Geoscience Education Field Officer International programme:...

■ Gina P. Correia ■ Giulia Realdon ■ Guillaume Coupechoux ■ Xavier Juan ■ Ramanathan Baskar ■ Yamina Bourgeoini ■ Chris King

...The first year of activity (May 2019-April 2020)

Abstract

The Geoscience Education Field Officer (FO) programme was launched in 2019 by the European Geosciences Union (EGU) Committee on Education (CoE). The initiative began in six countries: France, Italy, India, Morocco, Portugal and Spain. Supported by EGU, the International Union of Geological Sciences (IUGS) and the International Geoscience Education Organisation (IGEO), this international programme has the objective of providing professional development in geoscience teaching to teachers and future teachers, from primary to secondary schools, who have limited or no academic background in Earth Science, or who need training courses in practical geology teaching.

The aim of this paper is to present an analysis of the outcomes of the EGU-IUGS/IGEO FO programme one year after its launch (May 2019 – April 2020). The methodology is based on both a quantitative and qualitative analysis of the data provided by two instruments: the FO report presented to the EGU CoE and the teachers' workshop evaluation form. During the first year of activity, this project involved 379 workshop participants, from 188 different teacher education establishments, in a total of 21 workshops performed in the different countries. Also, FOs have presented four oral communications at teachers' conferences and published two abstracts to promote and disseminate information about this programme. The participants who completed the workshop evaluation form revealed a high level of interest in this kind of workshop and some declared that they were the best workshops that they had ever attended in their professional careers, and hoped to attend future similar workshops.

Keywords: Earth Science, EGU-IUGS/IGEO, Field Officer programme, hands-on activities, international programme, teaching geosciences

Introduction

Whilst geoscience topics are included in most primary and secondary school national curricula or standards around the world (Greco & Almberg, 2016; King, 2013; King, 2019), the need for improving geoscience education has been recognised since the 1990s by researchers and educators of different countries (King, 2008). In fact, according to a report by the International Geoscience Education Organisation (IGEO), there is *'a huge and disturbing gap between the importance of Earth Science to the fate of humankind and its low status in schools worldwide'* (Greco & Almberg, 2016, p.9) because of the weak subject background of many teachers, and uneven availability of good quality teaching materials and textbooks and of professional development opportunities (Greco & Almberg, 2016; King, 2019).

In this critical context of the provision of professional development, a remarkable exception is the experience of the Earth Science Education Unit (ESEU), originally based at Keele University (UK), which developed an innovative teacher training method based on interactive hands-on workshops and a wealth of teaching resources. These have been successfully used since 1999 with 40,000 teachers across the UK (King & Thomas, 2012). The resources have been freely available since 2008 through a website (https://www.earthlearningidea.com/), accounting for over 4.7 million downloads throughout the world by May 2020.

At the international level, the European Geoscience Union (EGU) Committee on Education (CoE), in aiming at *'Inspiring, updating and supporting*

Geoscience Education Field Officer International programme:...

■ Gina P. Correia ■ Giulia Realdon ■ Guillaume Coupechoux ■ Xavier Juan ■ Ramanathan Baskar ■ Yamina Bourgeoini ■ Chris King

geoscience teachers and educators' (EGU website), launched the Geosciences Information for Teachers (GIFT) programme in 2003. This programme is based on annual conferences and workshops, where invited teachers from all around the world meet top-level scientists and experts offering talks and teaching activities related to different Earth Science themes. GIFT workshops in Vienna and other locations worldwide involve many dozens of teachers every year but, for obvious reasons, there are many more who cannot access this professional development opportunity.

To overcome this limitation, in 2019 EGU CoE launched a new initiative by appointing several Geoscience Education Field Officers (FOs), initially four from European and two from non-European countries – the latter funded by the International Union of Geological Sciences (IUGS) and with the support of the IGEO. The FOs were trained to offer in-service and pre-service teacher training workshops in their respective countries. The workshops were based on the teaching methods and resources developed and successfully tested by ESEU. The EGU aim was to multiply the impact of this approach, by involving a much larger number of teachers across Europe and beyond.

The FO workshops are intended for teachers who have geoscience in the curriculum that they teach, but who have poor geoscience backgrounds and lack training in geoscience teaching. There are possibly tens of thousands of teachers in this situation in Europe and across the world. The workshops are targeted at the curriculum, are interactive, hands-on and designed to develop thinking and investigational skills in pupils through a constructivist approach (Cognitive Acceleration through Science Education (CASE)) method (Adey, 1999)).

