E., Ruslan, Z. A., Islam, U., Alauddin, N., Makassar, U. N., Author, C., & Air, R. (2024). *Edukasi Rancangan Roket Air Sederhana Bagi Mahasiswa Pendahuluan Metode Pelaksanaan*. 120–125. https://doi.org/10.35580/abdi.v2i1.5506

Arini, W. (2024). Pelatihan Pembuatan Roket Air Untuk Gaya Pada Siswa Di Smp Negeri Air Satan Jurnal Cemerlang *: Jurnal Cemerlang: Pengabdian pada Masyarakat*. *7*(1), 111–120. https://doi.org/10.31540/jpm.v7i1.3253

A'yun, D. Q., & Rosa, F. O. (2025). Evaluating the Requirements for Designing an Interactive Digital Student Worksheet to Support Science Process Skill Development in Elementary Education. Journal of Studies in Elementary Education, 1(1), 26-36. DOI: 10.64268/jsee.v1i1.33

Ernawati, E., Haris, I. N., Kharisma, G. N., Hl, N. I., Sari, T. M., Tendrita, M., MGB, F., & Muktafia, M. (2024). Pendampingan Revitalisasi Ekstrakurikuler KIR Berbasis Kolaborasi dengan Pendekatan Blended Learning di SMA Negeri 1 Tanggetada. *Wahana Dedikasi: Jurnal PkM Ilmu Kependidikan*, *7*(1), 231–239. https://doi.org/10.31851/wdk.v7i1.16729

Hakim, I. (2020). Manajemen Kegiatan Ekstrakurikuler Di Madrasah. *Jurnal Al-Hikmah*, *2*(2), 149–153. https://**doi**.org/10.36574/jpp.v2i1.27.

Hana Nurur Rohmah, Nabella Yaniariza Putri, Septi Yunita, Yunita Yasmin, & Agus Mulyana. (2023). Pengaruh Kegiatan Ekstrakurikuler Terhadap Karakter Peserta Didik Di Sekolah Dasar. *Jurnal Sadewa : Publikasi Ilmu Pendidikan, Pembelajaran Dan Ilmu Sosial*, *1*(3), 292–299. https://doi.org/10.61132/sadewa.v1i3.95

Haryani, F. F., Amaliah, R., Fitrasari, D., & Viridi, S. (2016). Konsep fisika dalam gerak permainan roket air. *Seminar Nasional Pendidikan Sains "Peningkatan Kualitas Pembelajaran Sains Dan Kompetensi Guru Melalui Penelitian & Pengembangan Dalam Menghadapi Tantangan Abad-21," October 2016*, 245–254. https://www.researchgate.net/publication/340308404_KONSEP_FISIKA_DALAM_GERAK_PERMAINAN_ROKET_AIR#full-text

Hastuti, E. D., Rosa, F. O. & Alarifin, D. H. (2025). Analysis of Science Problem-Solving Ability on Force Material Reviewed from the Personality Types of Eighth-Grade Students at SMP Negeri 3 Batanghari. *Jurnal Penelitian Pendidikan IPA*, *11*(9), 723-731. DOI:10.29303/jppipa.v11i9.12049

Herlyn, P., Dewi, N., Ayu, S., Sriasih, P., & Sudiana, I. N. (2018). Pengaruh Kegiatan Ekstrakurikuler Kelompok Ilmiah Remaja Terhadap Keterampilan Menulis Karya Ilmiah Siswa Kelas Xi Sma Negeri 1 Sawan. *Jurnal Pendidikan Bahasa Dan Sastra Indonesia UNDIKSHA*, *8*(2), 273–283. https://doi.org/10.23887/jjpbs.v7i2.15101

Ilman, R. (2019). Kegiatan Ekstrakurikuler Kelompok Ilmiah Remaja (Kir) Dalam Mengembangkan Kemampuan Ilmiah Siswa. *Lombok Journal of Science (LJS)*, *1*(1), 14–19. https://ojs.unm.ac.id/JLLO/article/view/29762/pdf

Intan, O. A., Juliantika, J., Selly, A. S., & Syahla, R. P. N. (2023). Peran Kegiatan Ekstrakurikuler Dalam Pembinaan Dan Pengembangan Siswa Sekolah Dasar. *Jurnal Bintang Pendidikan Indonesia*, *1*(4), 86–96. https://doi.org/10.55606/jubpi.v1i4.2001

Julviansyah, D., ardi, & Maysaroh Chairunnisa, N. (2024). Pelatihan Pembuatan Roket Air Untuk Meningkatkan Motivasi Belajar Siswa Di Desa Sirnajati. *Jurnal An-Nizām : Jurnal Bakti Bagi Bangsa*, *3(1)*, 59–63. https://doi.org/10.33558/an-nizam.v3i1.9291

