

REPORTS

Palestine at the International Olympiad in Informatics: Advancing Computational Thinking Among K-12 Students

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Abstract. The Palestinian Olympiad in Informatics has been a significant endeavour since its inception in 2017. It has steadily grown, with programming clubs established in all schools to foster student interest and skill development. The milestone of winning the first bronze medal in 2022 marked a notable achievement in our journey. This report provides an overview of Palestine's participation in the International Olympiad in Informatics, outlining our objectives, preparation efforts, performance, and the profound impact of our involvement on the local and international levels, sparking increased interest in computer science across Palestine and fostering international collaboration and innovation in informatics.

Keywords: Palestine, education technology, Palestinian Olympiad in Informatics, computational problem-solving.

Introduction

The state of Palestine has joined the family of the International Olympiad in Informatics through an initiative of the College of Information Technology and Computer Engineering at Palestine Polytechnic University led by Dr Musa Alrefaya since 2016. As a result of its successful experience in training school students by holding summer camps in the field of competitive programming, A special team of trainers from Palestine and the Arab countries in the Palestinian Collegiate Programming Contest for Universities (PCPC) are training the participants in the International Olympiad in Informatics.

Computational problem-solving initiatives began in Palestine in 2012, with the inaugural Palestinian Collegiate Programming Contest (PCPC) held at Palestine Polytechnic University (PPU). The event drew participation from 10 universities and 81 students from the West Bank. The following year saw the launch of the first training summer school at PPU, aimed at nurturing talent in problem-solving skills. Out of over 1000 students, 65 were selected to participate in this intensive program.

As the years progressed, the scope of problem-solving training widened, with more students engaging in various educational activities. Multiple summer schools were organised across different universities and affiliated associations, providing opportunities for students to enhance their problem-solving abilities and computational thinking skills.

Recognising the importance of fostering programming proficiency among students, the Ministry of Education introduced a local competition called the Student Coding Initiative. This competition encouraged students to explore computer programming and computational concepts. The Student Coding competition witnessed significant participation, attracting hundreds of students eager to expand their programming knowledge and showcase their skills.

In 2020, Samed AlHajajla, a former participant at the IOI and the deputy leader of the Palestinian team, founded Meshka, a social startup on a mission to enhance the computational problem-solving skills of K12 students through computer science, math, science, and design thinking. Since 2020, Meshka has trained thousands of K12 students in computational problem-solving, successfully fulfilling its goal of improving students' problem-solving abilities.

The landscape of problem-solving education in Palestine has evolved significantly since its inception in 2012. Initiatives such as the PCPC, Meshka's computational problem-solving programs, training summer schools, and the Student Coding competition have empowered Palestinian students to develop their problem-solving abilities and excel in computer science. This steady growth and progress inspires us to continue our efforts and strive for significant achievements.

The inception of summer schools in 2013 at Palestine Polytechnic University marked a significant milestone in advancing computer science education in Palestine. These summer schools aimed to enhance students' informatics and computational thinking skills. The selection of trainers for these schools was meticulously done through logical exams conducted by the Ministry of Education department in each city, ensuring the quality of education imparted to the students.

The levels of participating students have consistently improved, reflecting the effectiveness of the summer school programs. Additionally, more universities have joined in training students through the International Collegiate Programming Contest (ICPC) community, contributing to a broader reach and impact.

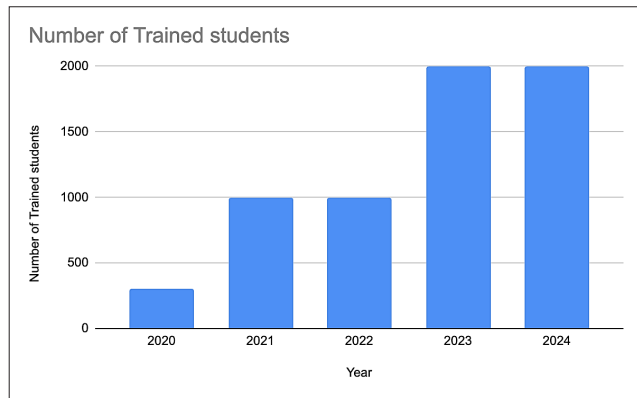
On average, each summer school at every university attracted between 60 and 100 students, indicating a growing interest and demand for such educational initiatives. Simultaneously, efforts to raise awareness among schools and students continued, promoting the importance of computer science education.