The objective of this paper is to analyse the outcomes of the EGU-IUGS/IGEO Geoscience Education Field Officer programme one year after its launch (May 2019-April 2020). In particular, the analysis focuses on the:

- implementation of the workshops;
- characteristics of attending teachers; and
- appreciation expressed by the teachers.

Implementation of the Field Officer programme

FO training:

- Selected though a call by the EGU CoE towards the end of 2018, the six FOs, from France, Italy, India, Morocco, Portugal and Spain, first met in Vienna in April 2019, shortly before the EGU General Assembly (GA) and GIFT 2019 (GIFT is a three-day updating workshop for teachers run as part of the GA). There, the FOs were trained in the programme methodology and materials over a two-day intensive training session run by Chris King, Chair of EGU CoE and former director of ESEU.
- The FOs were given a small budget to purchase workshop apparatus and materials and – for the European FOs – additional funding to support their travel and accommodation to allow them to attend teacher workshops and conferences venues.

Promotion of the programme and organisation of national workshops:

- Back in their own countries, the FOs communicated about the availability of EGU workshops through their professional networks, receiving requests from schools, national teachers' associations, universities, national scientific associations and Ministries of Education; the feedback was used to plan a workshop schedule for the 2019-2020 school year.

Geoscience Education Field Officer International programme:...

■ Gina P. Correia ■ Giulia Realdon ■ Guillaume Coupechoux ■ Xavier Juan ■ Ramanathan Baskar ■ Yamina Bourgeoini ■ Chris King

- The FOs presented oral communications at teachers' conferences and wrote abstracts to disseminate information about the programme.

Finding local support:

- The FOs were asked to identify a group of local supporters to help and support them in managing the planned activities.

Preparation of workshop materials:

- Given the practical hands-on approach characterising the workshops, the FOs had to set up materials and equipment that attending teachers would use during the workshops and then later in their classroom activities.
- The FOs also translated and adapted the activity worksheets containing the lab protocols and pedagogical guidelines into their languages, as necessary.

Evaluation:

- The FOs shared a short evaluation form to collect data from the attending teachers to assess the outcome of the workshops.
- The FOs informed EGU CoE through periodic reports.

Methodology

To assess the outcome of the EGU-IUGS/IGEO Geoscience Education Field Officer programme in its first year of implementation, the data from two instruments were considered: the FO annual report provided to EGU CoE, IUGS and IGEO, and the workshop evaluation forms completed by participants.

The FO annual report gathers the global information from individual reports completed after performing each workshop and includes indicators including the number of visits, workshops, workshop participants (teachers and non-teachers), different teacher education establishments, and workshop content. The number of communications at teacher conferences where FOs presented the project details, the abstracts published and the types of institution that invited FOs to present workshops, are also indicators used to assess the development of the programme.

For the workshop assessment, an evaluation form was designed based on an instrument used by ESEU. The evaluation form included closed and open-ended questions: the closed questions made it possible to characterise the workshop participants (gender, role, years of experience, professional positions level and taught subjects), and to assess the interest of the workshop by using a 5-level Likert scale [Lower interest (1) to higher interest (5)] to answer three questions addressing their personal interest, their professional interest and their interest in participating in further workshops (see Figure 1); the two open-ended questions allowed attendants to give their opinion on their experience and suggestions for future workshops.

The quantitative data obtained from the assessment instruments were processed for descriptive statistics, and a content analysis was performed on the open answers.

Conventional inductive content analysis (Hsieh & Shannon, 2005) was performed by three coders, separately reading questionnaire open answers, decontextualising meaning units, identifying categories and coding each unit according to the identified categories (Bengtsson, 2016; Graneheim & Lundman, 2004). Finally, the coders combined their results, reaching a consensus through discussion.

The evaluation form was provided by all FOs at the end of each workshop session to the 379 participants by using an online or paper questionnaire. But, as filling in the questionnaire was not compulsory and teachers were asked for their consent to use the evaluation form data, this study includes feedback from only 296 workshop attendees.

Geoscience Education Field Officer International programme:...

■ Gina P. Correia ■ Giulia Realdon ■ Guillaume Coupechoux ■ Xavier Juan ■ Ramanathan Baskar ■ Yamina Bourgeoini ■ Chris King

Results and discussion

Data from FO annual report

During the first year of activity, this project involved 379 workshops participants, of which 378 were teachers, through a total of 21 workshops (Table 1).

Table 1. Global activity of Field Officers from May 2019 to April 2020.

