

# The International Earth Science Olympiad as a tool to enhance the profile and quality of Earth Science education

**RAJASEKHARIAH SHANKAR**

CHAIR, INTERNATIONAL GEOSCIENCE EDUCATION ORGANISATION.

CHAIR, ADVISORY BOARD AND EXAMINATION BOARD FOR IESO

HOME ADDRESS: 29, 4TH MAIN ROAD, CHAMARAJAPETE, BENGALUURU 560 019, INDIA

E-MAIL: RSHANKARGEO@GMAIL.COM

**Abstract:** The International Earth Science Olympiad (IESO) is a relatively new international science olympiad, having begun in 2007. Besides the usual written and practical tests, co-operative activities like the International Field Team Investigation (ITFI) and Earth System Project (ESP) are special and exclusive to IESO. Two problems that are unique to Earth Science education are the lack of visibility and the quality of teaching of Earth Science. In recent years, the International Geoscience Education Organisation has brought in sweeping changes in the way IESO testing is done. This paper summarises how IESO has contributed to enhancing the profile and visibility and the quality of earth science education: Through national level entrance test and National Earth Science Olympiad; through publicity regarding the entrance test and related Olympiad activities; through workshops during and between IESO's; through Mentors and Observers; through the International Team Field Investigation (ITFI) and Earth System Project (ESP); and through hosting IESO. However, efforts have to be made to further increase the impact of IESO on the quality of Earth Science education by several means, including having more countries to participate in IESO.

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## 1 Introduction

It is important to realize and propagate the concept that the Earth works as a system with several subsystems within it, with matter and energy continuously transferred from one subsystem to another. Human activities have upset the natural balance among the subsystems. Earth Science (ES) is important to understand the Earth System, the surface processes, natural and human-induced hazards and the resources that we need for our existence. Therefore, Earth Science is important to humankind in several ways; every school student must have a basic understanding of Earth Science in order to grow up to be a responsible and earth science-literate citizen. Students must get this understanding from hands-on activities and make deductions from observations.

In promoting earth science education, two issues confront us globally: 1) Lack of / insufficient visibility for earth sciences in society as a whole and among school students; and 2) How earth sciences are taught in schools (the quality aspect) (Shankar et al., 2017). Based on my involvement with International Earth Science Olympiad (IESO) preparatory meetings and experience with all IESO's held so far except the one in the Philippines, I wish to show here how IESO, a flagship activity of the International Geoscience Education Organisation (IGEO) ([www.igeosced.org](http://www.igeosced.org)), has contributed to tackling the afore-mentioned two issues to some extent at least. This is based on my experiences and involvement in the preparatory stages of IESO (Shankar, 2004a, b), and my role as member, IESO Syllabus Commission (IESO Sylla-

bus, 2018), Indian Team Leader for IESO, National Co-ordinator for Earth Science Olympiad (India), Organising Secretary for the 7<sup>th</sup> IESO in India (Shankar, 2014), Chair, IGEO, Chair, IESO Advisory Board, and Chair, IESO Examination Board, and the formal discussions I had in meetings and informal discussions with several members of the IESO family. Presented below are an introduction to IESO, its objectives, the Olympiad *per se* and the ways in which IESO has improved the visibility and quality of earth science education in the world.

## 2. What is IESO?

IESO ([www.ieso-info.org](http://www.ieso-info.org)) is an annual competition for secondary school students who have been chosen based on their performance in national Earth Science Olympiad or national level test of their respective countries. The main aims of IESO are: to encourage students' interest and public awareness of Earth Science; to enhance Earth Science learning; to recognise talented and gifted Earth science students; to promote the improvement of teaching Earth Science in schools; and to encourage friendly relationships among young learners from different countries, and promoting international cooperation in exchanging ideas and materials on Earth Science and Earth Science education.

In pursuit of these aims, IESO involves i) written and practical tests based on the official syllabus for IESO; ii) the International Team Field Investigation (ITFI); and iii) the Earth System Project (ESP). The first item is competitive and performance in it determines the potential of a student obtaining a medal. The second and third items are co-operative activities, which are unique to IESO and not present in any other international science olympiad; they are performed by students hailing from different nations, with diverse socio-politico-economic backgrounds, different levels of development, and varied cultures; hence, these activities forge friendships among students.

During the formative years, IESO established itself as a credible and recognised international science olympiad. However, written and practical tests were compartmentalised, were beyond high school standards and they tested the memorising capacity of students. Therefore, both the IGEO and the international community felt that IESO must be conducted in the manner that it was originally intended. In accordance with the decision taken

by the International Jury at its meeting in Santander, Spain, in 2014, IESO testing has changed profoundly: the Earth System approach has been adopted; all questions pertain to the official IESO syllabus and test the analytical and thinking skills of students; more emphasis is now being laid on ITFI; and the new co-operative activity called Earth System Project (ESP) added in 2013 is being continued.