The Palestinian Olympiad in Informatics team has partnered with Meshka to develop advanced computational problem-solving programs for K12 students. One of these pro-

grams is Solve for Palestine, which offers three levels: beginner, intermediate, and advanced. All students are welcome to participate at the beginner level and will go through an online learning experience based on peer-to-peer learning. Facilitators are also available to provide group office hours and assist with projects and exercises every week. After one month, students who pass the final exam will be selected to move on to the intermediate level. Here, they will be exposed to IOI-style problems, which will ultimately help them develop the skills necessary to solve IOI problems. After that, in partnership with Code.X, advanced training is tailored to each selected student to prepare them for the national and international informatics competition.

The following table shows the number of students trained in a joint effort of the Palestinian Olympiad in Informatics and Meshka:

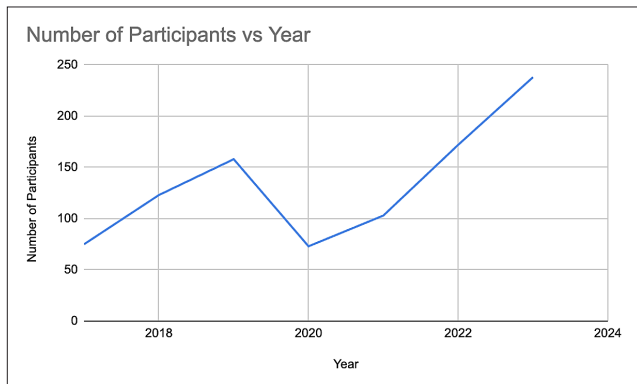
Year	Number of Trained students
2020	300
2021	1000
2022	1000
2023	2000
2024	2000



In 2020, the number of students interested in computational problem-solving has increased significantly. This can be attributed to the growing awareness and advocacy for the importance of technology and learning coding. Students who have joined this program have had access to mre opportunities to compete, win competitions, receive scholarships, gain outstanding recognition, and further their learning. This has consequently encouraged more students to develop an interest in this field of study.

The following table shows the number of participants in the national IOI competition during previous years:

Year	Number of Participants
2017	75
2018	123
2019	158
2020	73
2021	103
2022	172
2023	238
2024	Expected number (300–350)



Through the analysis of data collected on the number of participants in the annual competition from 2017 to 2023, with forecasts for 2024, we can observe significant developments and essential changes in the interest to participate. The competition began in 2017 with 75 participants and saw a noticeable increase in numbers in the following years, reaching 123 participants in 2018 and then rising to 158 in 2019; this is due to the ongoing work of the Palestinian Olympiad in informatics to advocate and raise awareness about informatics in Palestine.

The year 2020 witnessed a sharp decline in numbers, likely due to the impacts of the COVID-19 pandemic, where the number of participants fell to 73. However, the numbers began to recover gradually in 2021, with 103 participants and continued to rise strongly in the following two years, with 172 participants in 2022 and 238 in 2023. For 2024, organisers expect this increase to continue, with estimates ranging from 300 to 350 participants.

These figures reflect the success of the organisers' strategies in enhancing the event and increasing its appeal, as well as the sector's recovery from external shocks such as the pandemic. The expected growth for 2024 shows the organisers' confidence in continuity and expansion, indicating that the competition has established itself as a significant event that attracts increasing interest each year.

Preparation for International IOI

To effectively enhance and expand participation in the International Olympiad in Informatics (IOI), strategic steps include developing early programming skills in school curricula, strengthening training through advanced programs and mentorship, broadening participation via inclusive policies and regional contests, leveraging technology for broader engagement, promoting informatics education through awareness campaigns, continuously evaluating and adapting strategies, and building a supportive community for sustained excellence. These efforts aim to increase the quality of individual performances and the scope of international collaboration and innovation in informatics.

The journey to international IOI began with a nationwide selection process, culminating in identifying Palestine's most talented young programmers. Four students were chosen to represent our nation through competitive exams and performance evaluations.

The national team comprised four exceptional students, each with a proven track record in national programming contests and a deep passion for computer science.

The training process for students to participate in the competition begins through a strategic partnership with the Palestinian Olympiad in Informatics, Meshka, and the Ministry of Education, where agreements are made to identify and select outstanding students from various schools. This selection is based on specific criteria that ensure the choice of students who are most capable and prepared for competition. After selection, these students are enrolled in intensive technological summer camps designed

to enhance their programming and analytical skills. In these camps, students receive training from specialists and experts in programming and technology, where they are guided and trained on the latest methods and techniques that enable them to excel in international competitions.

The expertise of graduates from this competition and the PCPC programming contest was utilised to enhance the student's skills and prepare them effectively for the competition. These alumni, who possess extensive practical experience and a deep understanding of competition challenges, provided training and guidance to new participants. The training sessions were designed to cover a wide range of technical topics and necessary skills, which increased the students' efficiency and improved their ability to compete at a high level in these contests. Thanks to this approach, the competition created a dynamic educational environment that continuously develops students' skills and equips them with the tools needed for success.