Country	Indicator						
	Locations (n)	Workshops (n)	Workshop participants (n)	Teacher education establishments (n)	Teachers' conferences (n)	Published abstracts (n)	Cancelled workshops due to the COVID-19 (n)
France	2	2	45	7	-----	-----	2
India	1	1	22	17	1	-----	1
Italy	4	5	80	55	1	1	6
Portugal	3	5	84	53	1	1	2
Spain	5	8	148	56	1	-----	1
Totals	15	21	379	188	4	2	12

The FOs visited 15 cities in their own countries: Nice and Colomars (France); Hisar (India); Camerino, Civitanova Marche, Gorizia and Tivoli (Italy); Lisbon, Montemor-o-Velho and Lamego (Portugal); Barcelona, Madrid, Segovia, Valencia and Cáceres (Spain). The travel and accommodation were supported by EGU for the European workshops, or paid directly by the institutions visited. Teachers from 188 different teacher education establishments were involved.

After March 2020, the COVID-19 pandemic caused governments to close schools and cancel events, leading to 12 workshop cancellations in all the countries involved: France (2 in Nice); India (1 in New Delhi); Italy (1 in Alghero, 2 in Barolo; 2 in Staranzano and 1 in Rome); Portugal (2 in Coimbra); and Spain (1 in Cuenca).

Making the programme widely known and disseminating information is one aim of the FOs, so four oral communications were presented at teachers' conferences in Hisar (India), Parma (Italy), Oporto (Portugal) and the Geopark of Alto Tajo (Spain), and two abstracts were published. Also, several informal meetings took place with national teacher associations, universities and national scientific institutions to plan workshops across the countries concerned.

The workshops performed included the geosciences curricular content shown in Table 2 on page 15.

The range of content addressed by the workshops depended on their time limit. Whilst each individual workshop is normally scheduled for two hours, the workshop sessions offered lasted between 2 and 15 hours (the latter spread over different days), as requested by the institutions that invited FOs. The sessions were based on the initial training in Vienna and also on the resources of the Earthlearningidea website; FOs adapted and translated activity protocols (Table 3), and created practical materials according to their national curricula and the teaching level of the attendees.

Geoscience Education Field Officer International programme:...

■ Gina P. Correia ■ Giulia Realdon ■ Guillaume Coupechoux ■ Xavier Juan ■ Ramanathan Baskar ■ Yamina Bourgeoini ■ Chris King

Table 2. Workshop content presented by Field Officers.

Country	Workshop contents							
	Earth science out-of-doors	Earth structure and magnetic field	Fossils and geologic time	Platetectonics	Rock cycle	Rock detective	Seismic waves and earthquakes	Volcanism
France			x			x	x	
India	x	x		x			x	x
Italy		x	x	x	x	x	x	x
Portugal	x	x	x	x	x	x	x	x
Spain	x	x	x	x	x	x	x	x
Totals	3	4	4	4	3	4	5	4

On the Earthlearningidea website, many translated materials are already available, so for some languages it was not necessary to carry out this task (e.g. Portuguese). In India, the workshops were performed in English.

During the first year of activity, there were different kinds of institutions that invited FOs to run workshops (Table 4). Some workshops were included in scientific meetings or in university lectures, and others, the longer sessions, were organised as a teacher training professional development course. These and other institutions have increased their interest in these activities and the FOs have already scheduled several workshops for the next year.

Language	Translated (n)
French	10
Italian	13
Portuguese	8
Spanish	192
Catalan	232
Totals	455

Table 3. Translated activity protocols by Field Officers.

The partnership with such institutions is important because it promotes the growing recognition of the FO programme in the involved countries and gives the possibility of offering a certificate to the attendees.

The data obtained from completing the evaluation form (n=296) corresponded to 78.1% of the workshop participants (n=379). It revealed the prevalence of the female gender (82.4%), whilst almost all the participants were teachers (99.7%) (Table 5). Most of the workshop participants were experienced professionals, with seven or more years of teaching experience, with 53.0% of teachers on the stage [7-25 years of teaching], according to the stages proposed by Huberman (1989). The frequency of confirmed and permanent teachers, here ranked as 'Career teacher' (73.0%), is higher than those from other professional positions.

Data obtained from teachers' evaluation form

■ Sample characterisation

All the attendant teachers (n=295) were from primary or secondary level schools, with a prevalence of secondary level teachers (74.2%). Primary school teachers usually teach all subjects, thus only secondary teachers (n=219) were considered for the 'Taught subjects' categories.