Mardiansya, D., Ramacos, F., Annisa, H. F., Rifwandi, R., Rapitri, J. F., & Armysa, R. (2016). Edukasi Fisika Dan Praktik Roket Air Di Mts N 6 Sijunjung. *SELAPARANG. Jurnal Pengabdian Masyarakat Berkemajuan*, *7*, 2552–2556. https://www.scribd.com/document/843361044/roket-air-untuk-mts

Marpaung, D. P. Br., Nurroyian, Hasbih Sholeh Suryadi, Lucky Tirta Ardiansyah, & Muhammad Iqbal. (2024). Peran Kegiatan Ekstrakurikuler dalam Pengembangan Keterampilan Sosial Siswa. *Indo-MathEdu Intellectuals Journal*, *5*(3), 3408–3416. https://doi.org/10.54373/imeij.v5i3.1365

Masgumelar, N. K., & Mustafa, P. S. (2021). Teori Belajar Konstruktivisme dan Implikasinya dalam Pendidikan. *GHAITSA: Islamic Education Journal*, *2*(1), 49–57. https://doi.org/10.62159/ghaitsa.v2i1.188

Muchson, M., Santoso, A., Kusumaningrum, I. K., & Rokhim, D. A. (2022). Aksiologiya : Jurnal Pengabdian Kepada Masyarakat Program Pembinaan Intensif Guru Pembina dan Siswa Ekstrakurikuler KIR di SMP / MTs Kabupaten Malang Berbasis Hasil Penelitian Universitas Negeri Malang Indonesia telah berpartisipasi dalam tes *PISA pada ta*. *6*(2), 228–237. https://doi.org/10.30651/aks.v6i2.4623

Mulyani F, & Haliza N. (2021). Analisis Perkembangan Ilmu Pengetahuan dan Teknologi (Iptek) Dalam Pendidikan. *Jurnal Pendidikan Dan Konseling (Jpdk)*, *3*(1), 101–109. https://doi.org/10.31004/jpdk.v3i1.1432

Narayukti, N. N. D., Artika, I. W., & Rasna, I. W. (2019). Pembinaan Dan Penggunaan Bahasa Dalam Menulis Karya Ilmiah Pada Ekstrakurikuler Karya Ilmiah Remaja (Kir) Di Sma Laboratorium Undiksha. *Jurnal Pendidikan Bahasa Dan Sastra Indonesia Undiksha*, *8*(1), 64–74. https://doi.org/10.23887/jjpbs.v8i1.20520

Nuryanto, S. (2017). Manajemen Kegiatan Ekstrakurikuler di SD Al Irsyad 01 Purwokerto. *Jurnal Kependidikan*, *5*(1), 151–168. https://doi.org/10.24090/jk.v5i1.1260

Puspa Sari, T., Dzaky Issafira, R., Saputro, W., Khairul Faizin, A., & Hasan, N. (2023). Pelatihan Rancang Bangun Roket Air Kepada Siswa Sman 8 Malang. In *Jurnal Pengabdian Masyarakat Teknik Mesin (Abdi-Mesin: Vol. III* (Issue 1). https://doi.org/10.33005/abdimesin.v3i1.46

Rahman, A., Munandar, S. A., Fitriani, A., Karlina, Y., & Yumriani. (2022). Pengertian Pendidikan, Ilmu Pendidikan dan Unsur-Unsur Pendidikan. *Al Urwatul Wutsqa: Kajian Pendidikan Islam*, *2*(1), 1–8. https://journal.unismuh.ac.id/index.php/alurwatul/article/view/7757

Ramadhoni, I., Aththibby, A. R., Partono, & Rosa, F. O. (2025). Development of android-based Khazini adventure application as a physics learning media. In *AIP Conference Proceedings* (Vol. 3333, No. 1, p. 020014). AIP Publishing LLC. https://doi.org/10.1063/5.0290782

Rosa, F. O., Lestari, P., Febriana, F., & Fatmawati, E. L. (2024). Analysis of High Order Thinking Skills in Physics in 21St Century Learning. *EduFisika: Jurnal Pendidikan Fisika*, *9*(2), 148-154. https://doi.org/10.59052/edufisika.v9i2.31097

Saputri, N. M. I., & Rosa, F. O. (2025). Innovation of guided inquiry IPA wave module using PhET simulation. *Compton: Jurnal Ilmiah Pendidikan Fisika*, *11*(2), 115-129. https://doi.org/10.30738/cjipf.v11i2.20093

Tia Setiawan, J., Cahya Rohim, D., & Rusilowati, A. (2023). Peningkatan Struktur Kognitif Fisika Siswa SMK pada Pembelajaran Roket Air. *BRILIANT: Jurnal Riset Dan Konseptual*, *8*(3), 567–575. https://doi.org/10.28926/briliant.v8i3