This program focused on advanced algorithms, data structures, and problem-solving strategies essential for international success.

Participation in IOI

Experience

The Palestinian team engaged fully in the IOI experience, from the intellectually challenging competition to cultural exchange activities. This exposure to the global informatics community was invaluable, providing our students with new perspectives and inspiration.

Performance and Achievements

Our team performed admirably, with each member demonstrating exceptional skill and determination. While we did not secure a medal this year, the team ranked competitively, and their achievements have made our nation proud.

In 2017, Palestine debuted in the International Olympiad in Informatics (IOI) held in Iran. This was a significant milestone for the Palestinian informatics community. The breakthrough came in 2022 when Nicola Abu Saad secured Palestine's first medal in the competition, bringing recognition and pride to the nation.

Since 2020, independent training sessions have been conducted through a Meshka dedicated to nurturing young talent in informatics. Over the last two years, the Ministry of Telecom and Information Technology has stepped in to support and sponsor training sessions, further bolstering the country's participation in international competitions.

Outcomes and Impact

Learning and Development

IOI experience has significantly contributed to our participants' personal and academic growth, equipping them with skills far beyond the competition. Students who represent Palestine in the IOI study with scholarships in university, win every programming competition in Palestine, have opportunities to study at Ivy League schools, and intern at big tech companies such as Facebook and Google.

Future Participation

Reflecting on our IOI journey, we recognise areas for improvement, particularly in our training program and resource allocation. These insights will be invaluable in enhancing our future performance.

National Impact

Participation in IOI has stimulated increased interest in computer science across Palestine, encouraging more students to pursue excellence in this field. It has also highlighted the importance of supporting STEM education at a national level.

Challenges and Recommendations

Despite logistical and financial challenges, our team's resilience and dedication were unwavering. We recommend establishing robust support structures for future teams, including securing long-term funding and expanding our training resources.

Despite the progress made, several challenges persist. One major obstacle is the difficulty for students in attending on-site training sessions due to obstacles and checkpoints between cities. Financial constraints remain a significant challenge, as most training activities rely heavily on volunteer efforts.

Another formidable challenge is the inclusion of students from Gaza, given the restrictions on movement. However, a breakthrough occurred last year with the participation of a contestant from Gaza in IOI 2023, marking a significant step towards inclusivity.

Another challenge for many students is the language barrier, particularly the adoption of English in training sessions. Efforts to overcome this hurdle are ongoing but require sustained support and resources.

This year, students from Gaza faced significant obstacles that directly affected their participation in the competition due to the complex political situation in the region. The frequent closures of schools and universities due to tensions and security incidents have severely limited their opportunities for continuous education and proper preparation for international competitions. Additionally, difficulties in internet communication, wheth-

er due to disruptions or technological restrictions, posed a significant barrier to their effective communication with organisers and other participants. Together, these factors presented a tremendous challenge for the students of Gaza, who strive to demonstrate their capabilities and achieve excellence despite the overwhelming circumstances surrounding them.

Future Endeavors

Despite the challenges, there is optimism for the future. Initiatives like Bebras, introduced recently, hold promise for further engaging students and fostering interest in informatics. Additionally, ongoing efforts to overcome logistical and financial barriers will pave the way for greater participation and success in international competitions.

Conclusion

The Palestinian team's journey at the IOI was one of learning, growth, and inspiration. We extend our deepest gratitude to everyone who supported this endeavour. We are committed to building on this experience, nurturing our young talents, and aiming for even more outstanding achievements in future IOIs.

The Palestinian Olympiad in Informatics has come a long way since its inception, thanks to the dedication of educators, volunteers, and supporters. While challenges persist, the achievements and progress made serve as a testament to the resilience and determination of the Palestinian informatics community. With continued support and collaboration, Palestine is poised to make even more significant strides in the field of informatics and excel on the international stage.



M. Alrefaya – Dean of Dual Studies Deanship since 2021 and has been a full-time senior lecturer at the College of Information Technology and Computer Engineering college-Palestine Polytechnic University in Palestine since 2004. He was a researcher at the Electronic and Informatics Department at the Vrije University of Brussels from 2007 to 2015. Alrefaya has many publications in medical image processing. He is the director and founder of the Palestinian Olympiad in Informatics, Palestinian Bebras community, and the Palestinian Collegiate Programming Contest (PCPC).



S. AlHajjla – Social Entrepreneur, Software Engineer, and Social Service Designer, he is the CEO and Co-Founder of Meshka, a platform working on integrating problem-solving skills in K12 education. Director and Founder of the Palestinian Mathematical Olympiad, official representative of Palestine at the International Mathematical Olympiad, deputy leader and coach of the Palestinian team at the International Olympiad in Informatics.