Geoscience Education Field Officer International programme:...

■ Gina P. Correia ■ Giulia Realdon ■ Guillaume Coupechoux ■ Xavier Juan ■ Ramanathan Baskar ■ Yamina Bourgeoini ■ Chris King

Table 4. Types of institution that invited Field officers to present workshops.

Country	Ministry of Education	Teacher Association	School	University	Scientific association
France	x		x		
India				x	
Italy			x	x	
Portugal		x			x
Spain	x	x		x	x

	Category	Number (n)	Percentage (%)
Gender	Female	244	82.4
	Male	52	17.6
Role	Teacher	295	99.7
	Other	1	0.3
Teaching years	[1-3]	42	14.2
	[4-6]	29	9.8
	[7-25]	157	53.0
	[26-35]	53	17.9
	[36-40]	14	4.7
	> 40	1	0.3
Professional position	Career teacher	216	73.0
	Hired/supply teacher	57	19.3
	Trainee teacher	19	6.4
	Technician	1	0.3
	Other	3	1.0
School level	Primary	76	25.8
	Secondary	219	74.2
Taught subjects	Natural sciences/ biology/geology	178	81.3
	Physics/chemistry	19	8.7

Table 5. Sample characterisation.

Geoscience Education Field Officer International programme:...

■ Gina P. Correia ■ Giulia Realdon ■ Guillaume Coupechoux ■ Xavier Juan ■ Ramanathan Baskar ■ Yamina Bourgeoini ■ Chris King

The proportion of natural sciences/biology/geology teachers (81.3%) is higher than the other categories where Geoscience content is usually included (physics/chemistry and geography). As a curiosity, the category 'Other' (4.1%) comprised mathematics, technology and philosophy secondary teachers who were interested in attending the workshops even if they did not directly address their teaching subject.

■ Workshop interest

The highest level of appreciation (5) is the most frequent feedback category in the evaluation form (Figure 1) from France, Italy, Portugal and Spain (n=274; it was not possible to collect data from India), corresponding to 72.3% of the workshop attendees (n=379).

The global scores in the interest in the workshop (4.79), the interest for professional development (4.75) and for attending future workshops (4.64), reveal the perceived importance of this programme.

The 13 attendees who scored 1 in the last open question ('I am interested in attending other workshops of this kind…') participated in a single workshop, which took place in a university as part of their Master of Education. These attendees scored 4 or 5 in the other two closed questions. The first question was probably misunderstood by this group.

Out of 296 questionnaires collected, 117 included general comments about the participant's experience of the workshop and 59 included suggestions for future workshops. The comments on the workshops ranged from a single word to extended considerations addressing diverse issues. Scanning through them, the coders identified these concept categories: General appreciation for the course and the trainers; Impact on the participant; Comments on theoretical/pedagogical knowledge; Comments on practical knowledge; Criticism and suggestions; and General remarks on geoscience teaching (Figure 2).