## 3. How has IESO helped enhance the profile and quality of Earth Science Education?

Listed below are some ways in which IESO has contributed to enhancing the profile of earth science and the quality of ES education in the participating countries.

### 3.1. Through National Level Entrance Test and National Earth Science Olympiad

Selection of national teams for IESO involves the conduct of national level entrance test followed by one or more testing stages, culminating in the National Earth Science Olympiad. As the official syllabus stresses the Earth System approach and thinking, and emphasizes field investigations, countries are bound to adopt, and indeed have adopted these approaches to varying degrees in their testing schemes. Eventually, school curriculum will also be revised. IGEO is making efforts to encourage these approaches through workshops during and between IESO's (see below) and providing links to Earth System-related reading materials.

First level testing attracts large numbers of students – ranging from a few hundred to 30,000 (as in China; X. Wang 2019, personal communication). This automatically translates to Earth Science getting visibility among such large number of students that take the test.

### 3.2. Through publicity regarding the Entrance Test and related activities

International science olympiads, IESO being no exception, are seen as big and prestigious events across the world. Commensurate with this, considerable publicity is given to all Olympiad-related activities, starting from entrance test through other stages and culminating in the National Earth Science Olympiad. If a country hosts IESO, the

publicity level will be unprecedented. Publicity is carried out through the traditional print media; television channels; official circulars to schools, geological surveys and geological societies; social networking sites like Facebook and Twitter. Such large scale campaigns certainly increase the visibility of Earth Science not only among school students and teachers but also among common people, government officials, bureaucrats and policy-makers; such publicity would also spur students to opt for and study Earth System Science and go for higher studies in this discipline.

### 3.3. Through Workshops during and between IESO's

IGEO found it apt to organize short workshops during IESO's where Mentors and Observers, numbering typically around 100, would have gathered. These workshops discuss how systemic thinking can be encouraged and how Earth System-based questions could be framed, using that year's IESO questions as examples. Such workshops were found helpful for Mentors and Observers who had plans of carrying home the experience and exposure they gained. Hopefully, they would interact with schools in their respective countries, thus producing the much desired snowball effect.

As pointed out in the Introduction section, Earth Science is not being taught in many countries using hands-on activities to promote deduction from observations and to enhance analytical capabilities of students – the skills that are essential for young learners and to effectively compete in IESO's. To help overcome such a handicap, IGEO organized three teacher training workshops in India (Shankar et al., 2017). The outcome was amazing in that the participants unanimously expressed that teaching Earth Science through activities was effective, besides being fun.

### 3.4. Through Mentors and Observers

All national teams participating in IESO would be accompanied by Mentors and, in some instances, Observers as well. They are the main links between IESO organizers and the participating country and play an important role in spreading IGEO's message of incorporating the Earth System approach in school curriculum, and of training school teachers in their respective countries. These approaches have contributed to improving the quality of Earth Science education in schools.

### 3.5. Through the International Team Field Investigation (ITFI) and Earth System Project (ESP)

ITFI and ESP are co-operative activities carried out by international groups of students during IESO. Increased emphasis is being given to them in the more recent IESO's because of the potential they hold of building bridges of friendship and more importantly of promoting teamwork. We are in an era when major scientific breakthroughs are being achieved by multi-national, multidisciplinary groups of scientists. Long after their participation in IESO's, student participants have kept in touch with fellow IESO participants, demonstrating that the co-operative activities have achieved their intended objectives.

### 3.6. Through hosting the IESO

If a country hosts IESO, the hosting country gets an even better visibility for Earth Science education than what is mentioned above. The Department or Ministry of Education, of both provincial and federal governments, would be deeply involved in the organization of the event. They would get an exposure to what precisely is IESO, what it wants to promote and how it intends to further the cause of improving earth science education in schools. Government officials can interact with earth science education experts and identify areas of Earth Science education that need changes and support in the host country. With vision and drive, they could set up institutes for Earth Science Education, provide the required facilities like reading materials and labs, have school teachers trained in ES teaching, and start new initiatives to improve the quality of ES education in the host country.

## 4. Conclusions

It is gratifying to note the several ways in which IESO has given better visibility to Earth Science and helped improve Earth Science education in schools across the world. It is important to note that several students who took part in IESO's and even in national earth science Olympiads of individual countries opted to choose Earth Science for their higher education. Bearing in mind that IESO debuted in 2007, it is a matter of time when more students would opt for higher education and careers in Earth Science.

As IESO is a young international science olympiad and as ES is currently not a widely opted for

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subject, there is an urgent need to increase the number of participating countries.

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