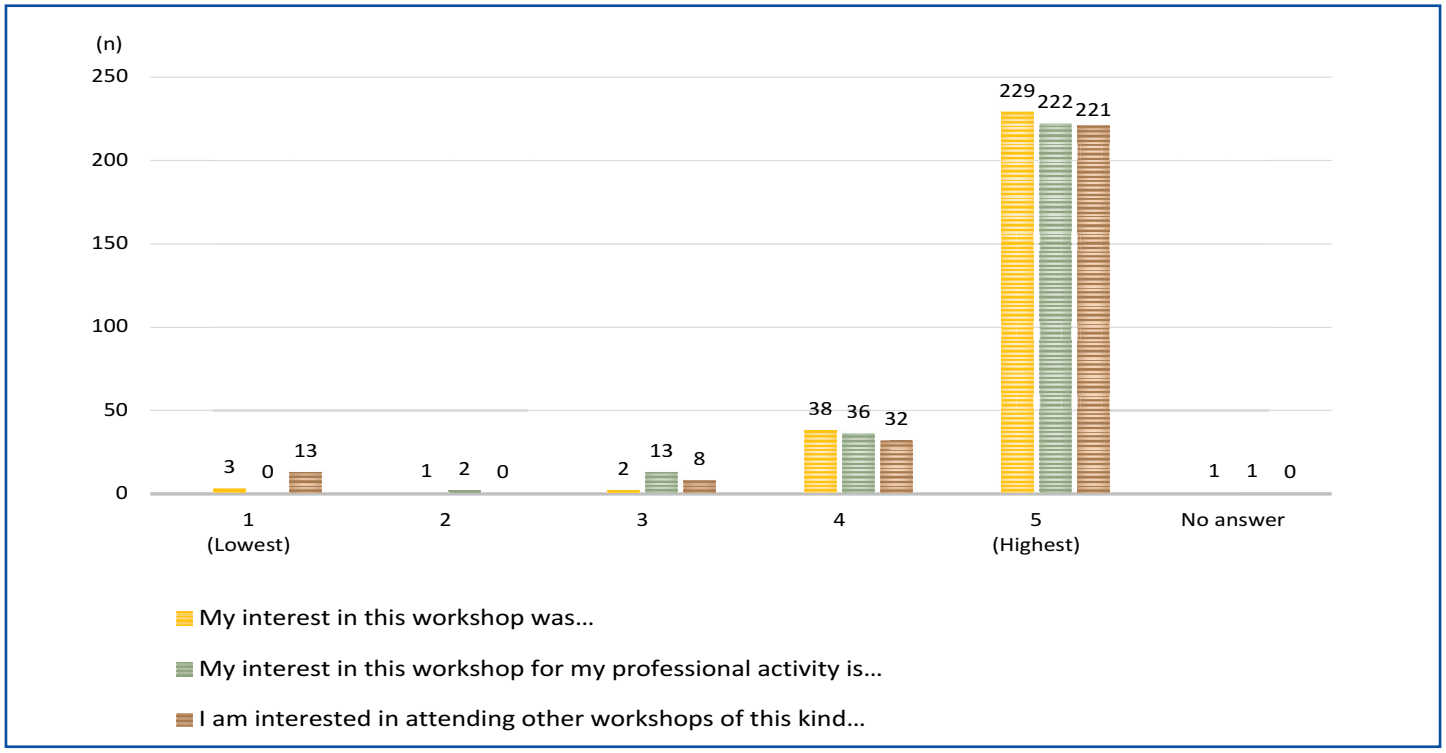
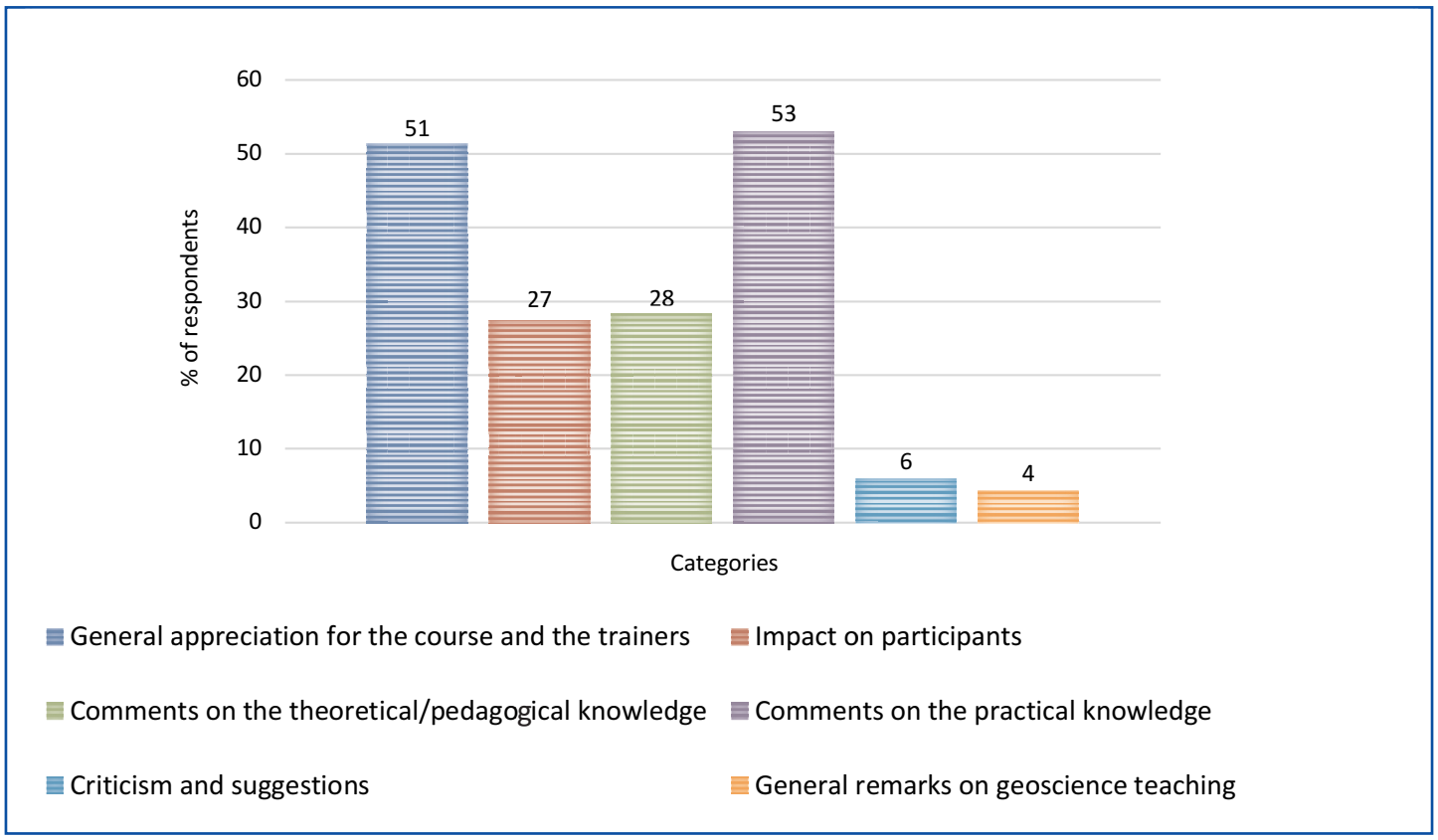


Figure 1. Frequency of the interest appreciation levels from workshop participants.

Figure 2. General comments on the workshops.



Half the answers expressed positive appreciation for the quality of the workshop and the trainers' skills: interest, methodology, organisation, usefulness and pleasure were the most valued aspects of the training. An even higher proportion of answers (53%) highlighted the appreciation of the practical knowledge provided and of the ease of transferring this knowledge to classroom practice. About 28% of the comments praised the pedagogical approach to Earth Science: its potential to motivate students, its novelty, flexibility for different age groups, and the capacity for addressing difficult topics.

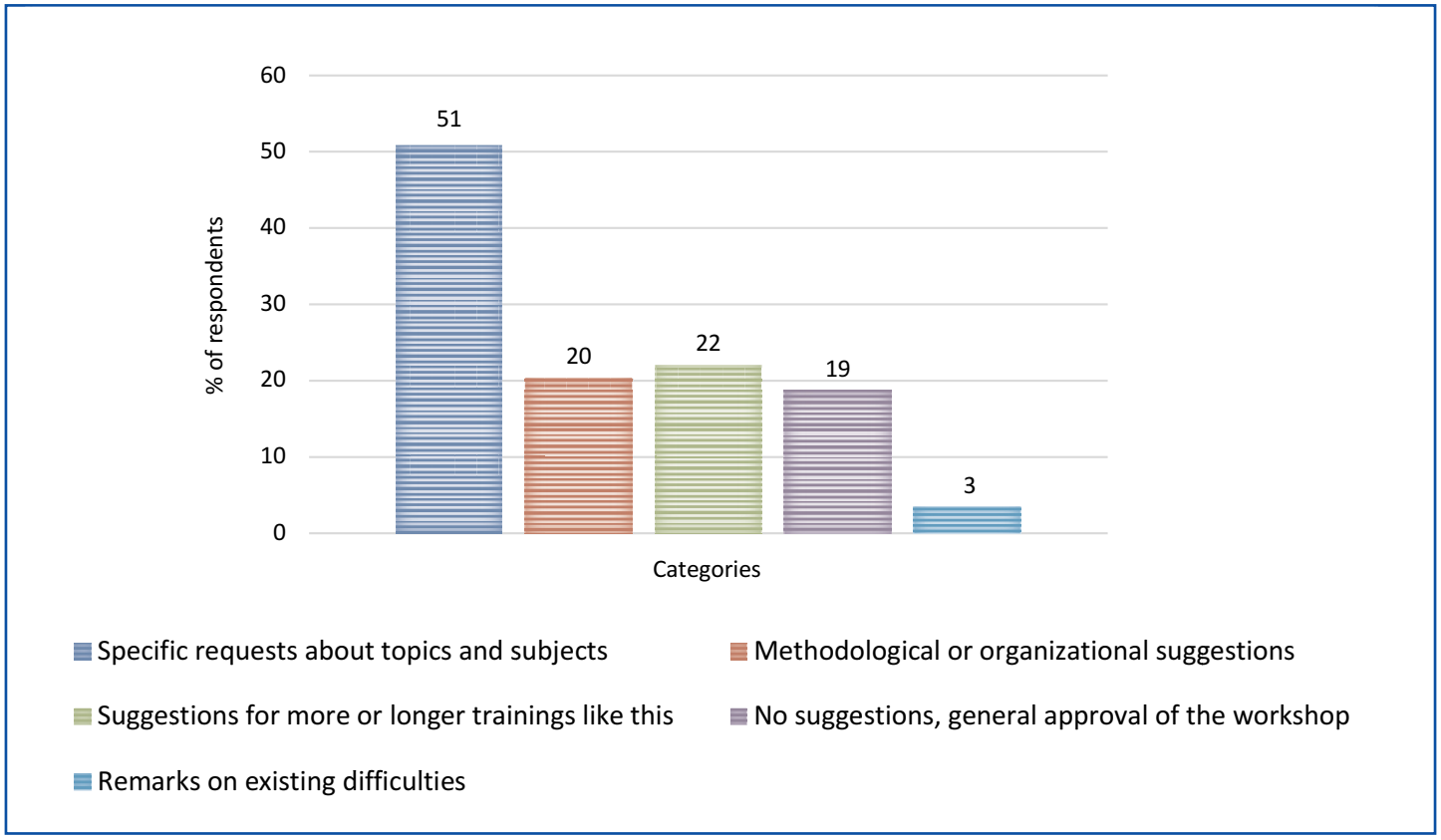
More than a quarter of the comments expressed positive feelings about the workshop's impact on participants, with only 6% of criticisms, mainly concerning the short time available for the workshop.

Suggestions for future workshops were offered by 59 teachers, presenting one or more requests (Figure 3). About half of these included specific geoscience topics, but also different subjects (e.g. biology, environmental sciences) and interdisciplinary activities. One fifth of the respondents presented suggestions about workshop organisation (e.g. activities for different school grades, schedule at the beginning of the school year) or methodology (fieldwork, videos). Finally, more than 40% of the suggestions evidenced general approval of the workshop (e.g. *continue this way*) or requests for more/longer activities like these. Only two answers mentioned difficulties, attributing them to factors external to the workshops.

Final considerations

The collected data confirm that the FO international programme has been a success in its first year of implementation. This is supported by the teacher responses, which show that workshop attendees

Figure 3. Suggestions for future workshops.



enjoyed participating in the activities and intend to participate in future ones. The number of workshops requested by national institutions to be conducted in the near future is another significant indicator of success.

The positive outcomes include the high number of teachers in the numerous regions and different schools in the countries involved; the range of geosciences curricular content presented in the workshops, which cover almost all the topics of geoscience taught at school according to the International Geoscience Syllabus prepared by the IGEO (IGEO, 2014); the dissemination of pedagogic materials and methods among the workshop participants; and the establishment of an international geoscience teacher trainers' network.

The elements that contributed to the success of this programme are: the excellent resources stemming from the internationally acknowledged ESEU experience and provided by the Earthlearningidea website; the interactive hands-on methods used; the constant collaboration and support of the EGU CoE, particularly its Chair, Chris King; the national FOs' supporters; and the permanent and collaborative interaction between FOs. The physical distance did not prevent them from carrying out outreach work through e-mails and virtual meetings that were held as often as required.

The lockdown due to the COVID-19 pandemic prevented the running of some scheduled workshops in March and April 2020, but also nine future workshops that had been programmed up to August 2020; some workshops had to be postponed until next year. This situation was an obvious limitation, but it did not stop the work of the FOs. During that time, they continued to disseminate the programme and to plan and prepare future activities.

Geoscience Education Field Officer International programme:...

■ Gina P. Correia ■ Giulia Realdon ■ Guillaume Coupechoux ■ Xavier Juan ■ Ramanathan Baskar ■ Yamina Bourgeoini ■ Chris King

Because of the positive results from this first pilot year, EGU and IUGS/IGEO decided to continue funding this programme and the training of new FOs. So, next year, this programme will be extended to include seven more FOs: four from Europe (Albania, Germany, Hungary and Turkey) and three from beyond Europe (Chile, Malaysia and Togo). Their training was scheduled for May 2020 but, because of the COVID-19 pandemic, this was postponed to a future date depending on pandemic conditions.

The extending of the programme over future years will allow the initiative to reach more teachers and schools across the world and to increase the international geoscience trainers' network.

The experience of this first year of the FO programme allows us to conclude that the initiative is successful. However, new challenges arise for the future, with the objectives of:

- increasing the number of workshops and participants;
- extending workshop coverage over wider geographic regions of the countries involved;
- disseminating and presenting the advantages of the programme at teacher conferences;
- discussing and testing new methods and materials for distance training (e.g. https://www.earthlearningidea.com/home/Teaching_videos_workshops.html); and
- developing websites/social media hubs for different countries to disseminate the workshop plans and geoscience information; alternatively hosting this information on the websites of national geoscience organisations in the respective countries.

The global outcome of these geoscience professional development and training activities is the promotion of capacity-building in Earth System Sciences and the contribution to meet the targets of the UN Sustainable Development Goals (SDGs), starting from SDG4 – Quality Education. This will also educate our communities for a safer world and make them more resilient to disasters, thereby achieving the objectives of the Sendai Framework for Disaster Risk reduction (SFDRR).

Acknowledgements

Those involved in the FO programme are most grateful to the EGU and IUGS for funding the programme so far and for the promise of future funding. They are also very grateful to EGU CoE, IUGS-COGE and IGEO for their strategic overview and support. The work of the supporters of individual FOs has been crucial to the success of the initiative.

References

Adey, P.S. (1999) *The science of thinking, and science for thinking: a description of cognitive acceleration through science education (CASE)*. Geneva: UNESCO-IBE International Bureau of Education

Bengtsson, M. (2016) 'How to plan and perform a qualitative study using content analysis', *NursingPlusOpen*, (2), 8–14. https://doi.org/10.1016/j.npls.2016.01.001

Earthlearningidea: http//www.earthlearningidea.com (last accessed May 2020)

European Geosciences Union (EGU): https://www.egu.eu/education/ (last accessed May 2020)

Graneheim, U.H. & Lundman, B. (2004) 'Qualitative content analysis in nursing research: concepts, procedures and measures to achieve trustworthiness', *Nurse Education Today,* **24,** (2), 105–112. https://doi.org/10.1016/j.nedt.2003.10.001

Greco, R. & Almberg, L. (Eds.) (2016) *Earth science education: Global perspectives*. Pouso Alegre: IFSULDEMINAS, ISBN: 987-85-67952-14-7

Geoscience Education Field Officer International programme:...

■ Gina P. Correia ■ Giulia Realdon ■ Guillaume Coupechoux ■ Xavier Juan ■ Ramanathan Baskar ■ Yamina Bourgeoini ■ Chris King

Hsieh, H.-F. & Shannon, S.E. (2005) 'Three Approaches to Qualitative Content Analysis', *Qualitative Health Research*, **15,** (9), 1277–1288. https://doi.org/10.1177/1049732305276687

Huberman, M. (1989) *La vie des Enseignants*. Neuchâtel-Paris: Delachaux & Niestlé

International Geoscience Education Organisation (IGEO) website (2014), International geoscience syllabus: http://www.igeoscied.org/activities/international-geoscience-syllabus/

King, C. (2008) 'Geoscience Education: an overview', *Studies in Science Education*, (44), 187–222

King, C. (2013) 'Geoscience education across the globe – results of the IUGS-COGE/IGEO survey', *Episodes*, **36,** (1), 19–30

King, C. (2019) 'Earth science education across the globe'. In: *Geoscience in primary and secondary education*, Volume 2: 'Results of experts' opinion survey 2018' (pps. 16–36). United Nations Education Scientific and Cultural Organization (UNESCO): https://unesdoc.unesco.org/ark:/48223/pf0000371311 (last accessed May 2020)

King, C. (2020) *Report on the international Geoscience Education Field Officer Programme: first year of operation, May 2019-April 2020 – the pilot year*. Internal report, June 2020

King. C. & Thomas, A. (2012) 'Earth Science Education Unit workshops – an evaluation of their impact', *School Science Review*, **94,** (347), 25–35

Gina P. Correia, Centre for Earth and Space Research of the University of Coimbra (CITEUC), Portugal.
E-mail: gina.maria@sapo.pt

Giulia Realdon, University of Camerino, UNICAMearth group, Italy.

Guillaume Coupechoux, Collège L. Nucéra, Académie de Nice, Education nationale française, France.

Xavier Juan, Spanish Earth Science Teachers Association (AEPECT), Spain.

Ramanathan Baskar, Department of Environmental Science and Engineering, Guru Jambheshwar University of Science and Technology, India.

Yamina Bourgeoini, Département des Sciences de la Terre - Laboratoire Géosciences et Environnement, Marrakech, Morocco.

Chris King, Education Department, Keele University, UK.

EGU European Geosciences Union